

DC/DC Converters Selection Guide

Rev. 7.0

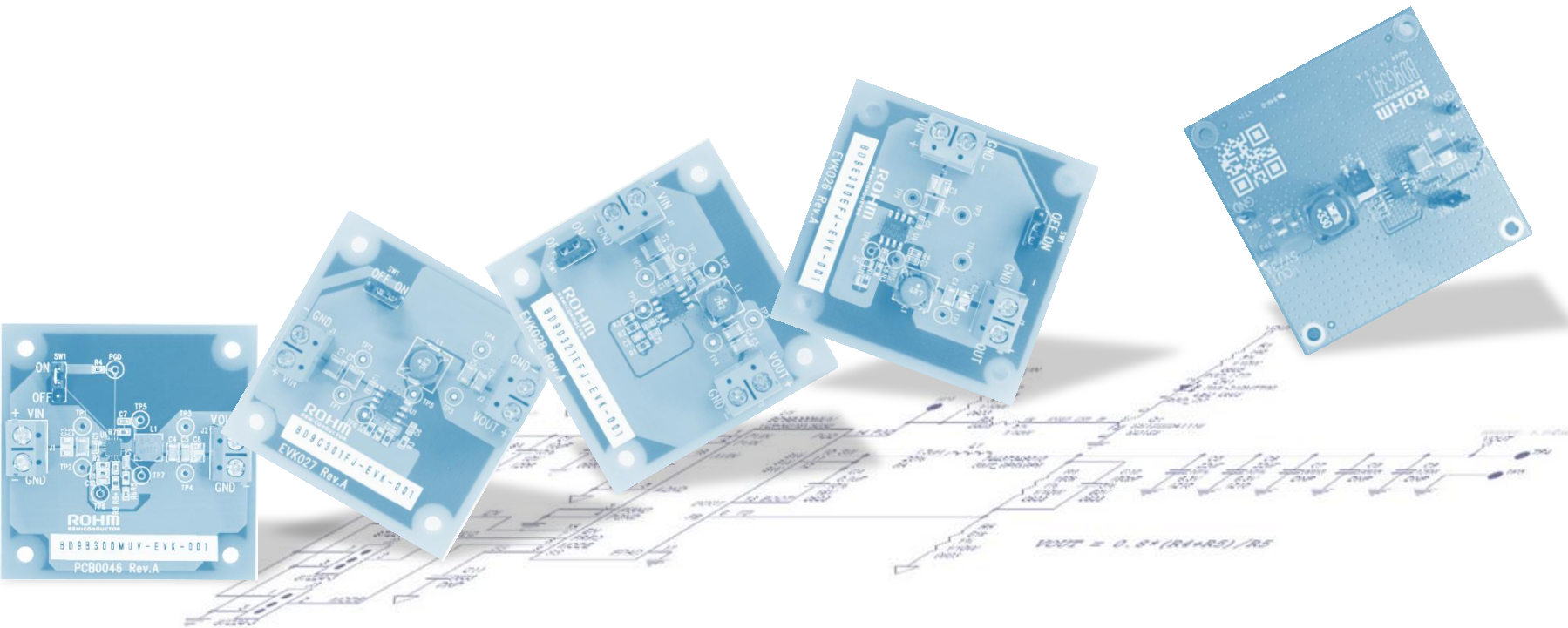
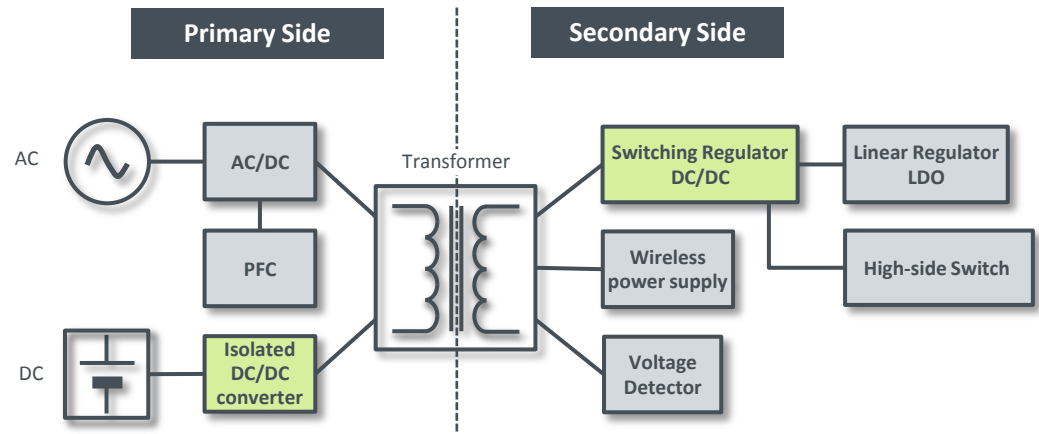


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Power Supply Block Schematic Chart

ROHM's product lineup covers the entire area of power supplies. This selection guide features DC/DC switching regulators and isolated DC/DC converters.

Pages **3** to 20 introduce select products with specific characteristics.

Page **3** shows characteristics of the buck converter BD9x families.

Pages **5** to 13 introduce buck converters with specific characteristics by input voltage range.

Page **14** shows the buck type switching regulators that operate at a maximum 6 MHz.

The chip-sized package and coil of low inductor value allow for a miniature power supply configuration that is especially suited for portable equipment.

Pages **15** to 18 show controller ICs that allow for power supply configurations for high current output by attaching a MOSFET to the IC external. Page 15 presents an application example that delivers both high-speed load

response and high current output in the power supply for FPGA. Page 16 explains ROHM's proprietary H³Reg™ high-speed transient response technology that is used for the controller ICs.

Page **17** introduces controllers with a 60V rating and high current applications using ICs.

Page **19** features isolated DC/DC switching regulators that assuredly improve reliability as they do not require an optocoupler.

Pages **21** to 26 show lineup tables, and Page **27** and following pages show product lists. You can select ICs based on representative values and functions.

Before using a ROHM IC, be sure to check its setting values, data and functions against the latest data sheet.

ROHM SEMICONDUCTOR

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Ultra-High-Efficiency 76V DC/DC Buck Converter

more >

- High Breakdown Voltage
- Small Footprint
- High Reliability
- High Efficiency

Contributes to improved reliability and greater energy savings in the expanding industrial equipment market

Products DC/DC Converters

ICs

- Memory
- Amplifiers & Linear
- Power Management**
- Clocks & Timers
- Switch & Multiplexer & Logic
- Data Converter
- Sensors & MEMS
- Display Drivers
- Motor / Actuator Drivers
- Interface
- Communication LSI (LAPIS)
- Audio & Video
- Speech Synthesis LSI (LAPIS)
- Microcontrollers (LAPIS)

Discrete Semiconductors

- Transistors
- Diodes

Power Devices

- SiC Power Devices
- IGBT
- IPM

Opto Electronics

- LED
- LED Displays
- Laser Diodes
- Optical Sensors
- IrDA Infrared Communication
- Remote Control Receiver

Passive Components

- Resistors
- Tantalum Capacitors

Modules (Sub Systems)

- Power Modules
- Wireless Communication Modules
- Contact Image Sensor Heads
- Printheads
- Batteryless Radio Module (EnOcean)

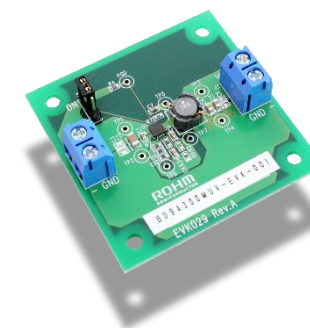
Commercial Products

- LED Lighting
- Intel Chipset

For ROHM's power supply IC lineup, visit the following ROHM website.

<http://www.rohm.com>

ROHM provides design and technical data and tools such as data sheets, application notes, technical notes, reference designs and evaluation boards to assist developers.



ENGINEERING TIPS

Tech Web
Technical Info for Power Supply ICs
Powered by ROHM [more >](#)

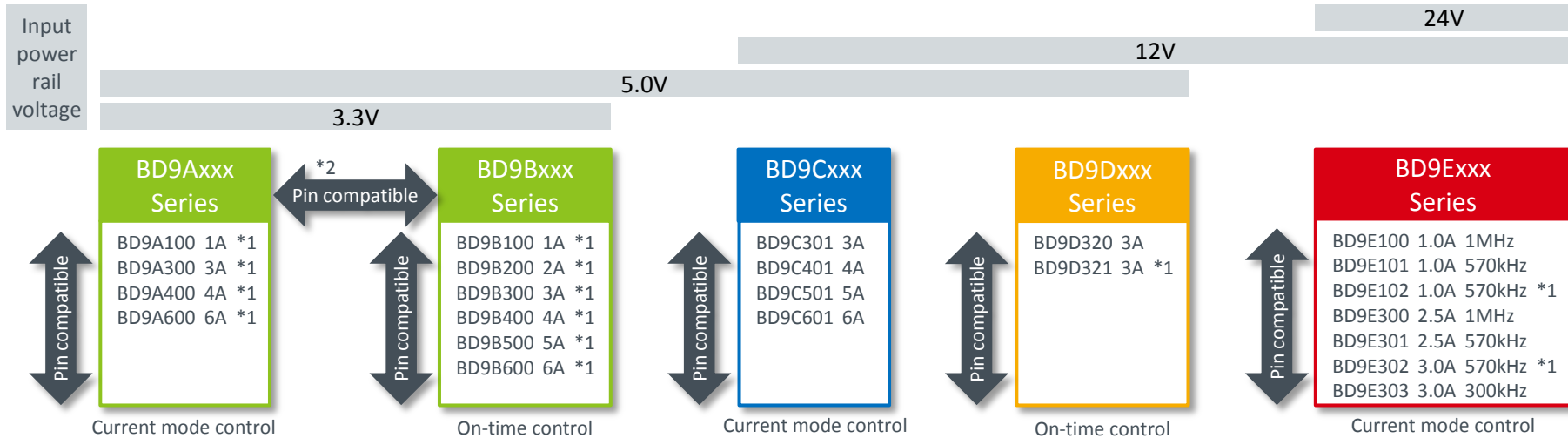
<http://micro.rohm.com/en/techweb/>

+ DEVICE PLUS
Engineering Life Plus Hacks.
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<http://deviceplus.com/>

Before using a ROHM IC, be sure to check its setting values, data and functions against the latest data sheet.

BD9x Family System Diagram



*1: Automatic switching from PWM to PFM at light load

*2: CRs with a single pin must be replaced by a jumper resistor.

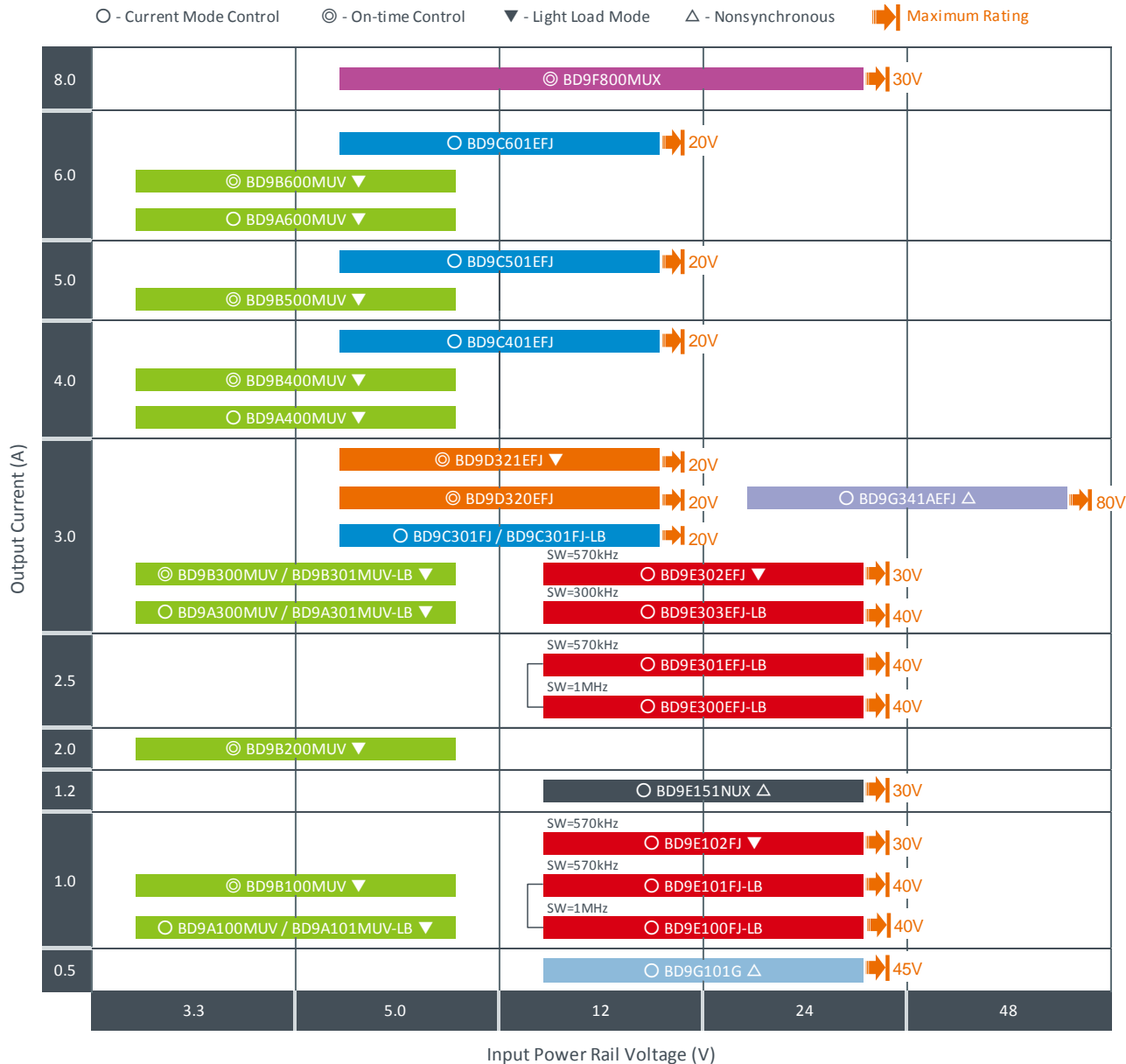
The above diagram shows the buck converter BD9x Family systems. These lists are color-coded and ICs of the same color are pin-compatible. The BD9Axxx Series in the green group supports input power rail voltages of 3.3V and 5.0V. This series adopts current mode control, supports output currents of 1A, 3A, 4A and 6A, and features high-speed load response characteristics. Since ICs of this series are pin-compatible, replacement is easy even when the current design value changes.

The BD9Bxxx Series, in the other green group, adopts on-time control and supports output currents of 1A, 2A, 3A, 4A, 5A and 6A. This series offers faster load response characteristics and higher efficiency at light load than the BD9Axxx Series. ICs of the BD9Bxxx Series are also pin-compatible. Moreover, ICs are pin-compatible between the BD9Axxx Series and BD9Bxxx Series, which enables easy replacement in the event of urgent design changes, such as in a case where a faster load response is required.

The BD9Cxxx Series in the blue group supports an input power rail voltage of 12V. As a secondary power supply, it is available with a 5V input. This series adopts current mode control and supports output current of 3A, 4A, 5A and 6A. ICs in this series are pin-compatible. The BD9Dxxx Series in the orange group supports an input power rail voltage of 12V. As a secondary power supply, it is available with a 5V input. For the output current, only a 3A type is available, but it includes two IC models with/without the

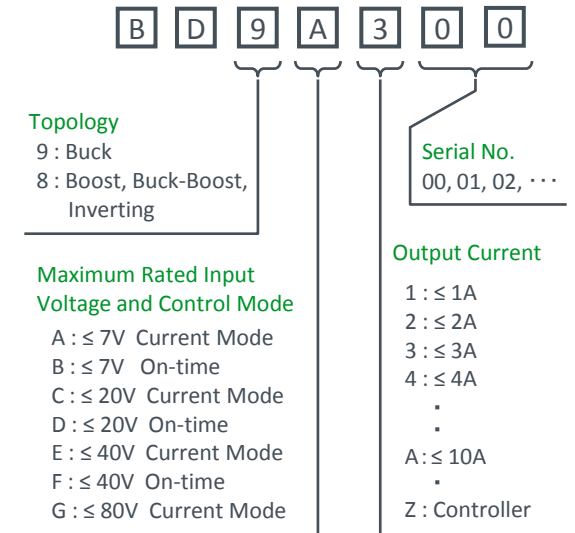
light-load high efficiency modes. ICs in this series are pin-compatible, which enables easy replacement according to efficiency requirements under light load. The BD9Exxx Series in the red group supports input power rail voltages of 12V and 24V. This series adopts current mode control and supports output currents of 1A, 2.5A and 3A and switching frequencies of 300 kHz, 570 kHz and 1MHz. ICs of 1A and 3A include models that ensure high efficiency under light load.

BD9x Family Lineup



ROHM's single output buck DC/DC converters provide a power supply solution that satisfies your specification requirements based on a matrix of input voltage and output current. In the product name of BD9x Family, the numeric value "9" following "BD" represents the "buck" topology, the subsequent alphabet represents the maximum rated input voltage and the subsequent numeric value represents the output current.

Part No. Description

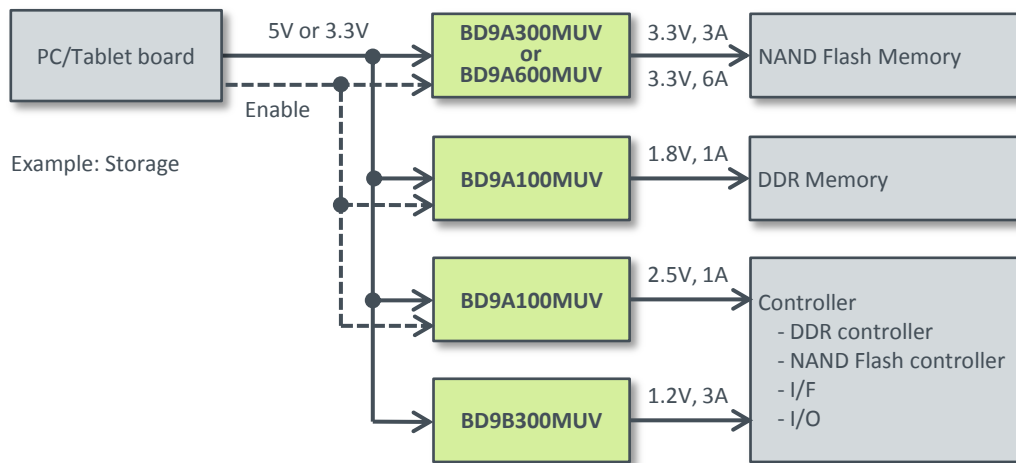


Note: There are some part numbers that do not conform with this rule

3.3V/5V Power Rail Input

Power Supply Solution for Consumer Equipment

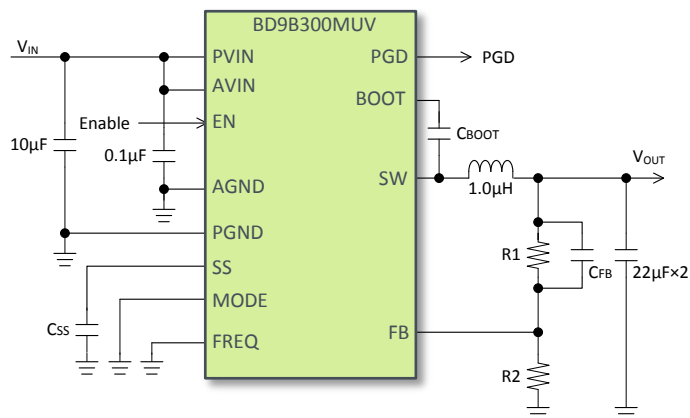
The BD9A100MUV, BD9A300MUV, BD9A600MUV and BD9B300MUV generate a low voltage of about 1.8 V from power supplies of 5V or 3.3V.



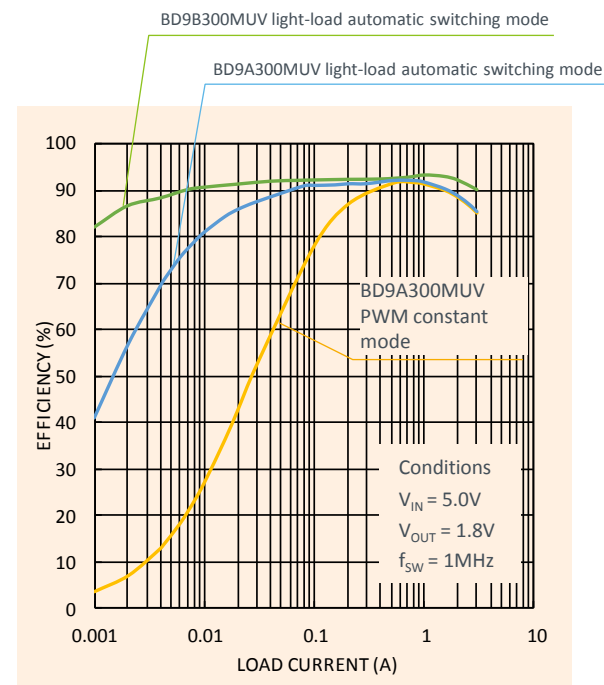
Example: Storage

Product example: BD9B300MUV

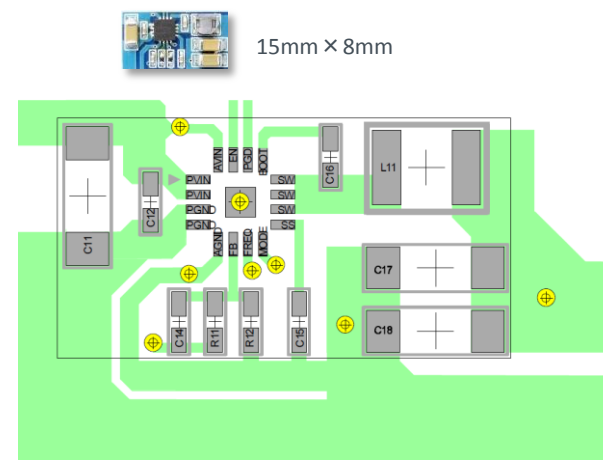
- Input voltage range : 2.7V to 5.5V
 - Output voltage range : 0.8V to ($V_{IN} \times 0.8$)V
 - Reference-voltage : 0.8V \pm 1.0%
 - Output current : 3A
 - Switching frequency : 1MHz / 2MHz
 - Integrated switch FET : 35m Ω
 - Current consumption : 35 μ A
 - High speed transient response characteristics with constant-on-time control
 - Light-load high-efficiency mode
 - Selectable between light-load automatic switching mode and PWM constant mode
 - Adjustable soft start
 - Power good output
 - Various protection functions
- Over current protection (OCP), short-circuit protection (SCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



BD9B300MUV Application Circuit



Efficiency vs. Load Current



BD9B300MUV PCB

Selectable from Two Series Depending on the System

The BD9AxxxMUV Series and BD9BxxxMUV Series consist of pin-compatible ICs of 1A to 6A. Thus, you can select the best IC for your application. These series operate in the PWM mode for an application with high load current, and automatically switch to power-saving operation with SLLM™ (PFM mode) for an application with low load current. The BD9BxxxMUV is a high-performance version of the BD9AxxxMUV series. Both versions can be interchangeably replaced by changing the PCB layout of a single pin. Also, by drawing a PCB layout compatible with both series in the initial stage of development, ICs can be easily changed.

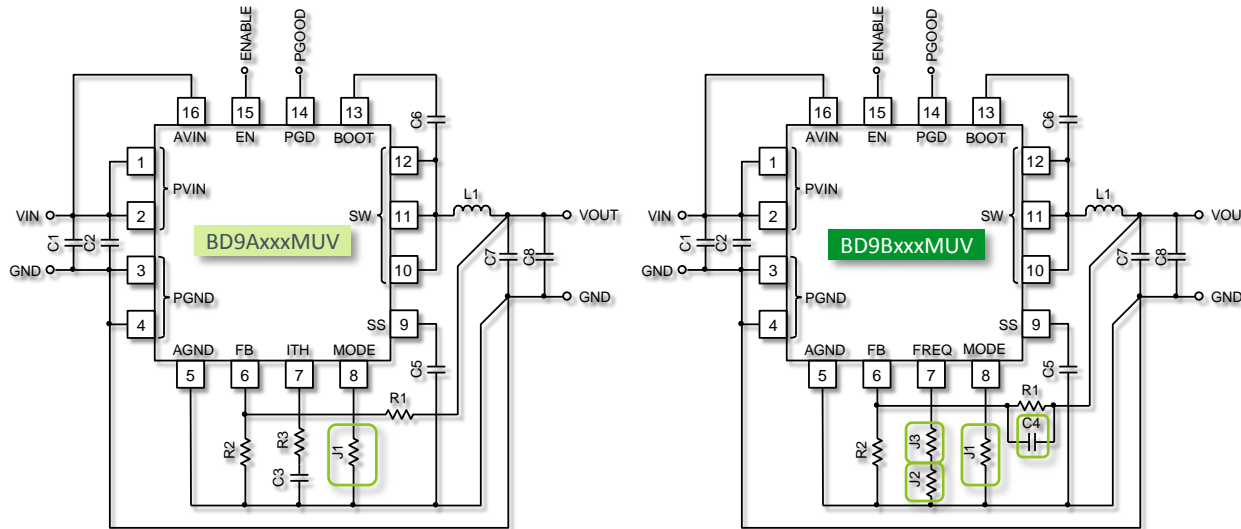
High performance



Upper Compatible

Product name	Control mode	Light-load operation	Functional difference
BD9B100MUV BD9B200MUV BD9B300MUV BD9B301MUV-LB BD9B400MUV BD9B500MUV BD9B600MUV	Constant-on-time	Deep SLLM	<ul style="list-style-type: none"> • Constant-on-time control helps implement transient response faster than that of the BD9AxxxMUV. • Phase compensation is unnecessary. • Efficiency across the entire load range is further improved over the BD9AxxxMUV. • The product operates in the light-load automatic switching mode by setting the MODE pin to Low and in the PWM constant mode by setting it to High. • The product operates at 2 MHz by setting the FREQ pin to Low and at 1 MHz by setting it to High. A small 1 μH coil can be used at 2 MHz.
BD9A100MUV BD9A101MUV-LB BD9A300MUV BD9A301MUV-LB BD9A400MUV BD9A600MUV	Current mode	SLLM™	<ul style="list-style-type: none"> • The product operates in the PWM constant mode by setting the MODE pin to Low and in the light-load automatic switching mode by setting it to High. (This is the same function as the BD9Bxxx Series, but the logic is reversed.)

SLLM™ : Simple Light Load Mode (Automatic switching from PWM to PFM in the light-load mode)

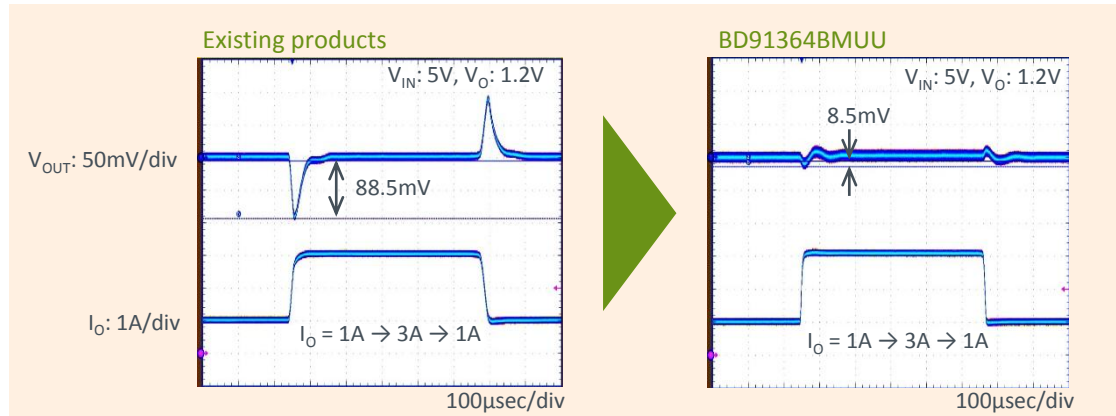


Difference in External Components

3.3V/5V Power Rail Input

Thin Type, High-Speed Transient Response Power Supply Solution

The BD91364BMUU provides the highest class of transient response in the industry by incorporating constant-on-time control and an overshoot reduction function. The adopted low type package is best suited for mounting on slim equipment.

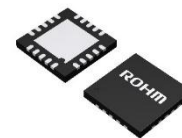


BD91364BMUU High-Speed Transient Response Characteristics

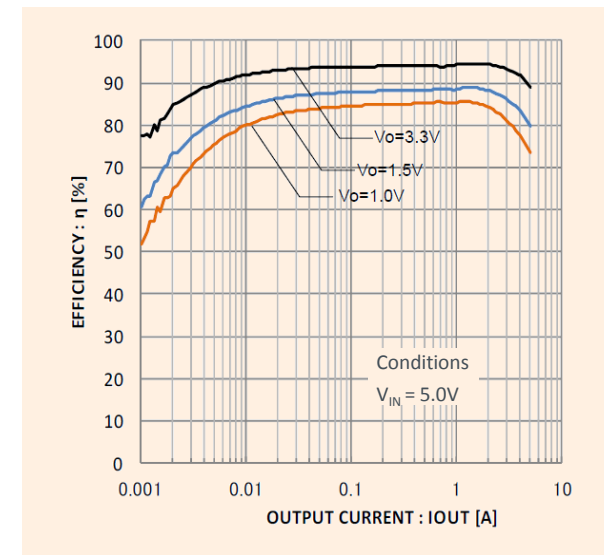
Product example: BD91364BMUU

- Input voltage range : 2.9V to 5.5V
- Output voltage range : 0.8V to ($V_{IN} \times 0.8$)V
- Reference-voltage : 0.8V \pm 1.5%
- Output current : 5A
- Switching frequency : 1.7MHz
- Integrated switch FET : 27m Ω
- High speed transient response characteristics with constant-on-time control
- The light-load automatic switching mode enables high efficiency across the entire load range.
- The overshoot reduction function reduces the increase in output voltage in the event of rapid changes in load current.
- Adjustable soft start
- Power good output
- Various protection functions

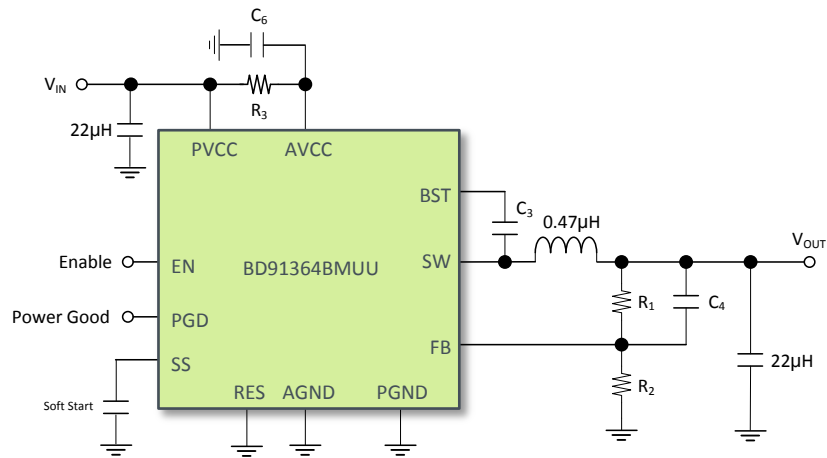
Over current protection (OCP), short-circuit protection (SCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



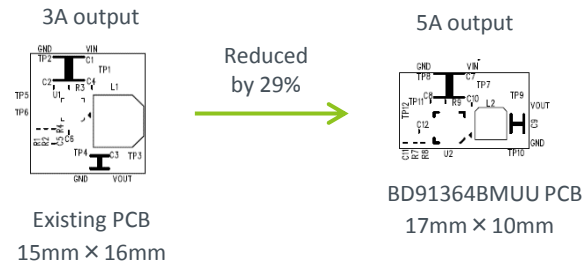
BD91364BMUU Thin Type Package
VQFN20U4040M
4.0mm \times 4.0mm \times 0.5mm
typ typ max



BD91364BMUU - Efficiency vs. Load Current



BD91364BMUU Application Circuit

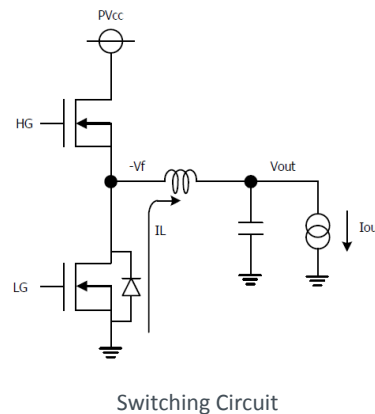
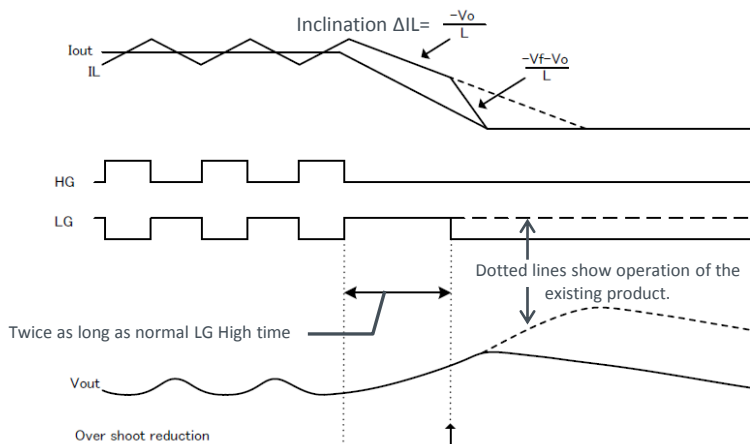


Comparison of PCB Mounting Area

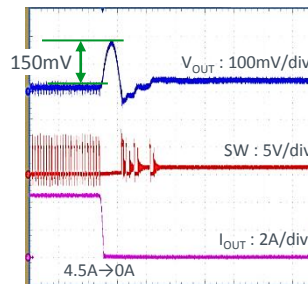
Overshoot Reduction

When the load current rapidly reduces, the output voltage increases. Thus, the low-side MOSFET remains ON. At this time, the inclination of the coil current ΔI_L becomes $-V_o/L$. If the slew rate ΔI_{out} of the load current I_{out} becomes greater than ΔI_L , continuous charging of excess current to the output capacitor increases the output voltage (shown as a dotted waveform). Especially, when the output voltage setting value is low, the value of ΔI_L becomes small and a more marked increase in output voltage occurs.

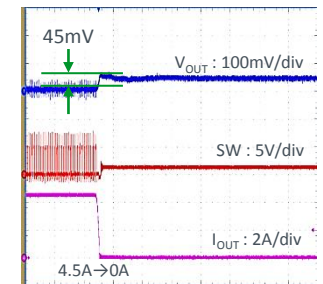
The BD91364BMUU activates the overshoot reduction function when the low-side MOSFET remains ON twice as long as PWM operates. By turning OFF both the low-side and high-side MOSFETs and flowing I_L through the low-side MOSFET body diode, $-V_f$ voltage is generated in the SW pin. Accordingly, ΔI_L becomes $(-V_f - V_o)/L$, which suppresses charging of excess current to the output capacitor and reduces the increase in output voltage.



Switching Circuit



Output Voltage Transient Characteristics of Existing Product

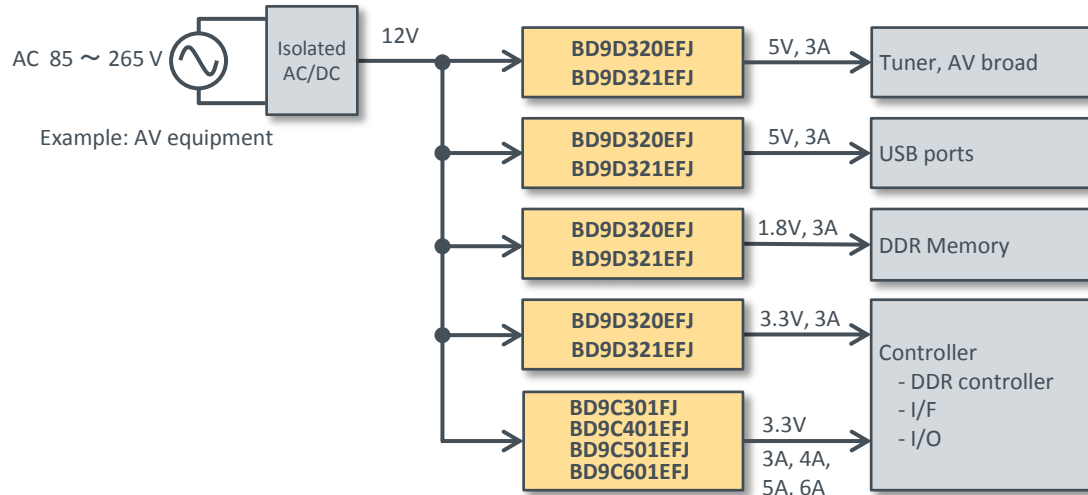


Output Voltage Increase Reduction Effect of Overshoot Reduction

12V Power Rail Input

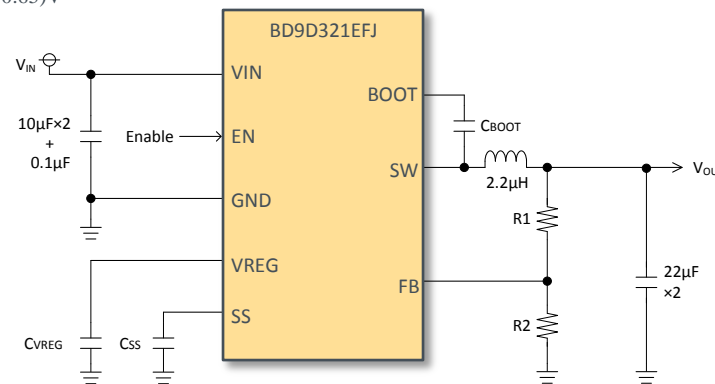
Power Supply Solution for Consumer Equipment

The BD9D320EFJ, BD9D321EFJ, BD9C301FJ, BD9C401EFJ, BD9C501EFJ and BD9C601EFJ generate voltages of 5V and 3.3V from a 12V power supply.

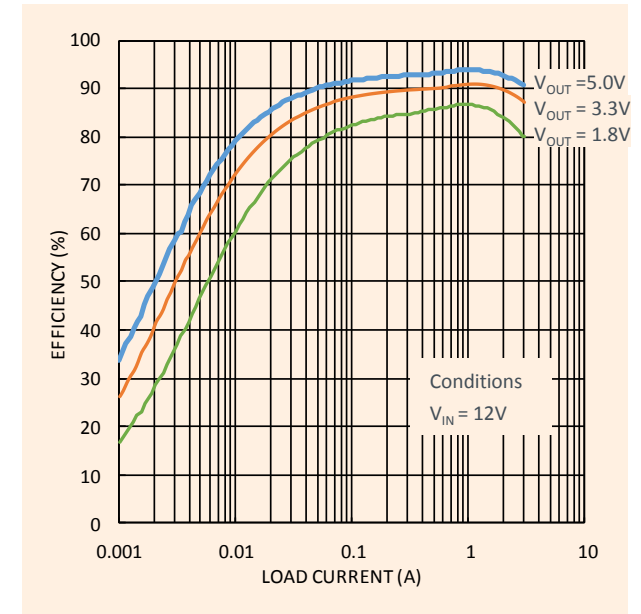


Product example: BD9D321EFJ

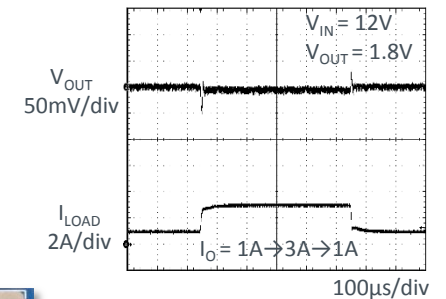
- Input voltage range : 4.5V to 18V
- Output voltage range : 0.765V to 7.0V, ($V_{IN} \times 0.07$)V to ($V_{IN} \times 0.65$)V
- Reference-voltage : 0.765V \pm 1.5%
- Output current : 3A
- Switching frequency : 700 kHz
- Integrated switch FET : 100m Ω , 70m Ω
- High speed transient response characteristics with constant-on-time control
- Phase compensation parts are unnecessary.
- A ceramic capacitor is available for output.
- Synchronous rectification type
- Light-load high efficiency mode
- Adjustable soft start that prevents rush current at power ON
- Various protection functions
Over current protection (OCP), short-circuit protection (SCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



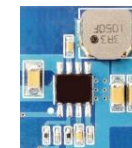
BD9D321EFJ Application Circuit



BD9D321EFJ - Efficiency vs. Load Current



BD9D321EFJ Transient Response Characteristics



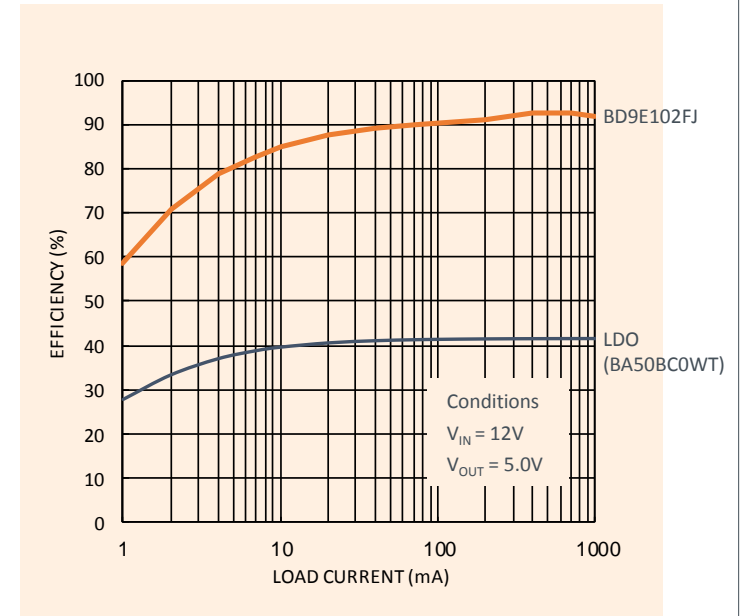
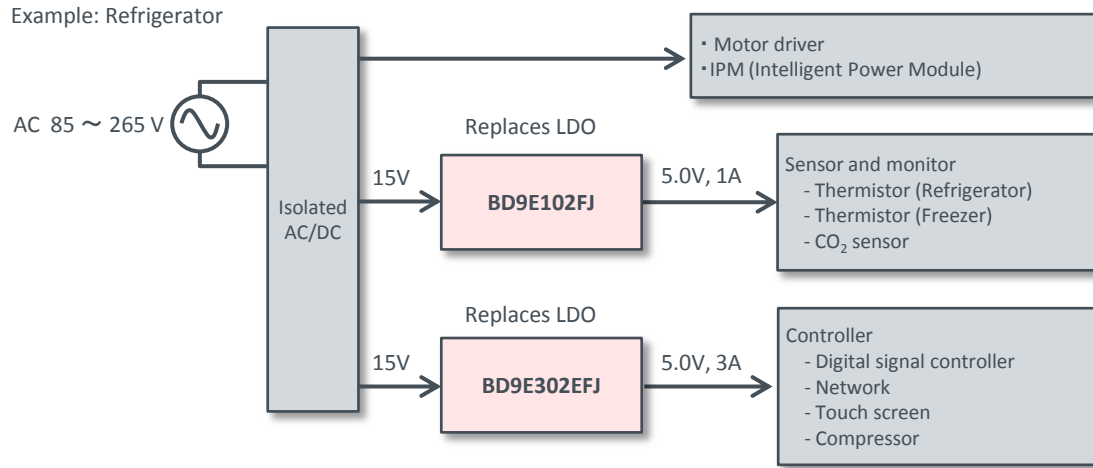
17mm \times 20mm

BD9D321EFJ PCB

24V Power Rail Input

Power Supply Solution for Home Appliances

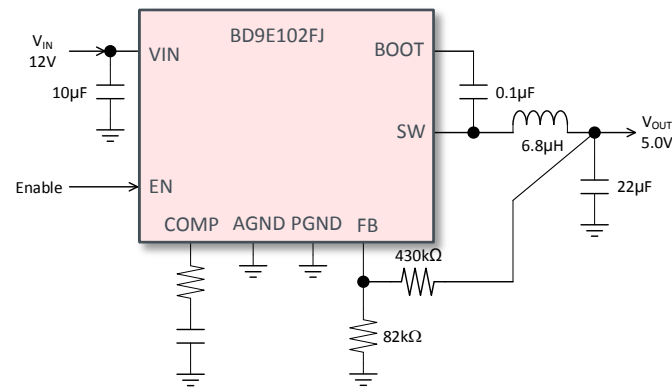
The BD9E102FJ and BD9E302EFJ generate voltages of 5V and 3.3V from power supplies of 24V and 15V. Replacement of the LDO enables energy-savings and reduced heat generation.



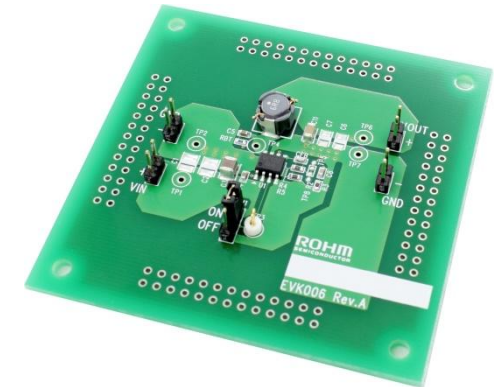
BD9E102FJ - Efficiency vs. Load Current

Product example: BD9E102FJ

- Input voltage range : 7.0V to 26V (30V rating)
- Output voltage range : $(V_{IN} \times 0.143)V$ to $(V_{IN} \times 0.7)V$
($V_{IN} \times 0.143 \geq 1.0V$)
- Reference-voltage : $0.8V \pm 2.0\%$
- Output current : 1.0A
- Switching frequency : 570 kHz
- Supports an input rating of 28V that is greatly demanded for electric home appliances.
- The excellent efficiency under light load is ideal for equipment that needs to suppress standby power consumption.
- Integrated switch FET : 250mΩ, 200mΩ
- High-speed transient response characteristics are delivered by controlling the current mode. Phase compensation can be set easily.
- Because of synchronous rectification, an external diode is unnecessary.
- Soft start to prevent rush current at power ON
- Various protection functions
Over current protection (OCP), short-circuit protection (SCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



BD9E102FJ Application Circuit

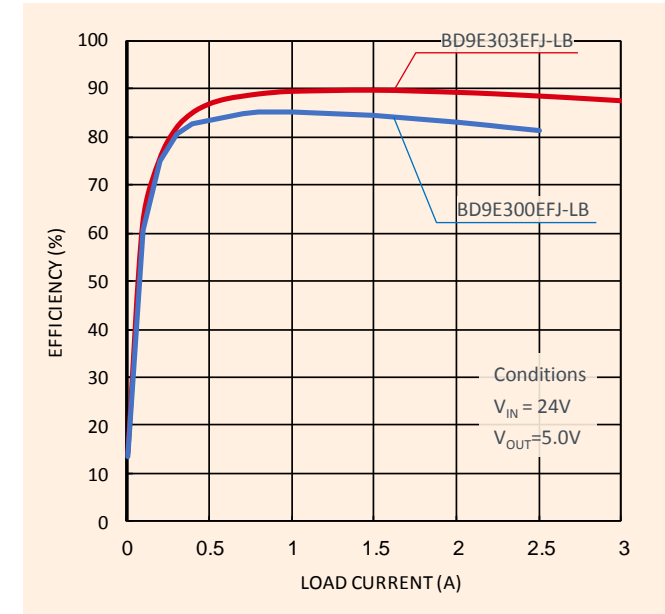
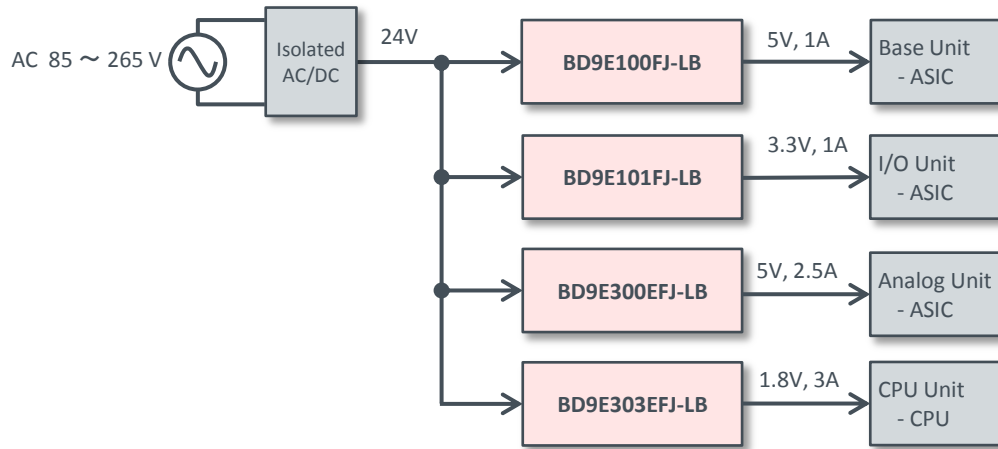


BD9E102FJ Evaluation Board

24V Power Rail Input

Power Supply Solution for Industrial Equipment

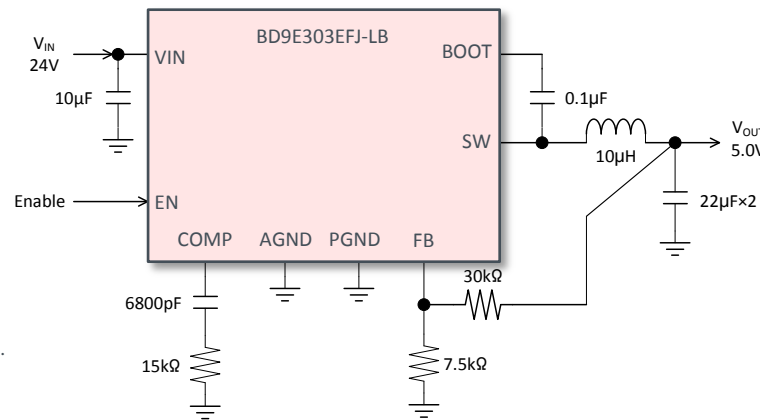
The BD9E100FJ, BD9E101FJ, BD9E300EFJ, BD9E301EFJ and BD9E303EFJ generate voltages of 5V and 3.3V from power supplies of 24V and 12V.



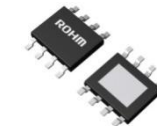
Efficiency vs. Load Current

Product example: BD9E303EFJ-LB

- Long-term supply indispensable for industrial equipment is assured.
- Supports an input rating of 40V that is greatly demanded for industrial equipment.
- Input voltage range : 7.0V to 36V (40V rating)
- Output voltage range : $(V_{IN} \times 0.06)V$ to $(V_{IN} \times 0.8)V$
($V_{IN} \times 0.06$) $\geq 1.0V$
- Reference-voltage : $1.0V \pm 1.0\%$
- Output current : 3.0A
- Built in low ON-resistance switch FET: 90m Ω , 80m Ω
- High-speed transient response characteristics are delivered by controlling the current mode.
- Because of synchronous rectification, an external diode is unnecessary.
- Soft start to prevent rush current at power ON
- Various protection functions
Over current protection (OCP), short-circuit protection (SCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



BD9E303EFJ-LB Application Circuit

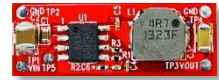


Efficient heat radiation characteristics owing to exposed pad

Selectable According to System

The BD9E300EFJ-LB and BD9E303EFJ-LB are both buck DC/DC converters with a power rail input of 24V, but they have been developed based on different concepts. Since the BD9E300EFJ-LB is a high-speed type with a switching frequency of 1 MHz, a small inductor can be used to assure space-savings of the PCB mounting area. Since the BD9E303EFJ-LB has a integrated FET of low ON-resistance and a low switching frequency of 300 kHz, it assuredly reduces switching-loss and minimizes heat generation with high efficiency.

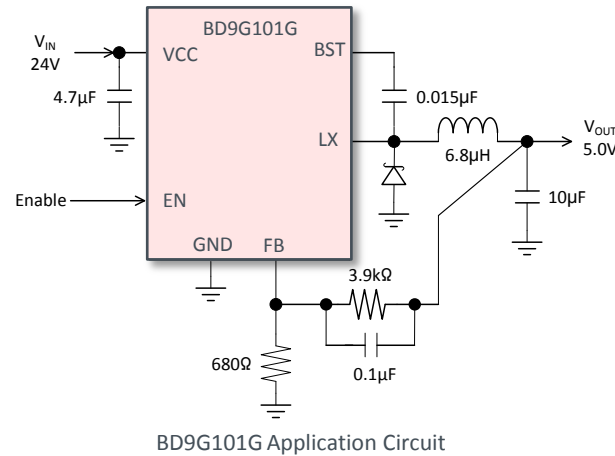
Product name	Feature	Switching frequency	Inductor value	FET ON-resistance	Efficiency	Output current	Maximum duty ratio	Minimum duty ratio	PCB size
BD9E300EFJ-LB	Small space-saving size	1MHz	4.7μH	170mΩ 140mΩ	See the upper-right figure on previous page.	2.5A	70%	15%	27mm × 10mm 270mm ²
BD9E303EFJ-LB	Low heat generation	300kHz	10μH	90mΩ 80mΩ	See the upper-right figure on previous page.	3A	80%	6%	33mm × 15mm 495mm ²



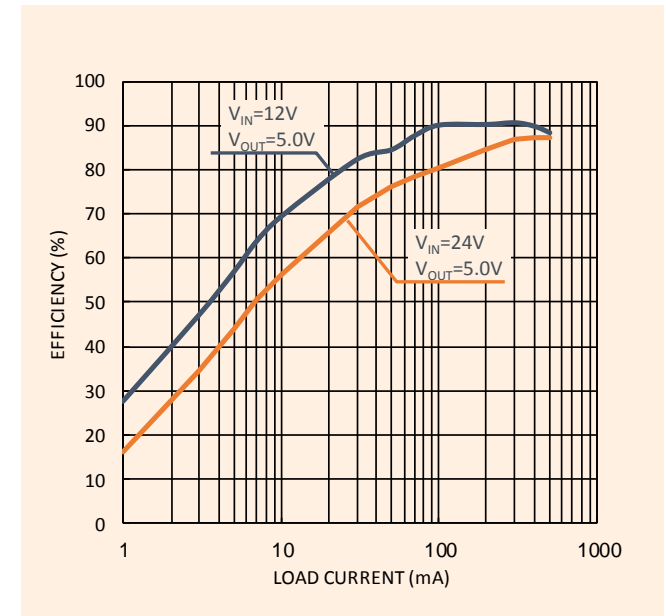
24V Small Size Power Supply Solution

Product example: BD9G101G

- DC/DC converter with integrated MOSFET with 45 V rating
- Input voltage range : 6.0V to 42V (45V rating)
- Output voltage range : ($V_{IN} \times 0.15$)V to ($V_{IN} \times 0.7$)V
($V_{IN} \times 0.15$) ≥ 1.0 V
- Reference-voltage : 0.75V \pm 1.5%
- Output current : 500mA
- High-speed switching frequency of 1.5 MHz enables use of small size inductor.
- Diode rectification automatically activates the pulse skip mode under light load to maintain the high efficiency.
- Integrated High-side switch FET: 800mΩ
- High-speed transient response characteristics are delivered by controlling the current mode.
- Built-in phase compensation circuit
- Soft start to prevent rush current at power ON
- Various protection functions
Over current protection (OCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



SSOP6
2.9mm × 2.8mm
h: 1.25mm



BD9G101G - Efficiency vs. Load Current

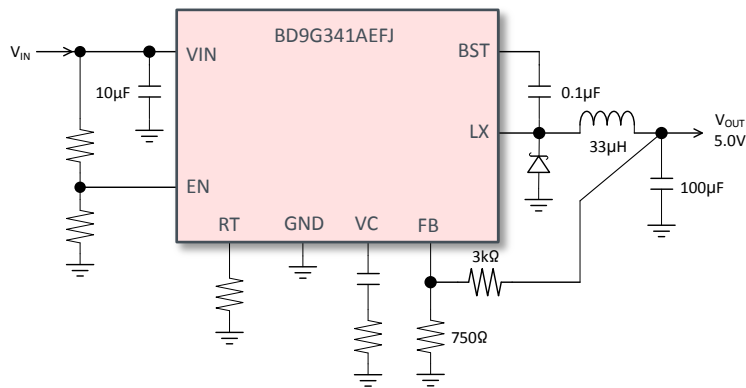
Supporting Maximum 76 V Input

Product example:BD9G341AEFJ

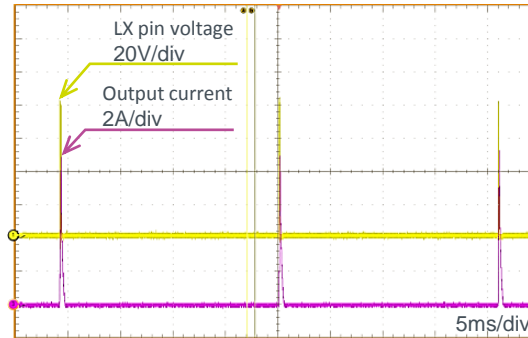
The BD9G341AEFJ is a 1-ch buck switching regulator with a integrated switch FET of 80 V rating (76 V input). Since sufficient voltage margin is ensured in a 48 V bus line adopted by communication infrastructures, this switching regulator easily enables safe power supply design in high voltage applications such as telephones, routers and base stations.

- Input voltage range : 12V to 76V (80V rating)
- Output voltage range : 1.0V to V_{IN}^{*1}
*1 Limitations apply under some conditions.
- Reference-voltage : 1.0V \pm 1.5%
- Output current : 3.0A
- Integrated switch MOSFET of 80 V rating: 150m Ω
- High-speed transient response characteristics are delivered by controlling the current mode. Phase compensation can be set easily.
- Soft start to prevent rush current at power ON
- Operating frequency can be set from 50 kHz to 750 kHz.
- Precise EN threshold: \pm 3%
- Various protection functions

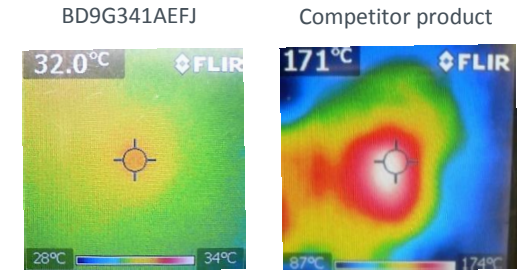
Over current protection (OCP), overvoltage protection (OVP), thermal shutdown (TSD), undervoltage lockout (UVLO)



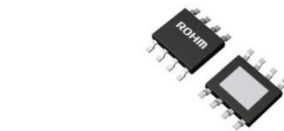
BD9G341AEFJ Application Circuit



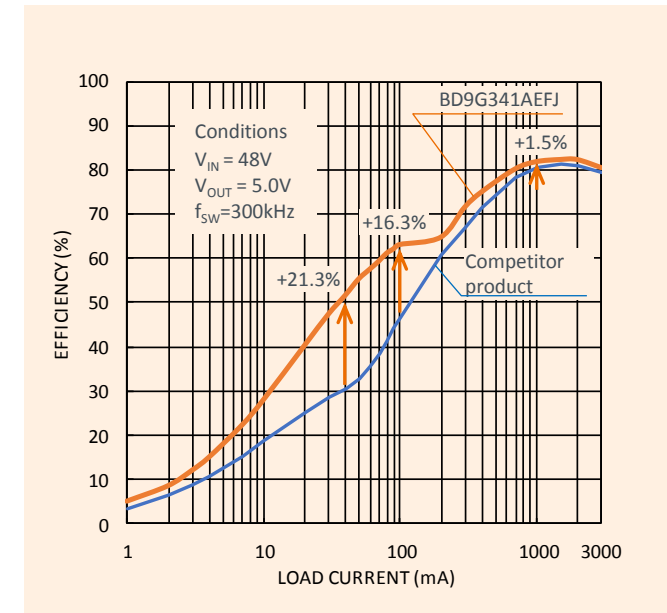
In the event of an output short-circuit, the over current protection circuit is used in the hiccup mode to prevent IC heating and destruction.



IC Surface Temperature in Output Short-Circuit



Efficient heat radiation characteristics owing to exposed pads



BD9G341AEFJ - Efficiency vs. Load Current

6 kHz High-Frequency Operating Switching Regulator

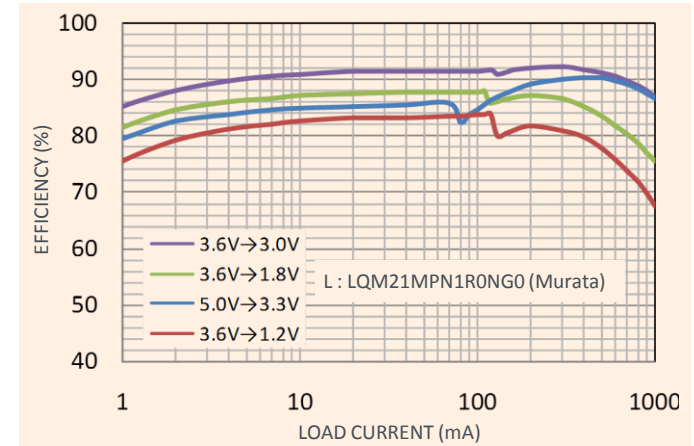
BU90xxxGWZ Series

- Input voltage range : 2.3V to 5.5V
- Output voltage: : 1.0V, 1.2V, 1.25V, 1.3V, 1.8V, 1.83V, 2.5V, 3.0V, 3.3V
- Output voltage precision: $\pm 2.0\%$
- Output current: : 1.0A
- Switching operation of maximum 6 MHz
- Ultra-small 1.3 mm \times 0.9 mm size chip package
- High-speed transient response characteristics with hysteresis control eliminate phase compensation.
- The PWM/PFM automatic switching function delivers high efficiency across the entire load area.
- The forced PWM mode keeps the switching frequency constant.
- Soft start to prevent rush current at power ON
- Various protection functions
Over current protection (OCP), thermal shutdown (TSD), undervoltage lockout (UVLO)

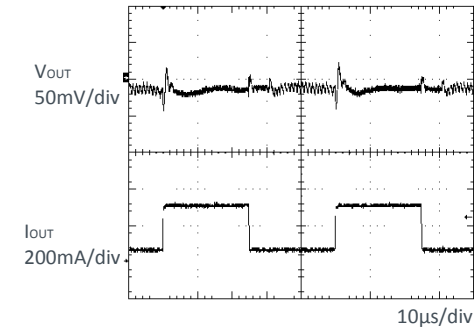
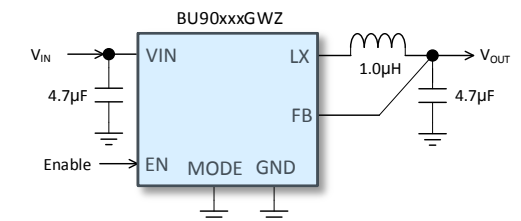
7mm \times 4mm

BU90002GWZ PCB

Output voltage	Product name	Input voltage range	Switching frequency	Maximum output capacitor	PWM/PFM automatic switching	Forced PFM	Forced PWM	Package
1.0V	BU90008GWZ	2.3V~5.5V	3.6MHz	10 μ F	✓	—	✓	UCSP35L1
1.2V	BU90003GWZ	2.3V~5.5V	4MHz	10 μ F	✓	—	✓	UCSP35L1
1.25V	BU90007GWZ	2.3V~5.5V	4MHz	10 μ F	✓	—	✓	UCSP35L1
1.3V	BU90009GWZ	2.3V~5.5V	4.2MHz	10 μ F	✓	—	✓	UCSP35L1
1.8V	BU90004GWZ BU90054GWZ BU90104GWZ	2.3V~5.5V	5.4MHz	10 μ F 10 μ F 100 μ F	✓	—	✓	UCSP35L1 UCSP30L1 UCSP35L1
1.83V	BU90090GWZ	2.3V~5.5V	5.4MHz	10 μ F	✓	—	✓	UCSP35L1
2.5V	BU90005GWZ	2.3V~5.5V	6MHz	10 μ F	—	✓ (100mA max)	✓	UCSP35L1
3.0V	BU90006GWZ	2.3V~5.5V	6MHz	10 μ F	✓	—	✓	UCSP35L1
3.3V	BU90002GWZ	4.0V~5.5V	6MHz	10 μ F	✓	—	✓	UCSP35L1

UCSP30L1 : 1.3mm \times 0.9mm \times 0.33mmUCSP35L1 : 1.3mm \times 0.9mm \times 0.4mm

BU90xxxGWZ - Efficiency vs. Load Current

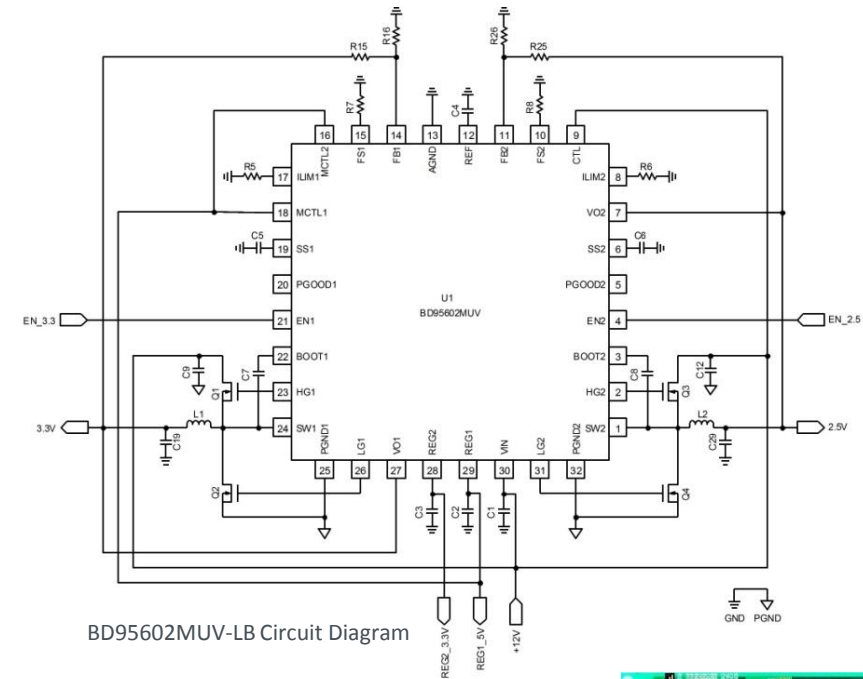
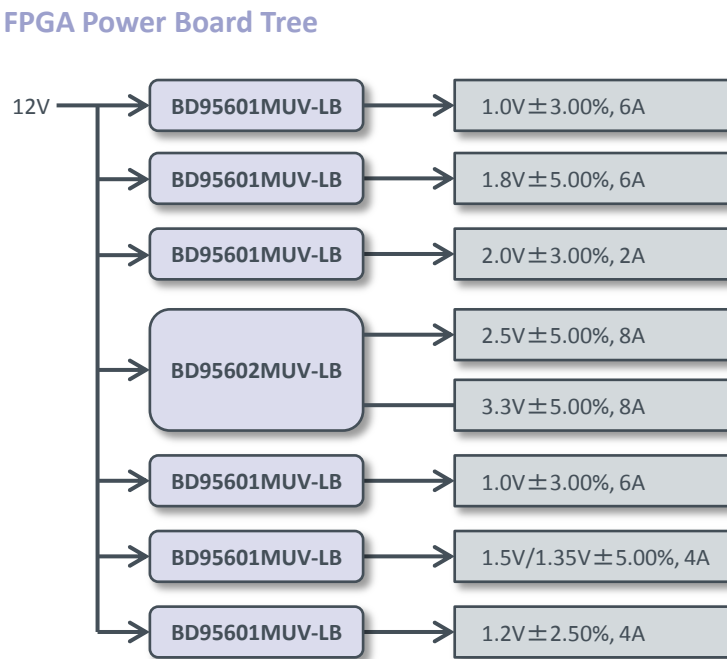
BU90003GWZ Transient Response Characteristics (50mA \rightarrow 350mA)

BU90xxxGWZ Application Circuit

Power Supply Solution for FPGA

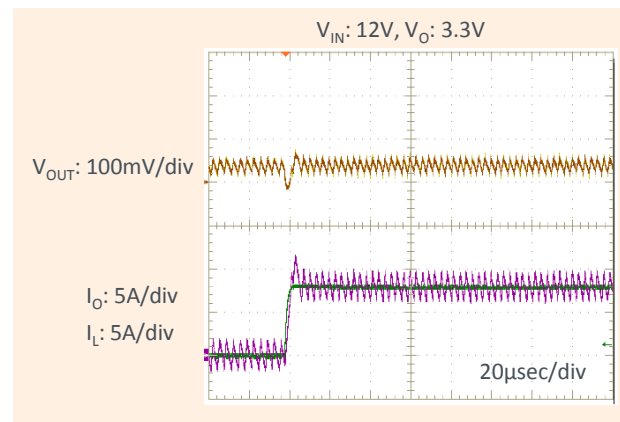
The BD95601MUV-LB and BD95602MUV-LB are power supply ICs outfitted with H³Reg™ technology that ensures high-speed transient response characteristics required by FPGA. These models generate power supply voltage from a 12 V input voltage, thus satisfying the stringent voltage precision specifications required by FPGA.

FPGA Power Board Tree



BD95602MUV-LB

- 2ch DC/DC controller equipped with H³Reg™ for high-speed transient response
- Selectable from light-load mode, continuous PWM mode and silent and light-load mode
- The adjustable soft start function reduces rush current at startup.
- Power good output
- Input voltage range : 5.5V to 28V
- Output voltage range : 1.0V to 5.5V
- Reference-voltage: 0.7V ± 1.0%
- Switching frequency : 150kHz to 500kHz
- Integrated with various protection functions
 - Automatic reset type over current protection (OCP)
 - Overvoltage protection function (OVP)
 - Thermal shutdown function (TSD)
 - Undervoltage lockout function (UVLO)



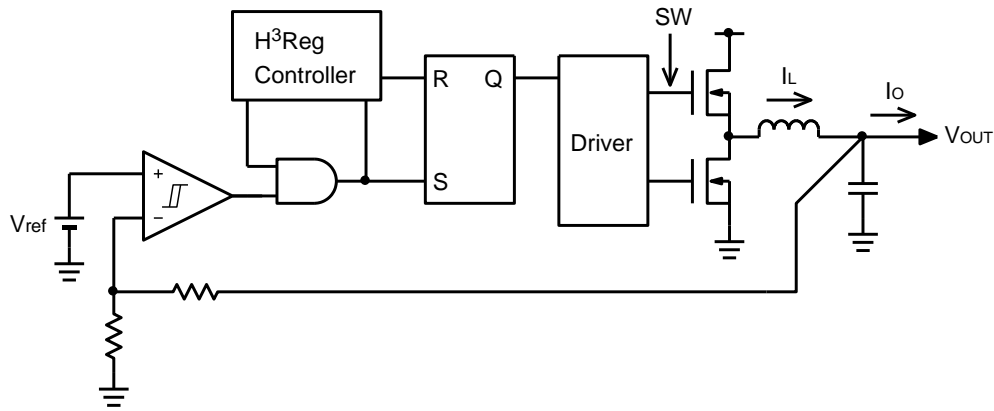
Avnet Inc.
Power module board (Kintex-7) for Mini-Module Plus development system

High-speed Transient Response Technology

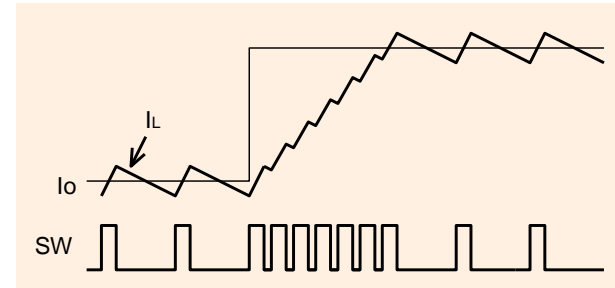
H³Reg™ Control Ensures High-Speed Response to Load Fluctuation

Generally, the current mode is used as the switching regulator control mode. However, transient response characteristics for fluctuating load current may not satisfy the required specifications. To solve this problem, it is effective to use a switching regulator in the hysteresis control mode. Constant-on-time control, one of the hysteresis control modes, feeds back a ripple voltage waveform generated by the output voltage and controls switching by comparing the bottom of the ripple voltage against the reference voltage so as to keep the output voltage constant. When the feedback voltage becomes lower than the reference voltage, a one-shot pulse is generated to turn ON the high-side switch, which enables current supply from input to output. In this way, H³Reg™ enables successive switching control via a straightforward comparison by a comparator. Since this method substantially eliminates time delays in feedback control, faster transient response characteristics than those in the current mode can be obtained.

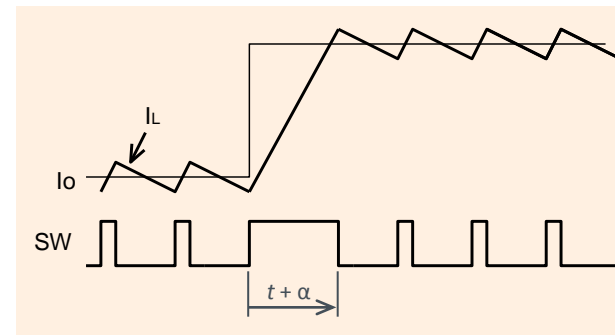
H³Reg™ control is a ROHM proprietary control mode and an advanced version of constant-on-time control. If the load current increases rapidly and, accordingly, the output voltage drops to the point that the feedback voltage does not exceed the reference-voltage even after the specified on-time has passed, H³Reg™ control extends the on-time of the high-side switch and supplies more power to accelerate output voltage recovery. This control mode assures faster transient response characteristics than constant-on-time control does. In addition, less frequent switching caused by rapid load fluctuations reduces noise generation.



H³Reg™ Block Diagram



Constant-On-Time Control Operation Waveform



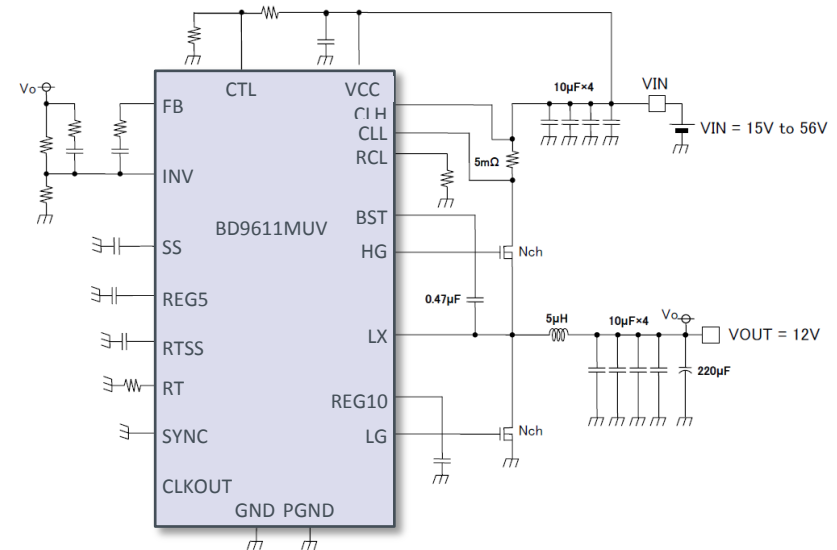
H³Reg™ Control Operation Waveform

Buck Controller Supporting Maximum 56 V Input

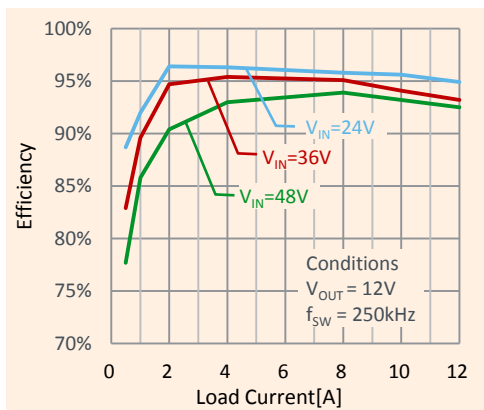
Product example: BD9611MUV

The BD9611MUV is a rated 60 V synchronous rectification type buck DC/DC controller that enables high voltage input and a wide input voltage range. This model incorporates the control circuit in the PWM and has voltage modes and drive circuit for two external 10V N-ch FETs. The oscillating frequency and soft start time adjustment function, over current protection function and synchronization function with external clock featured in this model enable flexible design. In addition, a low input malfunction prevention circuit (EXUVLO) of precise reference voltage is connected to the CTL pin, and can be adjusted from the VCC-GND resistance ratio. Pre-bias is supported to suppress current incoming from the output side at startup.

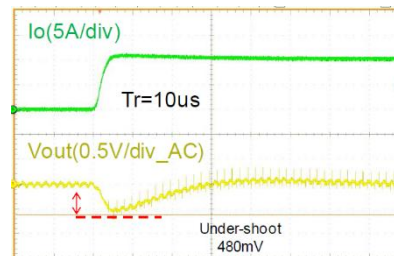
- Input voltage range : 10V to 56V (60V rating)
- Output voltage range : 1.0V to ($V_{IN} \times 0.8$)V
- Reference-voltage : $0.8V \pm 1.0\%$
- Integrated drive circuit for external N-ch FET
- Gate drive voltage : 9.0V to 11V
- Pre-bias supported
- Adjustable soft start that prevents rush current at power ON
- Operating frequency can be set from 50 kHz to 500 kHz.
- UVLO value can be set with an external component.
- Synchronization with external clocks is available.
- Multi-channel output synchronization using multiple ICs is available.
- Various protection functions
Over current protection (OCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



BD9611MUV Application Circuit



BD9611MUV - Efficiency vs. Load Current



$V_{IN} = 34V, V_{OUT} = 12V, I_O = 0A \rightarrow 10A$

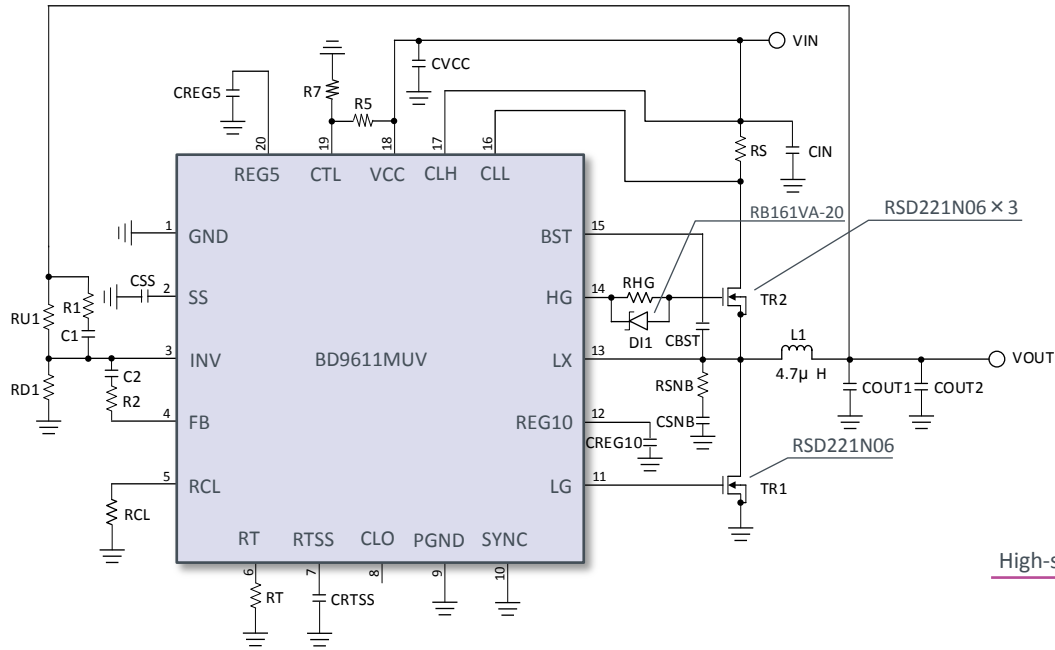
BD9611MUV Transient Response Characteristics



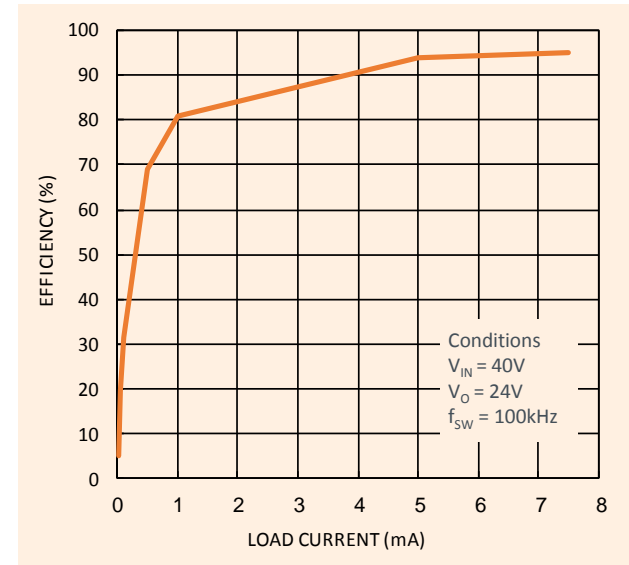
Efficient heat radiation characteristics owing to exposed pad

200 W Power Supply Solution

- Input voltage : 40V
- Output voltage : 24V
- Output current : 0.01A to 8A
- Switching frequency : 100kHz

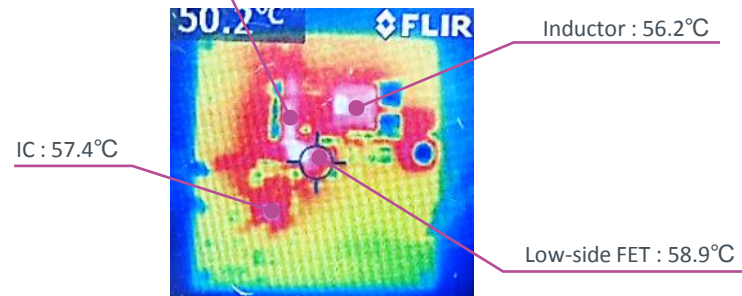


BD9611MUV 200W Output Application Circuit



BD9611MUV - Efficiency vs. Load Current

High-side FET : 56.1°C



Ta = 25°C

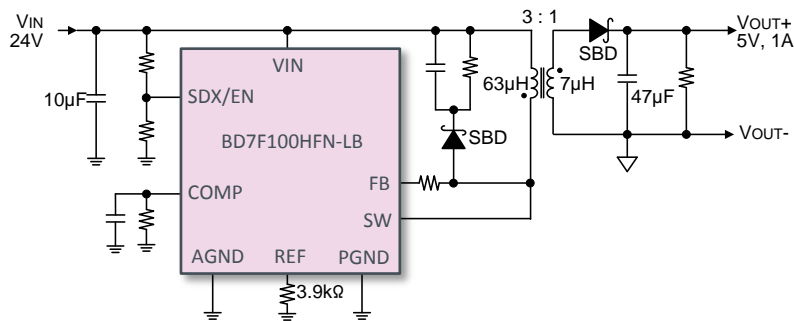
PCB Temperature Distribution

Flyback Converter

Product example : BD7F100HFN-LB, BD7F100EFJ-LB

The BD7F100HFN-LB and BD7F100EFJ-LB are ICs for newly developed isolated flyback DC/DC converters. Since control of the primary side flyback voltage stabilizes the secondary side output, an output feedback path is unnecessary. This eliminates the optocoupler that is required by general isolated converters to isolate the feedback path. Accordingly, owing to the cost reduction and elimination of components required to ensure a long service-life, unit reliability can be improved. In terms of performance, high-speed load response is implemented using adaptive on-time control and the automatic light-load mode realizes high efficiency across the entire load range. In addition, cross-regulation is dramatically improved. These models are suitable for isolated power supplies for various industries, such as power supplies for isolated gate drivers of inverters.

- Input voltage range : 3.0V to 40V (45V rating)
 - Switch pin voltage : 50V (60V rating)
 - Switch current limit : 1.25A
 - Operating frequency : 400kHz
 - Reference-voltage : $\pm 1.5\%$
 - High-speed load response is implemented by adaptive on-time control.
 - Frequency-constant operation facilitates EMC solutions.
 - The automatic light-load mode realizes high efficiency across the entire load range.
 - Elimination of components across the isolation boundary improves functional safety.
 - Elimination of components of finite service-life enables long operation.
 - Multi-output configurations of excellent cross-regulation are supported.
 - Load compensation function integrated in the secondary SBD
 - Output voltage can be set from two external resistors and the transformer winding ratio.
 - Integrated soft start function
 - Various protection functions
- Over current protection (OCP), thermal shutdown (TSD), undervoltage lockout (UVLO)



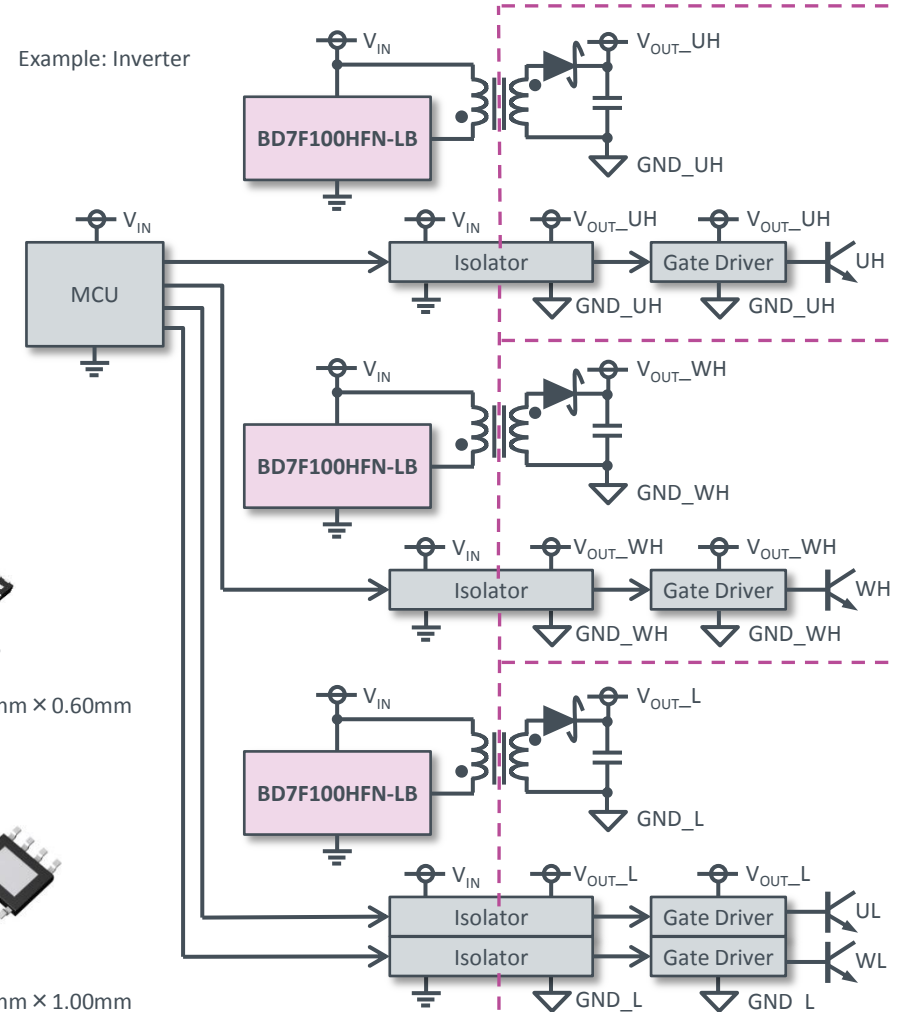
BD7F100HFN-LB Application Circuit
24V→5V

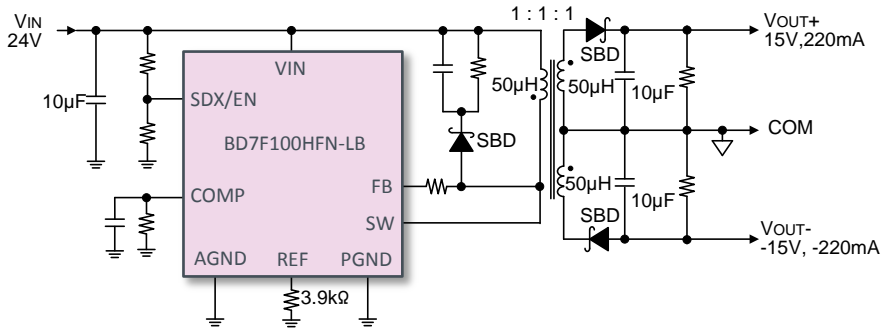


BD7F100HFN-LB
HSON8
2.90mm × 3.00mm × 0.60mm

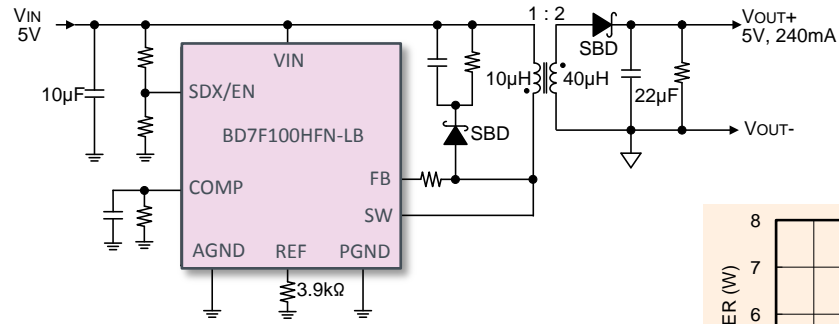


BD7F100EFJ-LB
HTSOP-J8
4.90mm × 6.00mm × 1.00mm

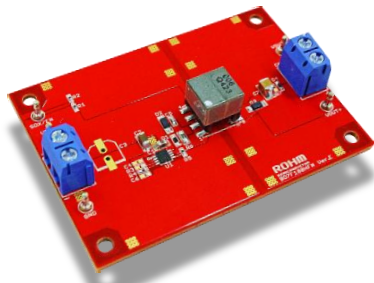




BD7F100HFN-LB Application Circuit
24V → ±15V

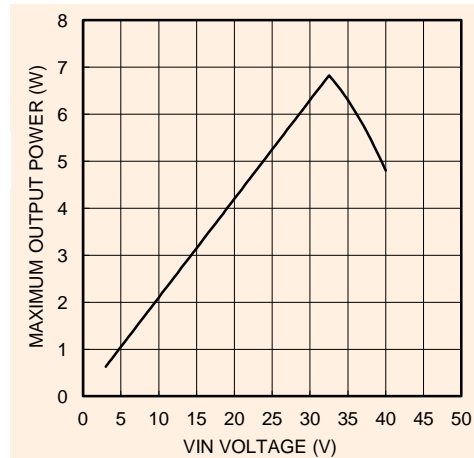
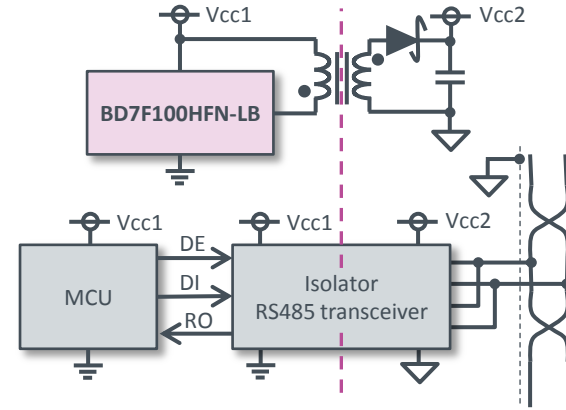


BD7F100HFN-LB Application Circuit
5V → 5V

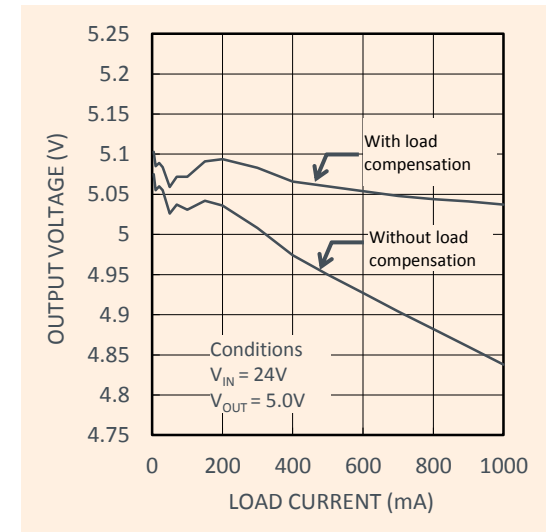


BD7F100HFN-LB Evaluation Board

Example: RS485 Transceiver



BD7F100HFN-LB Maximum Output Power vs. Input Power Supply Voltage

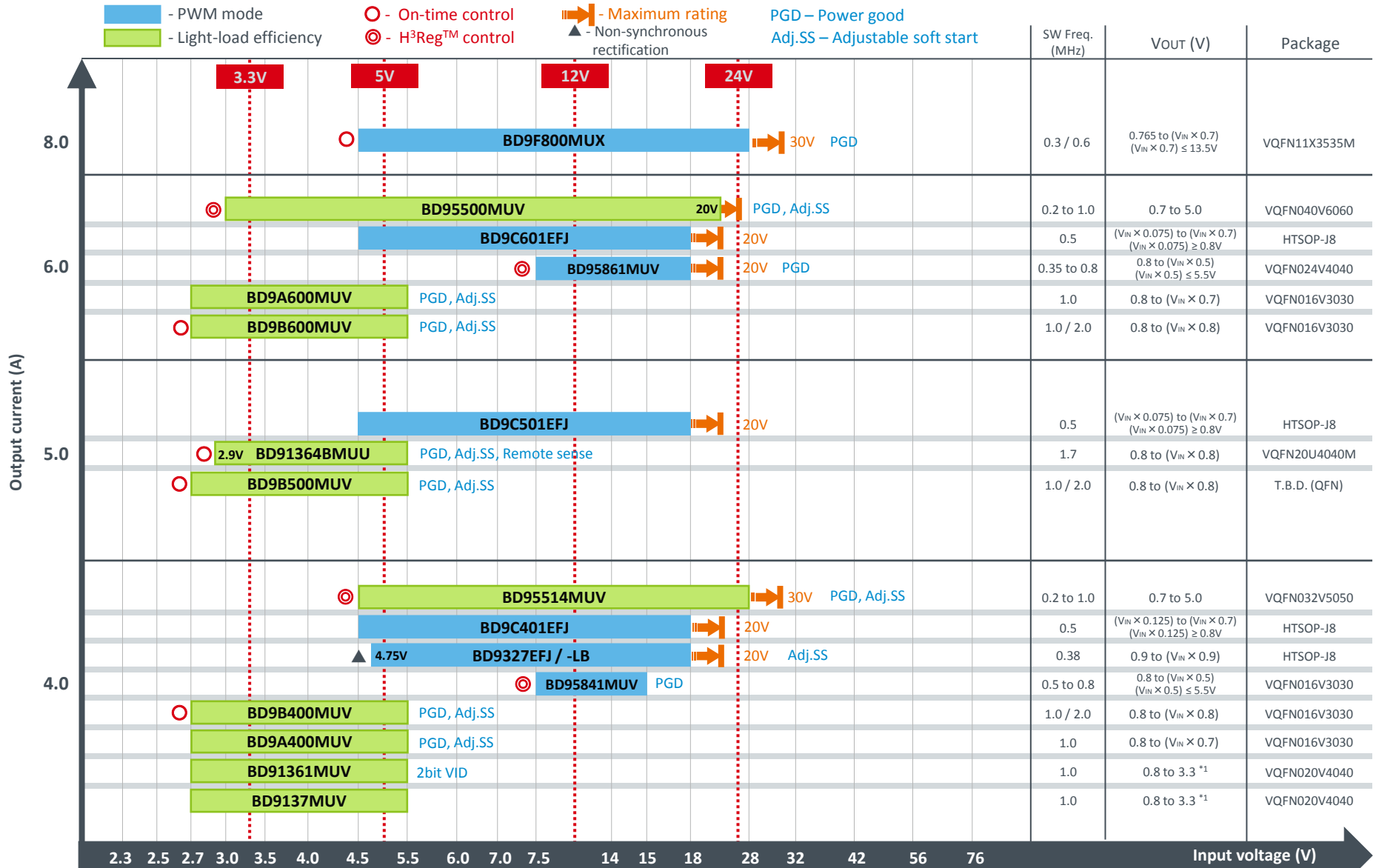


Effect of Load Compensation Function

“Load compensation function” that corrects output voltage drops caused by the V_f characteristics of the secondary side SBD that is dependent on load current

Lineup of Single Output Buck Converters (Integrated Switch FET)

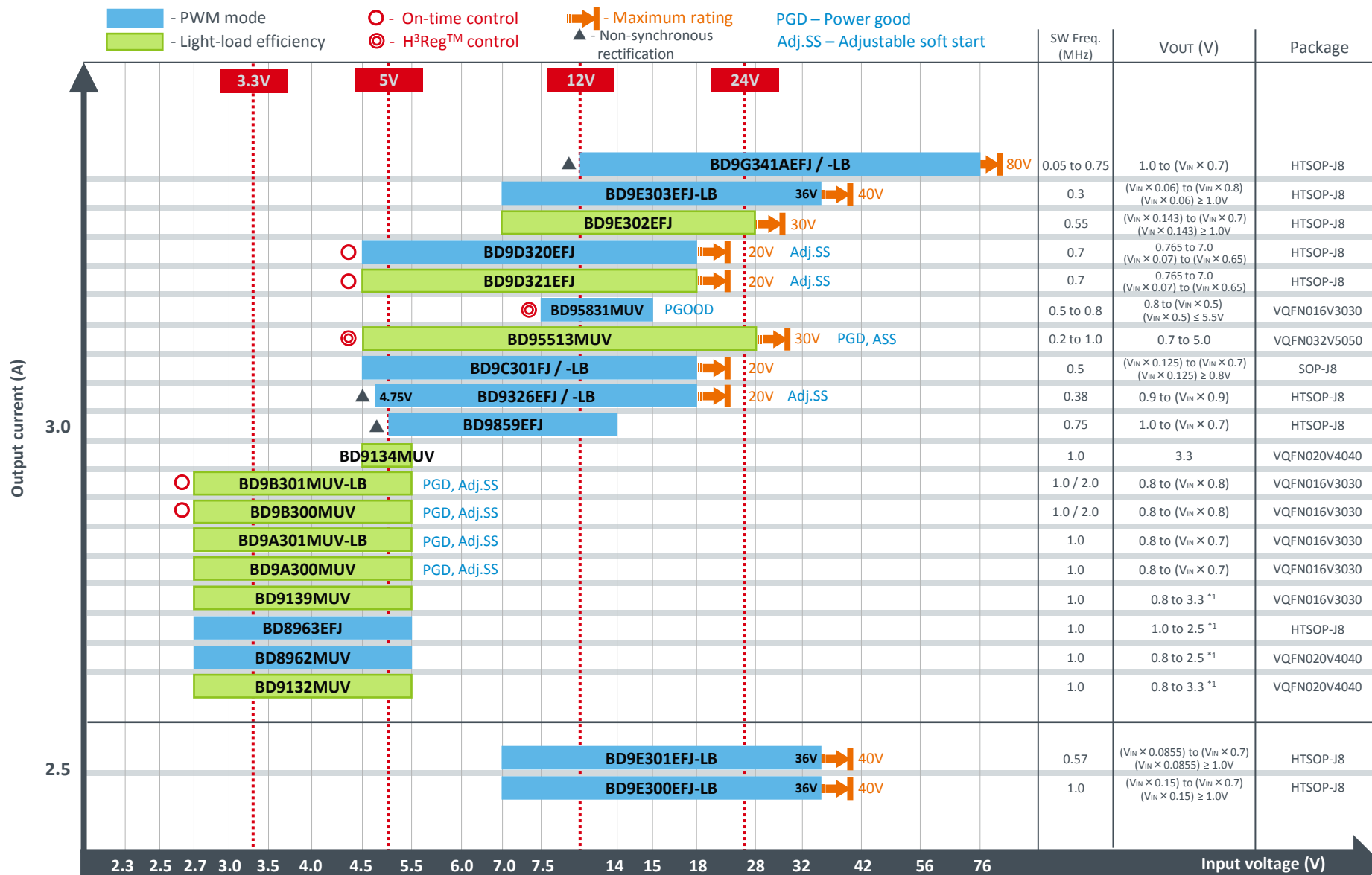
Unless otherwise specified: - Current mode control - Soft start - Synchronous rectification - Enable



*1 Limitations apply according to input/output voltage

Lineup of Single Output Buck Converters (Integrated Switch FET) (Continued from the previous page)

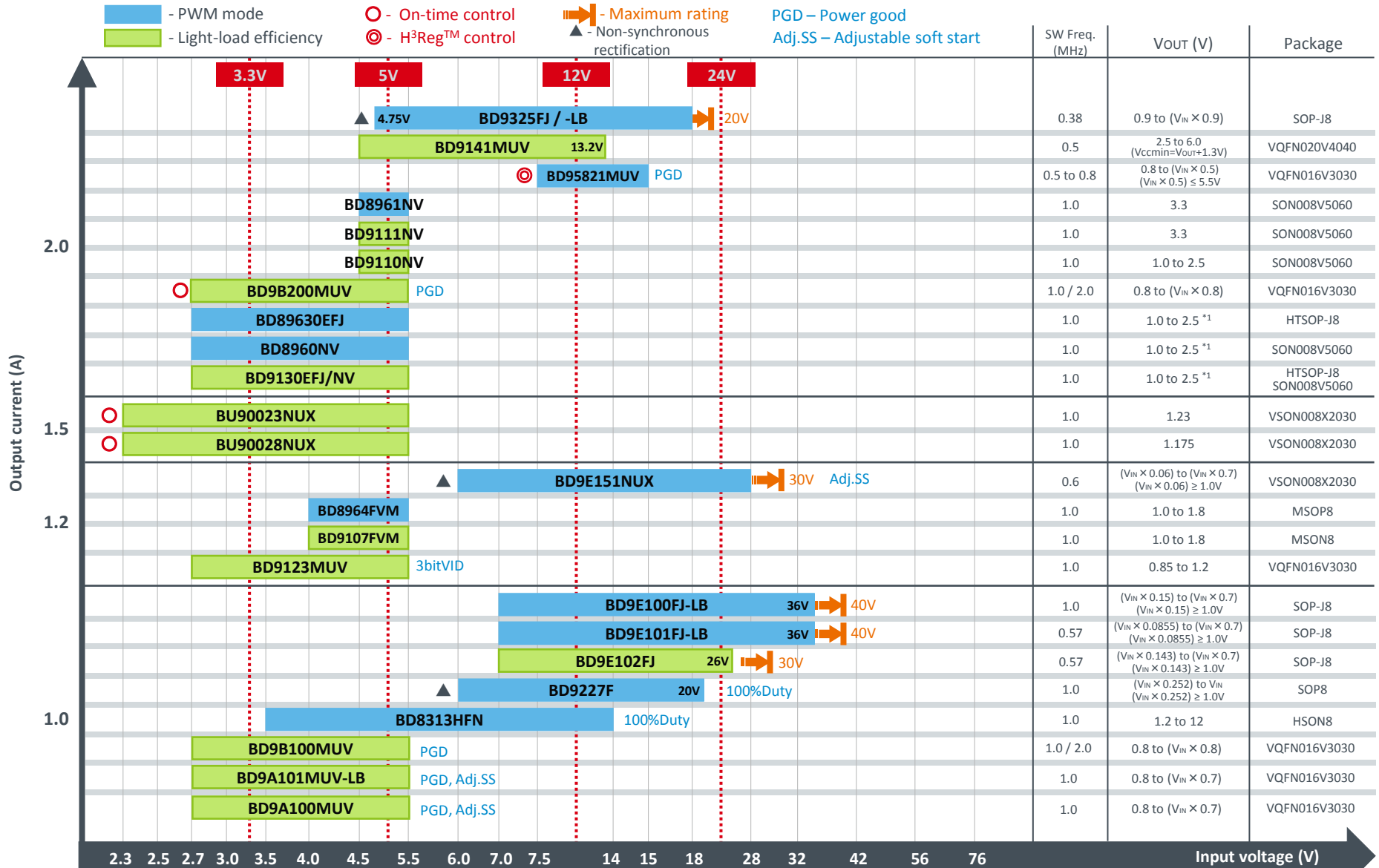
Unless otherwise specified: - Current mode control - Soft start - Synchronous rectification - Enable



*1 Limitations apply according to input/output voltage

Lineup of Single Output Buck Converters (Integrated Switch FET) (Continued)

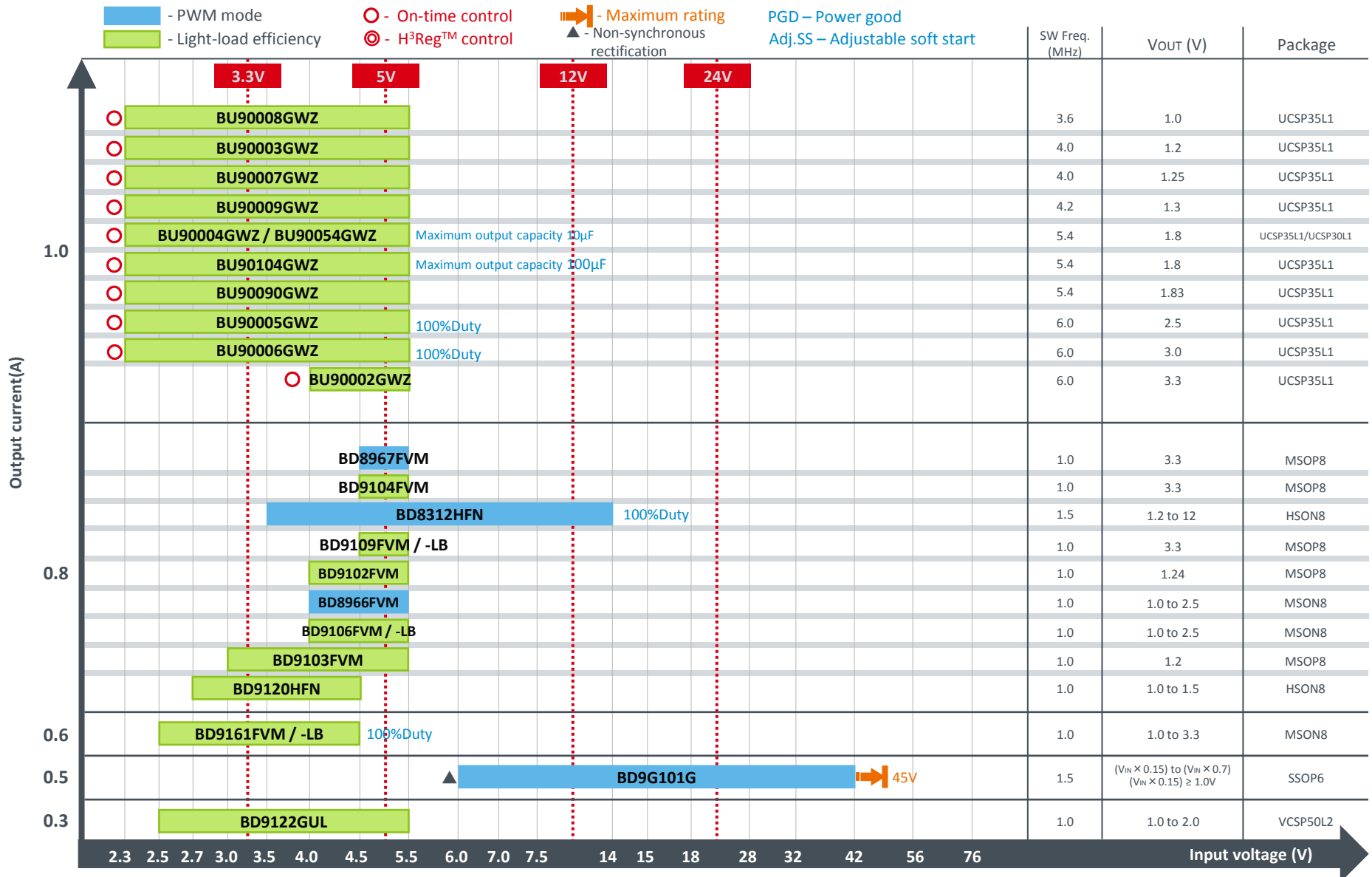
Unless otherwise specified: - Current mode control - Soft start - Synchronous rectification - Enable



*1 Limitations apply according to input/output voltage

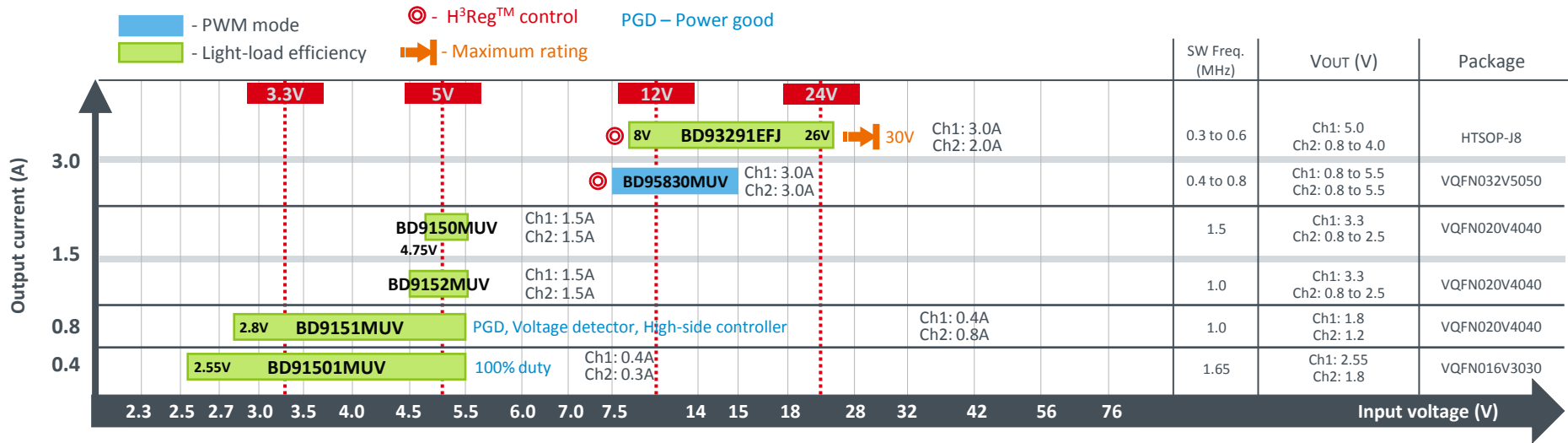
Lineup of Single Output Buck Converters (Integrated Switch FET) (Continued)

Unless otherwise specified: - Current mode control - Soft start - Synchronous rectification - Enable



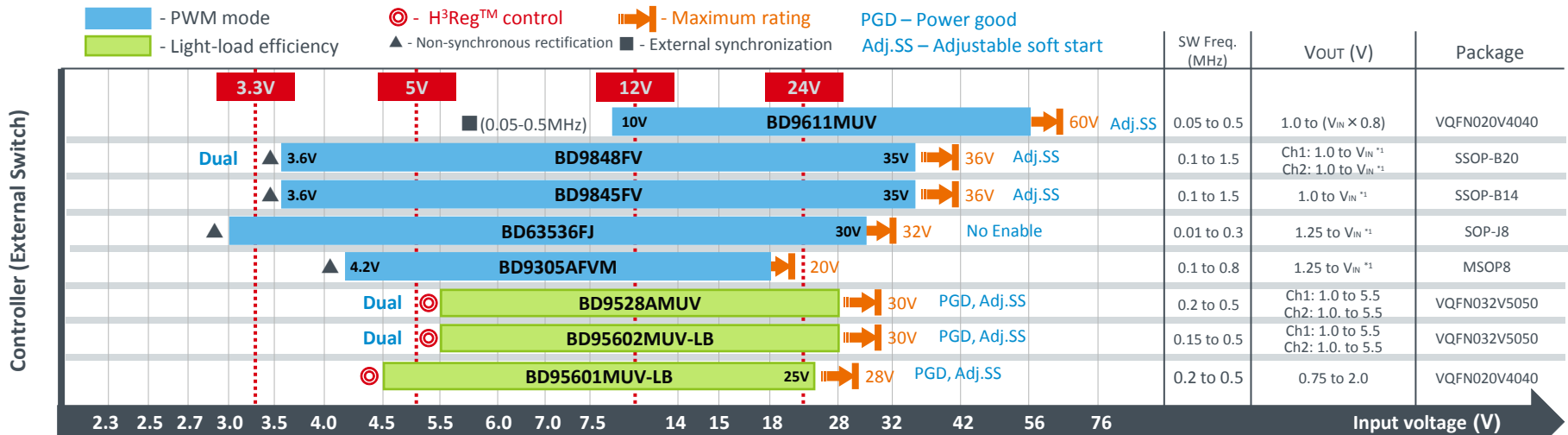
Lineup of Dual Output Buck Converters (Integrated Switch FET)

Unless otherwise specified: - Current mode control - Soft start - Synchronous rectification - Enable



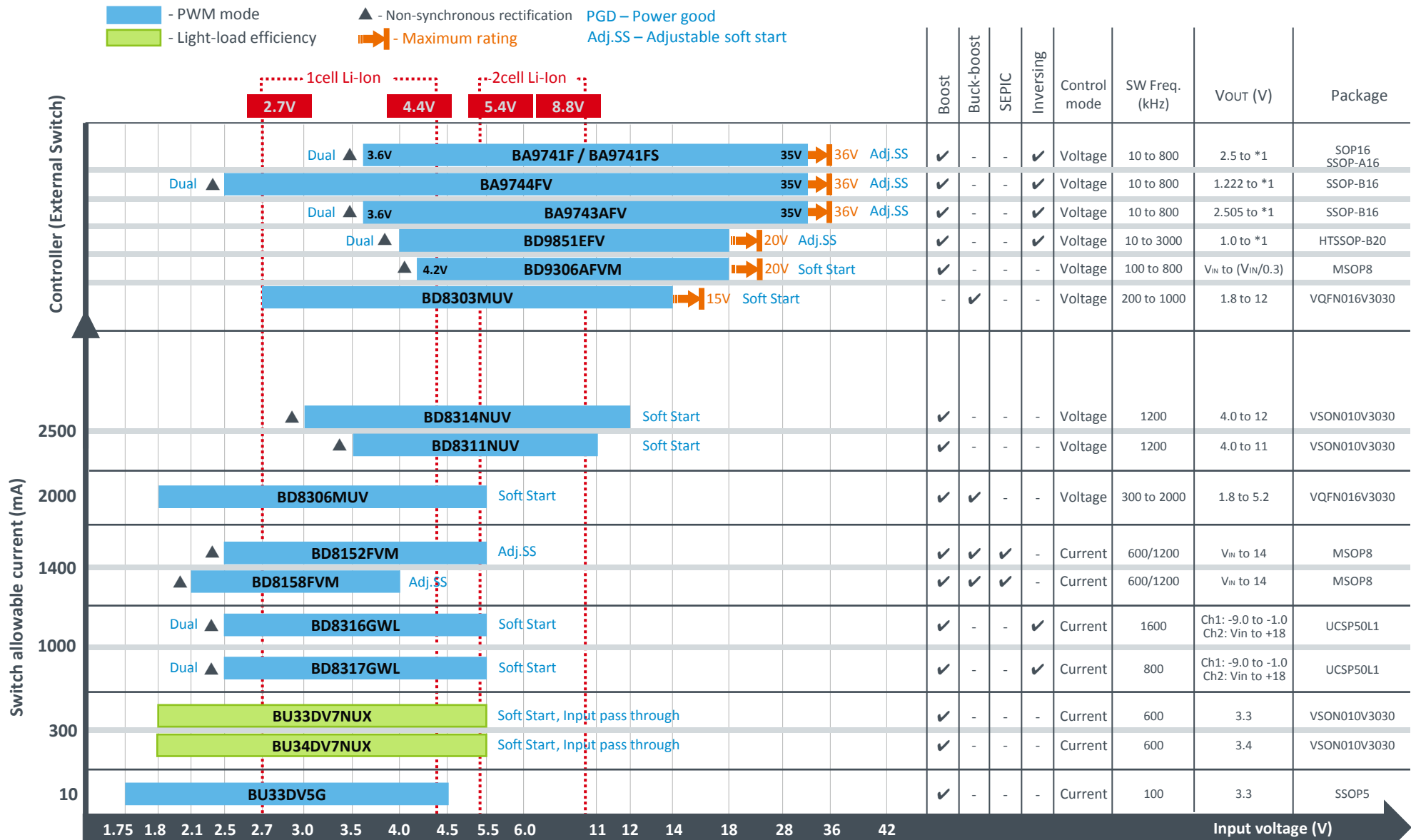
Lineup of Buck Controllers (External Switch FET)

Unless otherwise specified: - Current mode control - Soft start - Synchronous rectification - Enable



*1 Limitations apply according to input/output voltage

Lineup of Boost/Buck-boost/SEPIC and Inverting Converters and Controllers



*1 Limitations apply according to input/output voltage

3.3 V/5 V Power Rail Input Selection Guide

Part No.	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package (mm)
							Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection			
BD9122GUL	7	0.3	2.5~5.5	1.0~2.0	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	VCSP50L2 (2.5×1.1)
BD9161FVM BD9161FVM-LB	7	0.6	2.5~4.5	1.0~3.3	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	MSOP8
BU9006GUZ	7	0.75	2.5~4.5	1.0~V _{IN}	2	Current	-	-	-	✓	-	Recovery	Recovery	Incorporates in/output bias switch, 100% Duty	-35~+85	VCSP35L1 (1.6×1.6)
BD9109FVM BD9109FVM-LB	7	0.8	4.5~5.5	3.3	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	MSOP8
BD9102FVM	7	0.8	4.0~5.5	1.24	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	MSOP8
BD8966FVM	7	0.8	4.0~5.5	1.0~2.5	1	Current	-	-	-	✓	-	Latch	Latch		-25~+85	MSOP8
BD9106FVM BD9106FVM-LB	7	0.8	4.0~5.5	1.0~2.5	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	MSOP8
BD9120HFN	7	0.8	2.7~4.5	1.0~1.5	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	HSOP8
BD8967FVM	7	0.8	4.5~5.5	3.3	1	Current	-	-	-	✓	-	Latch	Latch		-25~+85	MSOP8
BD9104FVM	7	0.8	4.5~5.5	3.3	1	Current	-	-	-	✓	✓	Latch	Latch		-25~+85	MSOP8
New BU90008GWZ	7	1	2.3~5.5	1.0	3.6	On-time	-	-	-	✓	✓	Recovery	Recovery		-40~+85	UCSP35L1 (1.3×0.9×0.4)
BU90003GWZ	7	1	2.3~5.5	1.2	4	On-time	-	-	-	✓	✓	Recovery	Recovery		-40~+85	UCSP35L1 (1.3×0.9×0.4)
BU90007GWZ	7	1	2.3~5.5	1.25	4	On-time	-	-	-	✓	✓	Recovery	Recovery		-40~+85	UCSP35L1 (1.3×0.9×0.4)
New BU90009GWZ	7	1	2.3~5.5	1.3	4.2	On-time	-	-	-	✓	✓	Recovery	Recovery		-40~+85	UCSP35L1 (1.3×0.9×0.4)
BU90004GWZ	7	1	2.3~5.5	1.8	5.4	On-time	-	-	-	✓	✓	Recovery	Recovery	Maximum output capacitance 10μF	-40~+85	UCSP35L1 (1.3×0.9×0.4)
BU90054GWZ	7	1	2.3~5.5	1.8	5.4	On-time	-	-	-	✓	✓	Recovery	Recovery	Maximum output capacitance 10μF	-40~+85	UCSP30L1 (1.3×0.9×0.33)
New BU90104GWZ	7	1	2.3~5.5	1.8	5.4	On-time	-	-	-	✓	✓	Recovery	Recovery	Maximum output capacitance 100μF	-40~+85	UCSP35L1 (1.3×0.9×0.4)
New BU90090GWZ	7	1	2.3~5.5	1.83	5.4	On-time	-	-	-	✓	✓	Recovery	Recovery		-40~+85	UCSP35L1 (1.3×0.9×0.4)

3.3 V/5 V Power Rail Input Selection Guide (Continued)

Part No.	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package (mm)
							Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection			
BU90005GWZ	7	1	2.3~5.5	2.5	6	On-time	-	-	-	✓	✓	Recovery	Recovery	-40~+85	UCSP35L1 (1.3×0.9×0.4)	
BU90006GWZ	7	1	2.3~5.5	3.0	6	On-time	-	-	-	✓	✓	Recovery	Recovery	-40~+85	UCSP35L1 (1.3×0.9×0.4)	
BU90002GWZ	7	1	4.0~5.5	3.3	6	On-time	-	-	-	✓	✓	Recovery	Recovery	-40~+85	UCSP35L1 (1.3×0.9×0.4)	
BD9A100MUV BD9A101MUV-LB	7	1	2.7~5.5	0.8~(V _{IN} ×0.7)	1	Current	✓	-	✓	✓	✓	Recovery	Recovery	-40~+85 -40~+125	VQFN016V3030	
BD9B100MUV	7	1	2.7~5.5	0.8~(V _{IN} ×0.8)	1 / 2	On-time	✓	-	✓	✓	Deep	Recovery	Recovery	-40~+85	VQFN016V3030	
BD8964FVM	7	1.2	4.0~5.5	1.0~1.8	1	Current	-	-	-	✓	-	Latch	Latch	-25~+85	MSOP8	
BD9107FVM	7	1.2	4.0~5.5	1.0~1.8	1	Current	-	-	-	✓	✓	Latch	Latch	-25~+85	MSOP8	
BD9123MUV	7	1.2	2.7~5.5	0.85~1.2	1	Current	✓	-	-	✓	✓	Latch	Latch	Output voltage setting by 3-bit parallel control	VQFN016V3030	
BU90023NUX	7	1.5	2.3~5.5	1.23	1	On-time	-	-	-	✓	✓	Recovery	Recovery		-40~+85	VSON008X2030
BU90028NUX	7	1.5	2.3~5.5	1.175	1	On-time	-	-	-	✓	✓	Recovery	Recovery	-40~+85	VSON008X2030	
BD8961NV	7	2	4.5~5.5	3.3	1	Current	-	-	-	✓	-	Latch	Latch	-25~+105	SON008V5060	
BD9111NV	7	2	4.5~5.5	3.3	1	Current	-	-	-	✓	✓	Latch	Latch	-25~+105	SON008V5060	
BD9110NV	7	2	4.5~5.5	1.0~2.5	1	Current	-	-	-	✓	✓	Latch	Latch	-25~+105	SON008V5060	
BD89630EFJ	7	2	2.7~5.5	1.0~2.5 *1	1	Current	-	-	-	✓	-	Latch	Latch	-25~+85	HTSOP-J8	
BD8960NV	7	2	2.7~5.5	1.0~2.5 *1	1	Current	-	-	-	✓	-	Latch	Latch	-25~+105	SON008V5060	
BD9130EFJ	7	2	2.7~5.5	1.0~2.5 *1	1	Current	-	-	-	✓	✓	Latch	Latch	-25~+105	HTSOP-J8	
BD9130NV	7	2	2.7~5.5	1.0~2.5 *1	1	Current	-	-	-	✓	✓	Latch	Latch	-25~+105	SON008V5060	
New BD9B200MUV	7	2	2.7~5.5	0.8~(V _{IN} ×0.8)	1 / 2	On-time	✓	-	✓	✓	Deep	Recovery	Recovery	-40~+85	VQFN016V3030	

*1 Restrictions depend on input/output voltage conditions.

3.3 V/5 V Power Rail Input Selection Guide (Continued)

Part No.	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package (mm)
							Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection			
BD8962MUV	7	3	2.7~5.5	0.8~2.5 *1	1	Current	-	-	-	✓	-	Latch	Latch	-40~+105	VQFN020V4040	
BD9132MUV	7	3	2.7~5.5	0.8~3.3 *1	1	Current	-	-	-	✓	✓	Latch	Latch	-40~+105	VQFN020V4040	
BD8963EFJ	7	3	2.7~5.5	1.0~2.5 *1	1	Current	-	-	-	✓	-	Latch	Latch	-25~+85	HTSOP-J8	
BD9134MUV	7	3	4.5~5.5	3.3	1	Current	-	-	-	✓	✓	Latch	Latch	-40~+105	VQFN020V4040	
BD9139MUV	7	3	2.7~5.5	0.8~3.3 *1	1	Current	-	-	-	✓	✓	Latch	Latch	-40~+105	VQFN016V3030	
BD9A300MUV BD9A301MUV-LB	7	3	2.7~5.5	0.8~(V _{IN} ×0.7)	1	Current	✓	-	✓	✓	✓	Recovery	Recovery	-40~+85 -40~+125	VQFN016V3030	
New BD9B300MUV BD9B301MUV-LB	7	3	2.7~5.5	0.8~(V _{IN} ×0.8)	1 / 2	On-time	✓	-	✓	✓	Deep	Recovery	Recovery	-40~+85 -40~+125	VQFN016V3030	
BD9137MUV	7	4	2.7~5.5	0.8~3.3 *1	1	Current	-	-	-	✓	✓	Recovery	Recovery	-40~+105	VQFN020V4040	
BD91361MUV	7	4	2.7~5.5	0.8~3.3 *1	1	Current	-	-	-	✓	✓	Latch	Latch	Output voltage setting by 2-bit parallel control	-40~+105	VQFN020V4040
BD9A400MUV	7	4	2.7~5.5	0.8~(V _{IN} ×0.7)	1	Current	✓	-	✓	✓	✓	Recovery	Recovery	-40~+85	VQFN016V3030	
New BD9B400MUV	7	4	2.7~5.5	0.8~(V _{IN} ×0.8)	1 / 2	On-time	✓	-	✓	✓	Deep	Recovery	Recovery	-40~+85	VQFN016V3030	
New BD91364BMUU	7	5	2.9~5.5	0.8~(V _{IN} ×0.8)	1.7	On-time	✓	-	✓	✓	✓	Latch	Recovery	-40~+105	VQFN20U4040M	
New BD9B500MUV	7	5	2.7~5.5	0.8~(V _{IN} ×0.8)	1 / 2	On-time	✓	-	✓	✓	Deep	Recovery	Recovery	-40~+85	VQFN016V3030	
BD9A600MUV	7	6	2.7~5.5	0.8~(V _{IN} ×0.7)	1	Current	✓	-	✓	✓	✓	Recovery	Recovery	-40~+85	VQFN016V3030	
New BD9B600MUV	7	6	2.7~5.5	0.8~(V _{IN} ×0.8)	1 / 2	On-time	✓	-	✓	✓	Deep	Recovery	Recovery	-40~+85	VQFN016V3030	

*1 Restrictions depend on input/output voltage conditions.

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Part No.	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package	
							Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection				Over-Voltage Protection
BD8312HFN	15	0.8	3.5~14	1.2~12	1.5	Current	-	-	-	✓	-	-	Recovery	-	100% Duty	-25~+85	HSON8
BD8313HFN	15	1	3.5~14	1.2~12	1	Current	-	-	-	✓	-	-	Recovery	-	100% Duty	-40~+85	HSON8
BD9227F	22	1	6.0~20	$(V_{IN} \times 0.252) \sim V_{IN}$ $(V_{IN} \times 0.252) \geq 1.0$	1	Current	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	SOP8
BD9141MUV	15	2	4.5~13.2	2.5~6.0 *1	0.5	Current	-	-	-	✓	✓	Latch	Latch	-		-40~+105	VQFN020V4040
BD95821MUV	15.2	2	7.5~15	$0.8 \sim (V_{IN} \times 0.5)$ $(V_{IN} \times 0.5) \leq 5.5$	0.5~0.8	H ³ Reg	✓	-	-	✓	-	Latch	Recovery	✓		-20~+100	VQFN016V3030
BD9325FJ BD9325FJ-LB	20	2	4.75~18	0.9~ $(V_{IN} \times 0.9)$	0.38	Current	-	-	✓	-	-	Recovery	Recovery	-		-40~+85	SOP-J8
BD9C301FJ BD9C301FJ-LB	20	3	4.5~18	$(V_{IN} \times 0.125) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.125) \geq 0.8$	0.5	Current	-	-	-	✓	-	Latch	Recovery	-		-40~+85 -40~+125	SOP-J8
BD95831MUV	15.2	3	7.5~15	$0.8 \sim (V_{IN} \times 0.5)$ $(V_{IN} \times 0.5) \leq 5.5$	0.5~0.8	H ³ Reg	✓	-	-	✓	-	Latch	Recovery	✓		-20~+100	VQFN016V3030
BD9D320EFJ	20	3	4.5~18	0.765~7.0 $(V_{IN} \times 0.07) \sim (V_{IN} \times 0.65)$	0.7	On-time	-	-	✓	✓	-	Recovery	Recovery	-		-40~+85	HTSOP-J8
BD9D321EFJ	20	3	4.5~18	0.765~7.0 $(V_{IN} \times 0.07) \sim (V_{IN} \times 0.65)$	0.7	On-time	-	-	✓	✓	✓	Recovery	Recovery	-		-40~+85	HTSOP-J8
BD9859EFJ	15	3	5.0~14	1.0~ $(V_{IN} \times 0.7)$	0.75	Current	-	-	-	-	-	Recovery	Recovery	-		-40~+85	HTSOP-J8
BD9326EFJ BD9326EFJ-LB	20	3	4.75~18	0.9~ $(V_{IN} \times 0.9)$	0.38	Current	-	-	✓	-	-	Recovery	Recovery	-		-40~+85	HTSOP-J8
BD9C401EFJ	20	4	4.5~18	$(V_{IN} \times 0.125) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.125) \geq 0.8$	0.5	Current	-	-	-	✓	-	Latch	Recovery	-		-40~+85	HTSOP-J8
BD95841MUV	15.2	4	7.5~15	$0.8 \sim (V_{IN} \times 0.5)$ $(V_{IN} \times 0.5) \leq 5.5$	0.5~0.8	H ³ Reg	✓	-	-	✓	-	Latch	Recovery	✓		-20~+100	VQFN016V3030
BD9327EFJ BD9327EFJ-LB	20	4	4.75~18	0.9~ $(V_{IN} \times 0.9)$	0.38	Current	-	-	✓	-	-	Recovery	Recovery	-		-40~+85	HTSOP-J8
BD9C501EFJ	20	5	4.5~18	$(V_{IN} \times 0.075) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.075) \geq 0.8$	0.5	Current	-	-	-	✓	-	Latch	Recovery	-		-40~+85	HTSOP-J8
BD95861MUV	20	6	7.5~18	$0.8 \sim (V_{IN} \times 0.5)$ $(V_{IN} \times 0.5) \leq 5.5$	0.35~0.8	H ³ Reg	✓	-	-	✓	-	Latch	Recovery	✓		-20~+100	VQFN024V4040
BD9C601EFJ	20	6	4.5~18	$(V_{IN} \times 0.075) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.075) \geq 0.8$	0.5	Current	-	-	-	✓	-	Latch	Recovery	-		-40~+85	HTSOP-J8
BD95500MUV	24	6	3.0~20	0.7~5.0	0.2~1.0	H ³ Reg	✓	-	✓	✓	✓	Latch	Recovery	✓	Output Discharge	-10~+100	VQFN040V6060

*1 Restrictions depend on input/output voltage conditions.

24 V Power Rail Input Selection Guide

Part No.	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package	
							Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection				Over-Voltage Protection
BD9G101G	45	0.5	6.0~42	$(V_{IN} \times 0.15) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.15) \geq 1.0$	1.5	Current	-	-	-	-	-	Recovery	Recovery	-	-40~+105	SSOP6	
BD9E100FJ-LB	40	1	7.0~36	$(V_{IN} \times 0.15) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.15) \geq 1.0$	1	Current	-	-	-	✓	-	Recovery	Recovery	✓	-40~+150	SOP-J8	
BD9E101FJ-LB	40	1	7.0~36	$(V_{IN} \times 0.0855) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.0855) \geq 1.0$	0.57	Current	-	-	-	✓	-	Recovery	Recovery	✓	-40~+150	SOP-J8	
BD9E102FJ	30	1	7.0~26	$(V_{IN} \times 0.143) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.143) \geq 1.0$	0.57	Current	-	-	-	✓	✓	Recovery	Recovery	✓	-40~+85	SOP-J8	
BD9E151NUX	30	1.2	6.0~28	$(V_{IN} \times 0.06) \sim (V_{IN} \times 0.7)$ *1 $(V_{IN} \times 0.06) \geq 1.0$	0.6	Current	-	-	✓	-	-	Recovery	Recovery	✓	-40~+85	VSON008X2030	
BD9701CP-V5	36	1.5	8.0~35	1.0~ $(V_{IN}-3.0)$	0.1	Voltage	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	TO220CP-V5
BD9701FP	36	1.5	8.0~35	1.0~ $(V_{IN}-3.0)$	0.1	Voltage	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	TO252-5
BD9703CP-V5	36	1.5	8.0~35	1.0~ $(V_{IN}-3.0)$	0.3	Voltage	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	TO220CP-V5
BD9703FP	36	1.5	8.0~35	1.0~ $(V_{IN}-3.0)$	0.3	Voltage	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	TO252-5
BD9870FPS	36	1.5	8.0~35	1.0~ $(0.8 \times (V_{IN}-I_O \times R_{ON}))$	0.9	Voltage	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	TO252S-5
BD9873CP-V5	36	1.5	8.0~35	1.0~ $(0.8 \times (V_{IN}-I_O \times R_{ON}))$	0.11	Voltage	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+85	TO220CP-V5
BD9778HFP	36	2	7.0~35	$(V_{IN} \times 0.06) \sim V_{IN}$ $(V_{IN} \times 0.06) \geq 1.0$	0.05~0.5	Current	-	-	-	-	-	Recovery	Recovery	-	100% Duty	-40~+125	HRP7
BD9E300EFJ-LB	40	2.5	7.0~36	$(V_{IN} \times 0.15) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.15) \geq 1.0$	1	Current	-	-	-	✓	-	Recovery	Recovery	✓	-40~+150	HTSOP-J8	
BD9E301EFJ-LB	40	2.5	7.0~36	$(V_{IN} \times 0.0855) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.0855) \geq 1.0$	0.57	Current	-	-	-	✓	-	Recovery	Recovery	✓	-40~+150	HTSOP-J8	
New BD9E302EFJ	30	3	7.0~28	$(V_{IN} \times 0.143) \sim (V_{IN} \times 0.7)$ $(V_{IN} \times 0.143) \geq 1.0$	0.55	Current	-	-	-	✓	✓	Recovery	Recovery	✓	-40~+85	HTSOP-J8	
BD9E303EFJ-LB	40	3	7.0~36	$(V_{IN} \times 0.06) \sim (V_{IN} \times 0.8)$ $(V_{IN} \times 0.06) \geq 1.0$	0.3	Current	-	-	-	✓	-	Recovery	Recovery	✓	-40~+150	HTSOP-J8	
BD9702CP-V5	36	3	8.0~35	1.0~ $(V_{IN}-3.0)$	0.11	Voltage	-	-	-	-	-	Recovery	Recovery	-	-40~+85	TO220CP-V5	
BD9874CP-V5	36	3	8.0~35	1.0~ $(0.8 \times (V_{IN}-I_O \times R_{ON}))$	0.11	Voltage	-	-	-	-	-	Recovery	Recovery	-	-40~+85	TO220CP-V5	
BD95513MUV	30	3	4.5~28	0.7~5.0	0.2~1.0	H ³ Reg	✓	-	✓	✓	✓	Latch	Recovery	✓	Output Discharge	-10~+100	VQFN032V5050
BD95514MUV	30	4	4.5~28	0.7~5.0	0.2~1.0	H ³ Reg	✓	-	✓	✓	✓	Latch	Recovery	✓	Output Discharge	-10~+100	VQFN032V5050
☆ BD9F800MUX	30	8	4.5~28	0.765~ $(V_{IN} \times 0.7)$ $(V_{IN} \times 0.7) \leq 13.5$	0.3 / 0.6	On-time	✓	-	-	✓	-	Recovery	Recovery	-	-40~+85	VQFN11X3535M	

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*1 Restrictions depend on input/output voltage conditions.

Selection Guide for Maximum 75 V Input

Part No.	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features										Description	Operating Temperature (°C)	Package
							Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection	Over-Voltage Protection					
New BD9G341AEFJ BD9G341AEFJ-LB	80	3	12~76	1.0~V _{IN} *1	0.05~0.75	Current	-	-	-	-	-	Recovery	Recovery	✓		-40~+85	HTSOP-J8		

*1 Restrictions depend on input/output voltage conditions.

Dual Output Selection Guide

Part No.	Number of Channels	Input Voltage Maximum Rating (V)	Output Current (A)	Input Voltage Range (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features										Description	Operating Temperature (°C)	Package
								Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection	Over-Voltage Protection					
BD91501MUV	2	7	Io1 : 0.4 Io2 : 0.3	2.55~5.5	Vo1 : 2.55 Vo2 : 1.80	1.65	Current	-	-	-	✓	✓	Latch	Recovery	-	100% Duty	-30~+105	VQFN016V3030		
BD9151MUV	2	7	Io1 : 0.4 Io2 : 0.8	2.8~5.5	Vo1 : 1.8 Vo2 : 1.2	1	Current	-	-	-	✓	✓	Latch	Latch	-	Voltage Detector, High-side gate controller	-40~+85	VQFN020V4040		
BD9150MUV	2	7	Io1 : 1.5 Io2 : 1.5	4.75~5.5	Vo1 : 3.3 Vo2 : 0.8~2.5	1.5	Current	-	-	-	✓	✓	Latch	Latch	-		-40~+85	VQFN020V4040		
BD9152MUV	2	7	Io1 : 1.5 Io2 : 1.5	4.5~5.5	Vo1 : 3.3 Vo2 : 0.8~2.5	1	Current	-	-	-	✓	✓	Latch	Latch	-		-40~+85	VQFN020V4040		
BD93291EFJ	2	30	Io1 : 2.5 Io2 : 1.5	8.0~26	Vo1 : 5.0 Vo2 : 0.8~4.0	1.5~2.5	H ³ Reg	-	-	-	✓	✓	Recovery	Recovery	-		-40~+85	HTSOP-J8		
BD95830MUV	2	15.1	Io1 : 3.0 Io2 : 3.0	7.5~15	Vo1 : 0.8~5.5 Vo2 : 0.8~5.5	0.4~0.8	H ³ Reg	-	-	-	✓	-	Latch	Recovery	Latch		-20~+100	VQFN032V5050		

Boost/Buck-boost/SEPIC and Inverting Converter Selection Guide

Part No.	Number of Channels	Switch Current Limit (mA)	Input Voltage (V)	Output Voltage (V)	Switching Frequency (kHz)	Control Mode	Features											Package (mm)
							Boost	Buck-Boost	SEPIC	Inverting	Synchronous Rectifier	Light-Load Efficiency	Soft Start	Input pass through	UVLO	Over-Current protection	Thermal Protection	
BU33DV5G	1	10	1.75~4.5	3.3	100	Current	✓	-	-	-	✓	-	-	-	✓	Recovery	✓	SSOP5
BU33DV7NUX	1	300	1.8~5.5	3.3	600	Current	✓	-	-	-	✓	✓	✓	✓	✓	Recovery	✓	VSON010V3030
BU34DV7NUX	1	300	1.8~5.5	3.4	600	Current	✓	-	-	-	✓	✓	✓	✓	✓	Recovery	✓	VSON010V3030
BD8152FVM	1	1400	2.5~5.5	$V_{IN} \sim 14$	600 / 1200	Current	✓	✓	✓	-	-	-	Adj.	-	✓	Recovery	✓	MSOP8
BD8158FVM	1	1400	2.1~4.0	$V_{IN} \sim 14$	600 / 1200	Current	✓	✓	✓	-	-	-	Adj.	-	✓	Recovery	✓	MSOP8
BD8306MUV	1	2000	1.8~5.5	1.8~5.2	300~2000	Voltage	✓	✓	-	-	✓	-	✓	-	✓	Latch	✓	VQFN016V3030
BD8314NUV	1	2500	3.0~12	4.0~12	1200	Voltage	✓	-	-	-	-	-	✓	-	✓	Latch	✓	VSON010V3030
BD8311NUV	1	2500	3.5~11	4.0~11	1200	Voltage	✓	-	-	-	-	-	✓	-	✓	Latch	✓	VSON010V3030
BD8316GWL	2	1000	2.5~5.5	Vo1 : -9.0~-1.0 Vo2 : $V_{IN} \sim 18$	1600	Current	✓	-	-	✓	-	-	✓	-	✓	Latch	✓	UCSP50L1 (1.8x1.5)
BD8317GWL	2	1000	2.5~5.5	Vo1 : -9.0~-1.0 Vo2 : $V_{IN} \sim 18$	800	Current	✓	-	-	✓	-	-	✓	-	✓	Latch	✓	UCSP50L1 (1.8x1.5)

Isolated DC/DC Power Supplies

Isolated Flyback Converter Selection Guide

Part No.	Output Power (W)	Input Voltage Maximum Rating (V)	Switch Current Limit (A)	Input Voltage Range (V)	Switching Frequency (kHz)	Control Mode	Features						Operating Junction Temperature Range (°C)	Package
							Enable	Soft Start	Light-Load Efficiency	UVLO	Over-Current Protection	Thermal Protection		
New New BD7F100HFN-LB BD7F100EFJ-LB	1W at V_{IN} 5.0V 5W at V_{IN} 24V	45	1.25	3.0 to 40	400	Adaptive on-time	✓	✓	✓	✓	Feed back	Feed back	-40 to +125	HSO8 HTSOP-J8
New New BD7F200HFN-LB BD7F200EFJ-LB	5W at V_{IN} 12V 10W at V_{IN} 24V	45	2.75	8.0 to 40	400	Adaptive on-time	✓	✓	✓	✓	Feed back	Feed back	-40 to +125	HSO8 HTSOP-J8
☆ ☆ BD7J100HFN-LB BD7J100EFJ-LB	5W at V_{IN} 48V	80	1.0	8.0 to 80	400	Adaptive on-time	✓	✓	✓	✓	Feed back	Feed back	-40 to +125	HSO8 HTSOP-J8

☆ Under Development

Buck Controller Selection Guide

Part No.	Number of Channels	Input Voltage Maximum Rating (V)	Input Voltage Range (V)	Supply Voltage (V)	Output Voltage (V)	Switching Frequency (MHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package	
								Power Good	Externally Synchronizable	Adjustable Soft Start	Synchronous Rectifier	Light-Load Efficiency	Over-Current Protection	Thermal Protection				Over-Voltage Protection
BD9305AFVM	1	20	4.2~18	-	1.25~V _{IN} *1	0.1~0.8	Voltage	-	-	-	-	-	Latch	Recovery	-	-40~+85	MSOP8	
BD95601MUV-LB	1	28	4.5~25	4.5~5.5	0.75~2.0	0.2~0.5	H ³ Reg	✓	-	✓	✓	✓	Latch	Recovery	Recovery	Tracking feature	-10~+85	VQFN020V4040
BD63536FJ	1	32	3.0~30	-	1.25~V _{IN} *1	0.01~0.3	Voltage	-	-	-	-	-	Recovery	Recovery	Recovery	-25~+85	SOP-J8	
BD9845FV	1	36	3.6~35	-	1.0~V _{IN} *1	0.1~1.5	Voltage	-	-	✓	-	-	Recovery	Recovery	-	-40~+85	SSOP-B14	
BD9611MUV	1	60	10~56	-	1.0~(V _{IN} ×0.8)	0.05~0.5	Voltage	-	✓	✓	✓	-	Recovery	Recovery	-	Pre Bias, Adjustable UVLO	-40~+105	VQFN020V4040
BD9528AMUV	2	30	5.5~28	-	1.0~5.5	0.2~0.5	H ³ Reg	✓	-	✓	✓	✓	Latch	Recovery	Recovery	Output discharge, 3.3V LDO, 5V LDO	-20~+100	VQFN032V5050
BD95602MUV BD95602MUV-LB	2	30	5.5~28	-	1.0~5.5	0.15~0.5	H ³ Reg	✓	-	✓	✓	✓	Latch	Recovery	Recovery	Output discharge, 3.3V LDO, 5V LDO	-20~+85	VQFN032V5050
BD9848FV	2	36	3.6~35	-	1.0~V _{IN} *1	0.1~1.5	Voltage	-	-	✓	-	-	Recovery	Recovery	-	-40~+105	SSOP-B20	

*1 Restrictions depend on input/output voltage conditions.

Boost/Buck-boost Controller Selection Guide

Part No.	Number of Channels	Input Voltage Maximum Rating (V)	Input Voltage (V)	Output Voltage (V)	Switching Frequency (kHz)	Control Mode	Features							Description	Operating Temperature (°C)	Package (mm)		
							Boost	Buck-Boost	Inverting	Buck	Enable	Adjustable Soft Start	Synchronous Rectifier				Short Circuit Protection	Thermal Protection
BD8303MUV	1	15	2.7~14	1.8~12	200~1000	Voltage	-	✓	-	-	✓	-	✓	Latch	Recovery	-25~+85	VQFN016V3030	
BD9306AFVM	1	20	4.2~18	V _{IN} ~(V _{IN} /0.3)	100~800	Voltage	✓	-	-	-	✓	-	-	Latch	Recovery	-40~+85	MSOP8	
BD9851EFV	2	20	4.0~18	1.0~*1	10~3000	Voltage	✓	-	✓	✓	-	✓	-	Latch	Recovery	-40~+85	HTSSOP-B20	
BA9743AFV	2	36	3.6~35	2.505~*1	10~800	Voltage	✓	-	✓	✓	-	✓	-	Latch	Recovery	Adjustable Dead Time	-40~+85	SSOP-B16
BA9744FV	2	36	2.5~35	1.222~*1	10~800	Voltage	✓	-	✓	✓	-	✓	-	Latch	Recovery	Adjustable Dead Time	-40~+85	SSOP-B16
BA9741F	2	36	3.6~35	2.5~*1	10~800	Voltage	✓	-	✓	✓	-	✓	-	Latch	Recovery	Adjustable Dead Time	-40~+85	SOP16
BA9741FS	2	36	3.6~35	2.5~*1	10~800	Voltage	✓	-	✓	✓	-	✓	-	Latch	Recovery	Adjustable Dead Time	-40~+85	SSOP-A16

*1 Restrictions depend on input/output voltage conditions.

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