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*Before using the ICs, please verify the numerical values, data, and functions listed in the latest datasheet.*
Ultra-Low-Power Switching Regulator

The BD70522GUL utilizes ROHM’s ultra-low power technology Nano Energy® to achieve a quiescent operating current consumption of just 180nA. This significantly improves standby power efficiency, making it possible to prolong battery life in portable and wearable devices.

Sample Parameters and Features

- **Input voltage**: 2.5V to 5.5V
- **Output voltage**: 1.2V to 3.3V
- **Output voltage accuracy**: ±2.5%
- **Output current**: 500mA
- **Quiescent operating current**: 180nA
- **Standby current**: 50nA
- **>90% efficiency at 10uA output**
- **Output voltage setting via pin selection**: 1.2V/1.5V/1.8V/2.0V/2.5V/2.8V/3.0V/3.2V/3.3V
- **Power Good output**
- **100% duty operation**
- **Output discharge function**
- **Multiple protection circuits**: Over Current Protection(OCP), Thermal Shutdown(TSD), Under Voltage Lock Out(UVLO)

BD70522GUL Application Circuit Diagram

**Compact CSP(Chip Scale Package)**
VCSP50L1C
1.76mm(Typ)×1.56mm(Typ)×0.57mm(Max)

**Efficiency vs Load Current**

- **BD70522GUL**
- **Conventional Product**

*Nano Energy® is a registered trademark of ROHM Co., Ltd.*
**60V Max. Input High Buck Ratio Switching Regulator**

Power supply solution ideal for industrial equipment

The BD9V101MUF-LB utilizes ROHM’s ultra-fast pulse control technology Nano Pulse Control® to achieve a high step-down ratio of up to 24 : 1 at 2MHz. For example, 2.5V output is possible from a 60V power supply at 2MHz. This makes it possible to reduce the number of power ICs required for step-down from high voltage to low voltage from two or more with conventional solutions to just one, contributing to set miniaturization and simpler system design.

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**BD9V101MUF-LB Application Circuit Diagram**
Increasing the switching frequency to 2MHz reduces the size of external components (coil), decreasing mounting area. Further space savings can be achieved by switching from a 2-stage buck configuration to single stage conversion. Also, the 2MHz switching frequency is guaranteed to not affect the AM radio band (MW).

Conventional PCB
47mm×25mm=1,175mm²

BD9V101MUF-LB PCB
18mm×20mm=360mm²

69%

Ultra-High-Speed Pulse Control Technology Nano Pulse Control®

Buck switching DC/DC converters generate an output voltage by controlling the switching pulse width. This pulse width is thicker when the step-down ratio of the input/output voltage is low and thinner when the ratio is high. As a result, when stepping down from a 60V power supply to 2.5V, the switching pulse width becomes extremely thin due to the high buck ratio (24 : 1). For example, when the switching frequency is 2MHz the switching cycle is 500ns, so with a step-down ratio of 24:1 the pulse width becomes ultra-narrow at 20.8ns. ROHM’s Nano Pulse Control® technology achieves a pulse width of just 9ns.

Current mode control detects the current flowing through the coil, but when the pulse width narrows accurate current detection is prevented due to ringing caused by the parasitic inductance within the circuit, resulting in unstable circuit operation. ROHM’s original Nano Pulse Control® technology eliminates the effects of ringing by feeding back the coil current to the IC, making it possible to stabilize the output voltage even with narrow pulse widths using current mode control.

*Nano Pulse Control® is a registered trademark of ROHM Co., Ltd.
Ultra-Compact Low Ringing Switching Regulators

The BD9A302QWZ, BD9B304QWZ, BD9D322QWZ, and BD9D323QWZ utilize an ultra-compact package that not only reduces mounting area, but also minimizes the parasitic inductance within the circuit as well as decreases the trace area of the loop with large switching change on the PCB, making it possible to reduce both switching waveform ringing along with unwanted radiation.

Sample Parameters and Features

<table>
<thead>
<tr>
<th>BD9D322QWZ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input voltage range</strong></td>
</tr>
<tr>
<td><strong>Output voltage range</strong></td>
</tr>
<tr>
<td><strong>Reference voltage</strong></td>
</tr>
<tr>
<td><strong>Output current</strong></td>
</tr>
<tr>
<td><strong>Switching frequency</strong></td>
</tr>
<tr>
<td><strong>Built-In switching FET</strong></td>
</tr>
<tr>
<td><strong>Quiescent current</strong></td>
</tr>
<tr>
<td><strong>Fast transient response characteristics via fixed ON time control</strong></td>
</tr>
<tr>
<td><strong>High efficiency Light Load Mode</strong></td>
</tr>
<tr>
<td><strong>Variable Soft Start</strong></td>
</tr>
<tr>
<td><strong>Multiple protection functions</strong></td>
</tr>
</tbody>
</table>
  - Over Current Protection(OCP),
  - Thermal Shutdown(TSD), Under Voltage Lock Out(UVLO) |

Efficiency vs Load Current

- 3A output
- Large amount of current per unit area

Space-Saving

- 22mm×25mm=550mm²
- 17mm×20mm=340mm²
- 12mm×15mm=180mm²
Low Ringing + Low EMI
Reducing the trace area of the loop with large switching change decreases the parasitic inductance along with unwanted radiation.
Compact High Output Current Switching Regulator

The BD9F800MUX is a synchronous rectification buck DC/DC converter that integrates a low ON resistance power MOSFET. A maximum output current of 8A is possible in a compact 3.5mm square package. In addition, fixed ON time control achieves high-speed load response characteristics and eliminates the need for an external phase compensation circuit.

### BD9F800MUX

<table>
<thead>
<tr>
<th>Sample Parameters and Features</th>
<th>BD9F800MUX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>4.5V to 28V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>0.765V to 13.5V</td>
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<tr>
<td>Reference voltage</td>
<td>0.765V±1.05%</td>
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<tr>
<td>Output current</td>
<td>8A</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>300kHz/600kHz</td>
</tr>
<tr>
<td>Built-In switching FET</td>
<td>23mΩ, 11mΩ</td>
</tr>
<tr>
<td>Fast transient response</td>
<td>via fixed ON time control</td>
</tr>
<tr>
<td>Multiple protection functions</td>
<td>Over Current Protection(OCP), Short-Circuit Protection(SCP), Thermal Shutdown(TSD), Under Voltage Lock Out(UVLO)</td>
</tr>
</tbody>
</table>

### Ultra-Compact Package

- VQFN11X3535A
  - 3.5mm(Typ)×3.5mm(Typ)×0.6mm(Max)
- PCB
  - 30mm×20mm=600mm²

### BD9F800MUX Efficiency vs Output Current

![BD9F800MUX Efficiency vs Output Current](image)

### Transient Response Characteristics

- VOUT: 100mV/div
- ILOAD: 2A/div
- Conditions
  - VIN=12V
  - VOUT=3.3V

![Transient Response Characteristics](image)
The BD9G201EFJ-LB and BD9G401EFJ-M are asynchronous rectification switching regulators with built-in high side MOSFET that can operate over a wide input voltage range from 4.5V to 42V. Current mode control enables high-speed load response and easy phase compensation. When used as a compact secondary power supply, step-down voltages such as 3.3V and 5V can be output from 12V/24V power supplies. In addition, synchronization with an external clock makes it possible to carry out noise management.

- **Input voltage range**: 4.5V to 42V
- **Output voltage range**: 0.8V to \( V_{CC} \)
- **Reference voltage**: 0.8V±1.5%
- **Output current**: 1.5A (BD9G201)
  - 3.5A (BD9G401)
- **Switching frequency**: 300kHz
- **Built-in high side MOSFET**: 140mΩ
- **External clock synchronization function**: 250kHz to 500kHz
- **UVLO voltage setting via external resistance**
- **LLDO operation**: 95% Max. duty
- **Multiple protection functions**
  - Over Current Protection (OCP), Thermal Shutdown (TSD), Under Voltage Lock Out (UVLO)

**BD9G401EFJ-M Application Circuit Diagram**

**BD9G401EFJ-M BD9F800MUX Efficiency vs Output Current**

- Efficiency (%)
- Output Current: \( I_{OUT}(A) \)
- Conditions:
  - \( V_{OUT}=5.0V \)
  - \( V_{CC}=12V \)
  - \( V_{CC}=24V \)
  - \( V_{CC}=36V \)
  - \( V_{CC}=42V \)
Low Current Low Input Voltage Switching Regulator

The BU33UV7NUX is a boost DC/DC converter capable of generating 3.3V from a 1- or 2-battery power supply. The starting voltage is low at just 0.9V, and once started it can output 3.3V until the battery voltage drops to as low as 0.6V. In addition, a low circuit current of 13µA contributes to longer battery life.

**Sample Parameters and Features**

<table>
<thead>
<tr>
<th>Feature</th>
<th>BU33UV7NUX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage range</td>
<td>0.6V to 4.5V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>3.3V(+1.3%−1.15%)</td>
</tr>
<tr>
<td>Starting voltage</td>
<td>0.9V</td>
</tr>
<tr>
<td>Output current</td>
<td>500mA(VIN&gt;1.8V, during high)</td>
</tr>
<tr>
<td>Circuit current</td>
<td>13µA(High Power modes)</td>
</tr>
<tr>
<td>Power down current</td>
<td>2.7µA</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>800kHz</td>
</tr>
<tr>
<td>Includes a function that performs blocking</td>
<td>Pass-through operation when VIN&gt;VOUT</td>
</tr>
<tr>
<td>Automatically switches between PFM/PWM</td>
<td>Output discharge function</td>
</tr>
<tr>
<td>Fixed PFM operation in low power mode</td>
<td>Built-in voltage detector circuit</td>
</tr>
<tr>
<td>Multiple protection circuits</td>
<td>Prevents battery leakage</td>
</tr>
<tr>
<td>Under Voltage Lock Out(UVLO),</td>
<td>(1.5V detection voltage intended for 2</td>
</tr>
<tr>
<td>Over Voltage Protection(OVP),</td>
<td>batteries)</td>
</tr>
<tr>
<td>Over Current Protection(OCP),</td>
<td></td>
</tr>
<tr>
<td>Short-Circuit Protection(SCP), Thermal</td>
<td></td>
</tr>
<tr>
<td>Shutdown(TSD)</td>
<td></td>
</tr>
</tbody>
</table>

**Compact Package**

VSON10X3020
3.0mm(Typ)×2.0mm(Typ)×0.6mm(Max)

**Efficiency vs Load Current**

**Battery Life Comparison**

<table>
<thead>
<tr>
<th>IC</th>
<th>Battery Life(Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU33UV7NUX</td>
<td></td>
</tr>
<tr>
<td>Low Power Mode</td>
<td>712</td>
</tr>
<tr>
<td>High Power Mode</td>
<td>657</td>
</tr>
<tr>
<td>Conventional</td>
<td>537</td>
</tr>
</tbody>
</table>

Conditions:
- 2Ah battery capacity
- VIN=1.2V
- VOUT=3.3V
- IOUT=50µA

- +175
- +120
Wide Input Voltage Range Boost Switching Regulator

The BD9615MUV-LB is a low-side Nch FET controller that supports high withstand voltages (60V) for switching regulators, making it suitable for applications requiring low-side FETs such as boost flybacks.

### BD9615MUV-LB

- **Input voltage range**: 3.5V to 60V
- **Reference voltage**: 0.8V ± 1.5V
- **Switching frequency**: 100kHz to 2.5MHz
- **Guaranteed long-term supply for industrial equipment**
- **External clock synchronization**
- **Variable soft start**
- **ON/OFF control via EN pin**
- **Overvoltage protection circuit (via independent pin)**
- **Power Good output**
- **UVLO adjustment function (via external resistance)**
- **Max. duty switching function (50%/90%)**

### BD9615MUV-LB Application Circuit Diagram

![BD9615MUV-LB Application Circuit Diagram](image)

### Efficiency vs Load Current

![Efficiency vs Load Current](image)

### Compact Package

![Compact Package](image)

**VQFN16KV3030**

3.0mm(Typ)×3.0mm(Typ)×1.0mm(Max)
ROHM single output buck DC/DC converters allow designers to select the ideal power supply solution to meet specification requirements through a matrix of input voltage and output current. For the BD9x family, the ‘9’ after the ‘BD’ in the part number indicates step-down, while the subsequent letter and number denote the maximum rated input voltage and output current, respectively.
# Primary Applications

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Applications</th>
<th>Models</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC48V</td>
<td>Industrial Equipment, Communication Infrastructure, PoE, Telephone Equipment</td>
<td>BD9Gxxx series</td>
<td>P.19</td>
</tr>
<tr>
<td></td>
<td>Entertainment</td>
<td>BD9Vxxx series</td>
<td>P.19</td>
</tr>
<tr>
<td>DC24V</td>
<td>Industrial Equipment, Office Equipment, Printers</td>
<td>BD9Gxxx series</td>
<td>P.19</td>
</tr>
<tr>
<td></td>
<td>Consumer Devices, Home Appliances</td>
<td>BD9Fxxx series</td>
<td>P.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BD9Exxx series</td>
<td>P.17</td>
</tr>
<tr>
<td>DC12V</td>
<td>TVs, Recorders, Tuners, Projectors, AV Equipment</td>
<td>BD9Fxxx series</td>
<td>P.17</td>
</tr>
<tr>
<td></td>
<td>PCs, Home Gateways, Routers</td>
<td>BD9Exxx series</td>
<td>P.17</td>
</tr>
<tr>
<td></td>
<td>Office Equipment, Printers</td>
<td>BD9Dxxx series</td>
<td>P.15</td>
</tr>
<tr>
<td></td>
<td>FPGA Reference Boards, Motherboards</td>
<td>BD9Cxxx series</td>
<td>P.15</td>
</tr>
<tr>
<td>DC7.4V</td>
<td>Digital Cameras, Video Recorders</td>
<td>BD9Dxxx series</td>
<td>P.15</td>
</tr>
<tr>
<td>(2cell)</td>
<td>Portables</td>
<td>BD9Cxxx series</td>
<td>P.15</td>
</tr>
<tr>
<td></td>
<td>Mobile Phones</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chargers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC5V</td>
<td>PC Peripherals</td>
<td>BD9Bxxx series</td>
<td>P.13</td>
</tr>
<tr>
<td></td>
<td>Storage Equipment</td>
<td>BD9Axxx series</td>
<td>P.13</td>
</tr>
<tr>
<td></td>
<td>Secondary/POL Power Supplies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.3V/5V Input

The BD9Axxx and BD9Bxxx series are designed to generate a low voltage such as 1.8V from 3.3V or 5V power supplies. Pin-compatible models with output currents ranging from 1A to 6A are offered, making it possible to select the optimal IC based on application requirements. When the load current is large, operation is carried out at high speed under PWM mode, then automatically switches to light load mode (PFM mode) at smaller load currents. The BD9Bxxx series is the higher performance version of the BD9Axxx series, and replacement is possible with only minor board modifications needed. Changing ICs can be made easier by designing the PCB layout to support both types from the initial stage.

**BD9Axxx/BD9Bxxx series**

<table>
<thead>
<tr>
<th>BD9Axxx series</th>
<th>BD9Bxxx series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Method</strong></td>
<td>Current mode</td>
</tr>
<tr>
<td><strong>Light Load Operation</strong></td>
<td>Light load mode</td>
</tr>
</tbody>
</table>
| **Functions** | • Achieves fast transient response through current mode control | • Fixed ON time control proves faster transient response than the BD9Axxx series  
• No phase compensation needed  
• Higher efficiency than the BD9Axxx series across the entire load range |
| **System Diagram** | | |
| **Pin-Compatible** | BD9A100MUV  
1A Output  
BD9A300MUV  
3A Output  
BD9A400MUV  
4A Output  
BD9A600MUV  
6A Output | Industrial-Grade  
BD9A101MUV-LB  
1A Output  
BD9A301MUV-LB  
3A Output |
| **Ultra-compact molded package** | Ultra-compact molded package | |
| **BD9A302QWZ** | 3A Output  
2.0×2.0×0.4mm | |
| **BD9Bxxx series** | | |
| **Industrial-Grade** | Industrial-Grade  
BD9B301MUV-LB  
3A Output |
| **Pin-Compatible** | BD9B100MUV  
1A Output  
BD9B200MUV  
2A Output  
BD9B300MUV  
3A Output  
BD9B400MUV  
4A Output  
BD9B500MUV  
5A Output  
BD9B600MUV  
6A Output | |
| **Ultra-compact molded package** | Ultra-compact molded package | |
| **BD9B304QWZ** | 3A Output  
2.0×2.0×0.4mm  
Light load efficiency  
Output discharge |
| **BD9B331GWZ** | 3A Output  
1.98×1.8×0.33mm  
CSP, low profile, lower output voltage (Min 0.6V)  
Under Development |
| **Variable soft start  
Power Good  
Pin pitch: 0.4mm→0.5mm  
Light load efficiency  
Output discharge** | |
| **BD9B305QUZ** | 3A Output  
2.0×2.0×0.4mm  
Under Development |
| **BD9B333GWZ** | 3A Output  
1.98×1.8×0.4mm  
Under Development |

BD9Axxx series

- BD9A100MUV
- BD9A300MUV
- BD9A400MUV
- BD9A600MUV

BD9Bxxx series

- BD9B100MUV
- BD9B200MUV
- BD9B300MUV
- BD9B400MUV
- BD9B500MUV
- BD9B600MUV

- Under Development
BD9B300MUV Application Circuit Diagram

Efficiency vs Load Current

BD9B300MUV
Automatic light load switching mode

BD9Axxx/BD9Bxxx series Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Grade</th>
<th>Consumer</th>
<th>Industrial</th>
<th>Rated Input (V)</th>
<th>Output Current (A)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Operating Temperature (C)</th>
<th>Package (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD9A100MUV</td>
<td></td>
<td>✓</td>
<td>—</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>−40 to +85</td>
<td>VQFN016V3030</td>
</tr>
<tr>
<td>BD9A101MUV-LB</td>
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<td>1</td>
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<td></td>
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<td>−40 to +125</td>
<td>VQFN016V3030</td>
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<td>BD9A300MUV</td>
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<td>—</td>
<td>3</td>
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<td>0.8 to (Vin×0.7)</td>
<td>1</td>
<td>Current</td>
<td>Recovery Recovery</td>
<td>−40 to +85</td>
<td>VQFN016V3030</td>
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<tr>
<td>BD9A301MUV-LB</td>
<td>—</td>
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<td>—</td>
<td>3</td>
<td></td>
<td>2.7 to 5.5</td>
<td>0.8 to (Vin×0.8)</td>
<td>1 or 2 ON time</td>
<td>Recovery Recovery</td>
<td>−40 to +125</td>
<td>VQFN016V3030</td>
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<td>BD9A400MUV</td>
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<td>−40 to +85</td>
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<td>−40 to +85</td>
<td>VQFN016V3030</td>
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<td>BD9B301MUV-LB</td>
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<td>3</td>
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<td>0.8 to (Vin×0.8)</td>
<td>1</td>
<td>1 or 2 ON time</td>
<td>Recovery Recovery</td>
<td>−40 to +125</td>
<td>VQFN016V3030</td>
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<tr>
<td>BD9B400MUV</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>−40 to +85</td>
<td>VQFN016V3030</td>
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<tr>
<td>BD9B500MUV</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>−40 to +85</td>
<td>VQFN016V3030</td>
</tr>
<tr>
<td>BD9B600MUV</td>
<td>—</td>
<td>✓</td>
<td>—</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>−40 to +85</td>
<td>VQFN016V3030</td>
</tr>
<tr>
<td>BD9A302GQWZ</td>
<td>—</td>
<td>✓</td>
<td>—</td>
<td>3</td>
<td></td>
<td>0.8 to (Vin×0.7)</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>−40 to +85</td>
<td>UMMP008AZ020</td>
</tr>
<tr>
<td>BD9A303GQWZ</td>
<td>—</td>
<td>✓</td>
<td>—</td>
<td>3</td>
<td></td>
<td>0.8 to (Vin×0.8)</td>
<td>1 or 2 ON time</td>
<td>—</td>
<td>Recovery Recovery</td>
<td>−40 to +85</td>
<td>VMMP08LZ2020</td>
</tr>
<tr>
<td>BD9B305GQZ</td>
<td>—</td>
<td>✓</td>
<td>—</td>
<td>3</td>
<td></td>
<td>0.6 to (Vin×0.8)</td>
<td>1</td>
<td>ON time</td>
<td>—</td>
<td>−40 to +85</td>
<td>UCS25017L</td>
</tr>
<tr>
<td>BD9B331GQZ</td>
<td>—</td>
<td>✓</td>
<td>—</td>
<td>3</td>
<td></td>
<td>0.6 to (Vin×0.8)</td>
<td>1</td>
<td>ON time</td>
<td>—</td>
<td>−40 to +85</td>
<td>UCS25017L</td>
</tr>
<tr>
<td>BD9B333GQZ</td>
<td>—</td>
<td>✓</td>
<td>—</td>
<td>3</td>
<td></td>
<td>0.6 to (Vin×0.8)</td>
<td>1.3</td>
<td>ON time</td>
<td>—</td>
<td>−40 to +85</td>
<td>UCS25017L</td>
</tr>
</tbody>
</table>
12V Input

The BD9Cxxx and BD9Dxxx series are designed to generate voltages such as 3.3V or 5V from 12V power supplies. The BD9Cxxx series consists of simple current mode buck converters. Pin-compatible models with output currents ranging from 3A to 6A are offered, making it possible to quickly replace the power supply even when the load current specifications change. The BD9Dxx series of fixed ON time mode buck converters provides faster transient response than the BD9Cxxx series. In addition, two types of power supplies, one featuring fixed PWM mode and the other integrating an automatic light load switching mode, can be selected based on system specifications.

BD9Cxxx/BD9Dxxx series

<table>
<thead>
<tr>
<th>Control Method</th>
<th>BD9Cxxx series</th>
<th>BD9Dxxx series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Load Operation</td>
<td>—</td>
<td>With and without</td>
</tr>
<tr>
<td>Functions</td>
<td>• Achieves fast transient response through current mode control</td>
<td>• Fixed ON time control provides faster transient response than current mode control • No phase compensation needed • Light load operation ensures high efficiency across the entire load range</td>
</tr>
</tbody>
</table>

BD9C301FJ Application Circuit Diagram

BD9D321EFJ Application Circuit Diagram
BD9Cxxx/BD9Dxxx series Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Grade</th>
<th>Output Voltage (V)</th>
<th>Switching frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Operating Temperature (°C)</th>
<th>Package (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD9C301FJ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9C301FJ-LB</td>
<td>— ✓</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9C401EFJ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9C501EFJ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9C601EFJ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9D320EFJ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9D321EFJ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9D322QWZ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BD9D323QWZ</td>
<td>✓ –</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Conditions:
- VIN = 12V
- VOUT = 1.8V
- ILOAD = 1A–3A–1A

100μs/div
24V Input

The BD9Exxx and BD9Fxxx series are designed to generate voltages such as 3.3V or 5V from 12V or 24V power supplies. The BD9Exxx series consists of simple current mode buck converters. Users can select between 3 different switching frequencies and models with/without light load mode based on application requirements. The BD9Fxxx series of fixed ON time mode buck converters provides fast transient response.

BD9Exxx/BD9Fxxx series

<table>
<thead>
<tr>
<th>Control Method</th>
<th>BD9Exxx series</th>
<th>BD9Fxxx series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Load Operation</td>
<td>Current Mode</td>
<td>Fixed ON time</td>
</tr>
<tr>
<td>Functions</td>
<td>With and without</td>
<td>With and without</td>
</tr>
<tr>
<td>· Current mode control provides fast transient response</td>
<td>· Fixed ON time control provides faster transient response than current mode control</td>
<td></td>
</tr>
<tr>
<td>· Light load operation ensures high efficiency across the entire load range</td>
<td>· No phase compensation needed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Industrial-Grade</td>
</tr>
<tr>
<td>· Pin-Compatible</td>
</tr>
<tr>
<td>· 1MHz</td>
</tr>
<tr>
<td>· BD9E100FJ-LB</td>
</tr>
<tr>
<td>· 1A Output</td>
</tr>
<tr>
<td>· BD9E300EFJ-LB</td>
</tr>
<tr>
<td>· 2.5A Output</td>
</tr>
<tr>
<td>· 570kHz</td>
</tr>
<tr>
<td>· BD9E101FJ-LB</td>
</tr>
<tr>
<td>· 1A Output</td>
</tr>
<tr>
<td>· BD9E301EFJ-LB</td>
</tr>
<tr>
<td>· 2.5A Output</td>
</tr>
<tr>
<td>· 300kHz</td>
</tr>
<tr>
<td>· BD9E303EFJ-LB</td>
</tr>
<tr>
<td>· 3A Output</td>
</tr>
<tr>
<td>· Light Load Mode</td>
</tr>
<tr>
<td>· Fixed output</td>
</tr>
<tr>
<td>· BD9E103FJ</td>
</tr>
<tr>
<td>· 1.5A, 330kHz</td>
</tr>
<tr>
<td>· Vo=5.0V</td>
</tr>
<tr>
<td>· Pin-Compatible</td>
</tr>
<tr>
<td>· BD9E102FJ</td>
</tr>
<tr>
<td>· 1A, 570kHz</td>
</tr>
<tr>
<td>· BD9E302EFJ</td>
</tr>
<tr>
<td>· 3A, 550kHz</td>
</tr>
<tr>
<td>· BD9E104FJ</td>
</tr>
<tr>
<td>· 1A, 570kHz</td>
</tr>
<tr>
<td>· Max duty 50%</td>
</tr>
<tr>
<td>· BD9E151NUX</td>
</tr>
<tr>
<td>· 1.2A, 600kHz</td>
</tr>
<tr>
<td>· 2.0mm×3.0mm×0.6mm</td>
</tr>
<tr>
<td>· Variable Soft Start</td>
</tr>
<tr>
<td>· Compact package</td>
</tr>
<tr>
<td>· BD9F800MUX PCB</td>
</tr>
<tr>
<td>· 30mm×15mm=450mm²</td>
</tr>
<tr>
<td>· BD9F500QUZ</td>
</tr>
<tr>
<td>· 5A Output</td>
</tr>
<tr>
<td>· 600kHz/1MHz/2.2MHz</td>
</tr>
<tr>
<td>· Power Good</td>
</tr>
<tr>
<td>· Light Load Mode</td>
</tr>
<tr>
<td>· BD9F800MUX</td>
</tr>
<tr>
<td>· 8A Output</td>
</tr>
<tr>
<td>· 300kHz/600kHz</td>
</tr>
<tr>
<td>· Power Good</td>
</tr>
<tr>
<td>· Light Load Mode</td>
</tr>
</tbody>
</table>

Under Development

DC/DC Converter Selection Guide
Selectable based on system requirements

Although the BD9E300EFJ-LB and BD9E303EFJ-LB are buck DC/DC converters compatible with the same 24V power rail input, they were developed using very different concepts. The BD9E300EFJ-LB features high 1MHz switching frequency that saves valuable board space by supporting the use of smaller inductors. In contrast, the BD9E303EFJ-LB integrates a low ON resistance FET and operates at a low switching frequency of 300kHz, ensuring high efficiency and reduced heat generation with low switching loss.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BD9E300EFJ-LB</td>
<td>Compact space-saving package</td>
<td>1MHz</td>
<td>4.7μH</td>
<td>170mΩ/140mΩ</td>
<td>See below</td>
<td>2.5A</td>
<td>70%</td>
<td>15%</td>
<td>27mm×10mm/372mm²</td>
</tr>
<tr>
<td>BD9E303EFJ-LB</td>
<td>Low heat generation</td>
<td>300kHz</td>
<td>10μH</td>
<td>90mΩ/80mΩ</td>
<td>See below</td>
<td>3.0A</td>
<td>80%</td>
<td>6%</td>
<td>33mm×15mm/495mm²</td>
</tr>
</tbody>
</table>

BD9E300EFJ-LB Application Circuit Diagram

**BD9E300EFJ-LB vs BD9E303EFJ-LB**

**Efficiency vs Load Current**

**BD9E3xxx/BD9Fxxx series Specifications**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Grade</th>
<th>Consumer</th>
<th>Industrial</th>
<th>Rated Input (V)</th>
<th>Output Current (A)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Operating temperature (°C)</th>
<th>Package (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD9E100FJ-LB</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>1</td>
<td>1</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15)×1.0</td>
<td>0.57</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +150</td>
<td>SOP-J8</td>
</tr>
<tr>
<td>BD9E101FJ-LB</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>1</td>
<td>1</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15)×1.0</td>
<td>0.57</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +150</td>
<td>SOP-J8</td>
</tr>
<tr>
<td>BD9E300FJ-LB</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>40</td>
<td>2.5</td>
<td>7.0 to 36</td>
<td>0.6 to 14 μA</td>
<td>0.6/0.2 μA</td>
<td>ON time</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>VQFN11X3535A</td>
</tr>
<tr>
<td>BD9E301FJ-LB</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>2.5</td>
<td>3</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15)×1.0</td>
<td>0.57</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +150</td>
<td>HTSOP-J8</td>
</tr>
<tr>
<td>BD9E303FJ-LB</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>3</td>
<td>3</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.15)×1.0</td>
<td>0.3</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>VQFN11X3535A</td>
<td></td>
</tr>
<tr>
<td>BD9F500QOZ</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>39</td>
<td>5</td>
<td>4.5 to 36</td>
<td>0.6 to 14 μA</td>
<td>0.6/0.2 μA</td>
<td>ON time</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>VMMP012Z0833 (3.0×3.0×0.4)</td>
</tr>
<tr>
<td>BD9E102FJ</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>30</td>
<td>1</td>
<td>7.0 to 26</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.143) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>0.57</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>SOP-J8</td>
</tr>
<tr>
<td>BD9E302FJ</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>3</td>
<td>7.0 to 28</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.143) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>0.57</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>SOP-J8</td>
<td></td>
</tr>
<tr>
<td>BD9E104FJ</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>1</td>
<td>7.0 to 26</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.143) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>0.57</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>HTSOP-J8</td>
<td></td>
</tr>
<tr>
<td>BD9E305FJ</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>15</td>
<td>7.0 to 28</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.143) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>0.33</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>SOP-J8</td>
<td></td>
</tr>
<tr>
<td>BD9E151UX</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>30</td>
<td>12</td>
<td>6.0 to 28</td>
<td>(V&lt;sub&gt;IN&lt;/sub&gt;×0.06) to (V&lt;sub&gt;IN&lt;/sub&gt;×0.7)</td>
<td>0.6</td>
<td>Current</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>VSON056K02030</td>
</tr>
<tr>
<td>BD9F900UX</td>
<td></td>
<td>✓</td>
<td>❌</td>
<td>30</td>
<td>8</td>
<td>4.5 to 28</td>
<td>0.765 to 13.5 μA</td>
<td>0.3/0.6 μA</td>
<td>ON time</td>
<td>Recovery</td>
<td>✓ – 40 to +85</td>
<td>VONFN11X3535A</td>
</tr>
</tbody>
</table>

*1: Limitations will exist depending on the input/output voltage conditions.
The BD9Gxxx series of simple current mode buck converters is designed to generate intermediate voltages of 12V or 24V from 42V and 48V power supplies. The BD9G341AEFJ features a rated current of 80V (76V input) that ensures sufficient margin even for 48V bus lines used in communication infrastructure applications, making it easy to achieve safe power supply designs for high voltage sets including phones, routers, and base stations. The BD9Vxxx series utilizes ROHM’s ultra-fast pulse control technology Nano Pulse Control® to deliver the industry’s highest step-down ratio. This makes it possible to generate 2.5V from a 60V power supply using a single IC, contributing to set miniaturization and simpler system design.

**BD9Gxxx/BD9Vxxx series**

<table>
<thead>
<tr>
<th>Control Method</th>
<th>Current mode</th>
<th>Current mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Load Operation</td>
<td>Asynchronous rectification</td>
<td>Synchronous rectification</td>
</tr>
<tr>
<td>Functions</td>
<td>• Achieves fast transient response through current mode control</td>
<td>• High step-down ratio enables direct conversion from high voltage to low voltage • Synchronous rectification eliminates the need for an external diode</td>
</tr>
</tbody>
</table>

**BD9Gxxx/BD9Vxxx series Specifications**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Grade</th>
<th>Control Method</th>
<th>Rated Input (V)</th>
<th>Output Current (A)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Power Good</th>
<th>Overvoltage Protection</th>
<th>Thermal Shutdown</th>
<th>Operating temperature (°C)</th>
<th>Package (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD9G101G</td>
<td>Consumer</td>
<td>Current</td>
<td>45</td>
<td>8.0 to 42</td>
<td>(VIN×0.15) to (VIN×0.7)</td>
<td>(VIN×0.08) to (VIN×0.25)</td>
<td>1.5</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>Recovery</td>
<td>—</td>
<td>—</td>
<td>SSOP6</td>
</tr>
<tr>
<td>BD9G102G-LB</td>
<td>Industrial</td>
<td>Asynchronous</td>
<td>—</td>
<td>0.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>SSOP6</td>
</tr>
<tr>
<td>BD9G201EFJ-LB</td>
<td>Automotive</td>
<td>Asynchronous</td>
<td>1.5</td>
<td>4.5 to 42</td>
<td>0.8 to VIN</td>
<td>0.3</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>Recovery</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>HTSOP-J8ES</td>
</tr>
<tr>
<td>BD9G401EFJ-M</td>
<td>—</td>
<td>Synchronous</td>
<td>3.5</td>
<td>1.5</td>
<td>80</td>
<td>3</td>
<td>0.05 to 0.75</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>Recovery</td>
<td>—</td>
<td>—</td>
<td>HTSOP-J8</td>
</tr>
<tr>
<td>BD9G201EFJ-LB</td>
<td>—</td>
<td>Asynchronous</td>
<td>1.5</td>
<td>4.5 to 42</td>
<td>0.8 to VIN</td>
<td>0.3</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>Recovery</td>
<td>—</td>
<td>—</td>
<td>HTSOP-J8ES</td>
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<tr>
<td>BD9V101MUF-LB</td>
<td>Automotive</td>
<td>Asynchronous</td>
<td>1.0</td>
<td>60</td>
<td>16 to 60</td>
<td>0.8 to 5.5</td>
<td>1.9 to 2.3</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>Recovery</td>
<td>—</td>
<td>—</td>
<td>VQFN24FV4040</td>
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<tr>
<td>BD9G341AEFJ</td>
<td>—</td>
<td>—</td>
<td>80</td>
<td>3</td>
<td>0.05 to 0.75</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>Recovery</td>
<td>—</td>
<td>—</td>
<td>HTSOP-J8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1: Limitations will exist depending on the input/output voltage conditions.*
When the output is shorted, overcurrent protection in hiccup mode prevents breakdown by suppressing heat generation within the IC.

BD9G341AEFJ Application Circuit Diagram

**BD9G341AEFJ Efficiency vs Load Current**

![Graph showing efficiency vs load current for conventional and product versions of BD9G341AEFJ ICs.]

- **Conditions:**
  - $V_{IN}=48V$
  - $V_{OUT}=5.0V$
  - $f_{SW}=300kHz$

- **Efficiency (%):**
  - Conventional: 21.3%
  - Product: 16.3%
  - BD9G341AEFJ: 1.5%

- **Output Current (A):**
  - 1A/div

- **Load Current (A):**
  - 1 to 3,000 A

**BD9G101G Application Circuit Diagram**

**BD9V101MUF-LB Application Circuit Diagram**

- **BD9V101MUF-LB PCB:** 18mm × 20mm = 360mm²
The BD9611MUV 56V (Max.) input buck controller is a 60V rated synchronous rectification buck DC/DC controller featuring a wide input voltage range that supports high voltages. Control circuitry is built in (based on PWM/voltage mode), along with 2 external 10V Nch FET drive circuits. Additional features include an adjustment function for the oscillation frequency and soft start time, overcurrent protection function, and external clock synchronization function that provide superior design flexibility. Furthermore, a low input malfunction prevention circuit (EXUVLO) with high accuracy reference voltage is connected to the CTL pin, which can be adjusted by the resistance ratio between Vcc and GND. Also, pre-bias is enabled that suppresses current draw from the output side during startup.

**BD9611MUV**

- **Input voltage range**: 10V to 56V (Rated 60V)
- **Output voltage range**: 1.0V to (V_IN × 0.8)V
- **Reference voltage**: 0.8V ±1.0%
- **Built-in external Nch FET drive circuit**
- **Gate drive voltage**: 9V to 11V
- **Supports pre-bias**
- **Variable soft start prevents inrush current during power ON**
- **Adjustable operating frequency from 50kHz to 500kHz**
- **UVLO value settable using external parts**
- **External clock synchronization possible**
- **Synchronous operation of multiple output channels enabled using multiple ICs**
- **Multiple protection circuits**: Over Current Protection (OCP), Thermal Shutdown (TSD), Under Voltage Lock Out (UVLO)

**Exposed pad ensures excellent heat dissipation characteristics**

**BD9611MUV Efficiency vs Load Current**

- V_IN = 24V
- V_IN = 36V
- V_IN = 48V

**BD9611MUV Application Circuit Diagram**

**BD9611MUV Transient Response Characteristics**

- I_o (5A/div.)
- V_OUT (0.5V/div. AC)
- Under-shoot 480mV

**Conditions**

- V_IN = 34V
- V_OUT = 12V
- I_o = 0A to 10A
- Tr = 10µs
200W Power Supply Solution

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

BD9611MUV 200W Output Application Circuit Diagram

BD9611MUV Efficiency vs Load Current

PCB Temperature Distribution

High-side FET : 56.1°C
Inductor : 56.2°C
IC : 57.4°C
Low-side FET : 58.9°C
Flyback Converters

The BD7F100HFN-LB and BD7F100EFJ-LB are newly developed isolated flyback DC/DC converter ICs that stabilize the secondary output by controlling the flyback voltage of the primary side, eliminating the need for a return path from the output. As a result, optocouplers typically required to isolate the feedback circuit in general-purpose isolated converters are no longer needed, reducing costs and improving reliability by decreasing the number of limited life components. In terms of performance, high-speed load response is achieved by utilizing adaptive ON time control, while light load mode ensures high efficiency across the entire load range. In addition, cross-regulation is significantly improved, making them ideal for isolated power supplies in a variety of industrial equipment, such as for isolated gate drivers in inverters.

Sample Parameters and Features

- 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: ±1.5%
- High-speed load response achieved through adaptive ON time control
- Fixed frequency operation facilitates EMC countermeasures
- Automatic light load mode provides high efficiency across the entire load range
- Eliminates the need for parts that cross the isolation boundary, improving functional safety
- No limited life parts required ensures long-term operation
- Supports multi-output configuration with superior cross regulation
- Integrates a load compensation function for secondary Schottky barrier diodes
- Output voltage can be set by 2 external resistors and the transformer winding ratio
- Built-in soft start function
- Multiple protection circuits
  - Over Current Protection (OCP)
  - Thermal Shutdown (TSD)
  - Under Voltage Lock Out (UVLO)

Example: Inverter

```
Example: Inverter

BD7F100HFN-LB

MCU

BD7F100HFN-LB

Isolator

Gate Driver

Isolator

Isolator

BD7F100EFJ-LB

VOUT_UH

VIN

GND_UH

GND_L

VOUT_UH

VOUT_WH

VOUT_L

GND_WH

GND_L

UL

UL

WL

WL

VIN

VOUT_L

GND_L

VIN

VOUT_WH

GND_WH

VIN

VOUT_UH

GND_UH

GND_UH
```

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

BD7F100EFJ-LB
- HTSOP-J8
- 4.90mm×6.00mm×1.00mm
The load compensation function corrects output voltage drops due to the Vf characteristics of the secondary Schottky barrier diode depending on the load current.
Single Output Buck Converter Selection Guide

<1A Output

### PWM Mode Light Load Efficiency

<table>
<thead>
<tr>
<th>Input Voltage (V)</th>
<th>Part No.</th>
<th>Rated Input (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>BD9122GUL</td>
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<td>BD7052GUL</td>
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<td>2.9</td>
<td>BD9G101G</td>
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<td>3.0</td>
<td>BD9G102G-LB</td>
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<tr>
<td>3.5</td>
<td>BD9161FVM</td>
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<td>4.0</td>
<td>BD9161FVM-LB</td>
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<td>4.5</td>
<td>BU9006GUZ</td>
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<td>5.0</td>
<td>BD9109FVM</td>
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<td>5.5</td>
<td>BD9109FVM-LB</td>
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<td>6.0</td>
<td>BD9102FVM</td>
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<td>BD8966FVM</td>
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<td>18.5</td>
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<td>70</td>
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*1. Limitations will exist depending on the input/output voltage conditions.
<table>
<thead>
<tr>
<th>Output Current (A)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Other Functions</th>
<th>Operating Temperature (°C)</th>
<th>Package (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>2.5 to 5.5</td>
<td>1.0 to 2.0</td>
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<td>Current</td>
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<td>—</td>
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<td></td>
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<td>(2.5×1.1)</td>
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<tr>
<td>0.5</td>
<td>2.5 to 5.5</td>
<td>1.2 to 3.3</td>
<td>1</td>
<td>ON time</td>
<td>+</td>
<td>—</td>
<td>VCSP50L1C</td>
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<td>(1.76×1.56×0.57)</td>
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<td>6 to 42</td>
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<td>Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
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<td></td>
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<td>— to +105</td>
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<tr>
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<td>6 to 42</td>
<td>(VIN×0.008) to (VIN×0.8)</td>
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<td>—</td>
<td>SSOP6</td>
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<td>(VIN×0.008)≥0.75</td>
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<td>0.6</td>
<td>2.5 to 4.5</td>
<td>1.0 to 3.3</td>
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<td>—</td>
<td>MSOP8</td>
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<td>0.75</td>
<td>2.5 to 4.5</td>
<td>0.95 to VIN</td>
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<td>—</td>
<td>—</td>
</tr>
<tr>
<td>0.8</td>
<td>4.5 to 5.5</td>
<td>3.3</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>MSOP8</td>
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<tr>
<td>0.8</td>
<td>4 to 5.5</td>
<td>1.24</td>
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<td>—</td>
<td>MSOP8</td>
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<td>4.5 to 5.5</td>
<td>1.0 to 2.5</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>MSOP8</td>
</tr>
<tr>
<td>0.8</td>
<td>4.5 to 5.5</td>
<td>1.0 to 2.5</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>MSOP8</td>
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<tr>
<td>0.8</td>
<td>2.7 to 4.5</td>
<td>1.0 to 1.5</td>
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<td>Current</td>
<td>—</td>
<td>—</td>
<td>HSON8</td>
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<td>4.5 to 5.5</td>
<td>3.3</td>
<td>1</td>
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<td>—</td>
<td>—</td>
<td>MSOP8</td>
</tr>
<tr>
<td>0.8</td>
<td>4.5 to 5.5</td>
<td>3.3</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>MSOP8</td>
</tr>
<tr>
<td>0.8</td>
<td>3.5 to 14</td>
<td>1.2 to 12.0</td>
<td>1.5</td>
<td>Voltage</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.3 to 5.5</td>
<td>1.0</td>
<td>1.2</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.3 to 5.5</td>
<td>1.25</td>
<td>1.3</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.3 to 5.5</td>
<td>1.8</td>
<td>5.4</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.3 to 5.5</td>
<td>1.8</td>
<td>5.4</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.3 to 5.5</td>
<td>2.5</td>
<td>3.0</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>4 to 5.5</td>
<td>3.3</td>
<td>6</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.7 to 5.5</td>
<td>0.8 to (VIN×0.7)</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>2.7 to 5.5</td>
<td>0.8 to (VIN×0.8)</td>
<td>1 or 2</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>3.5 to 14</td>
<td>1.2 to 12.0</td>
<td>1</td>
<td>Voltage</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>6 to 20</td>
<td>(VIN×0.252) to (VIN×0.252)</td>
<td>1.0</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>7 to 36</td>
<td>(VIN×0.15) to (VIN×0.7)</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>7 to 36</td>
<td>(VIN×0.0855) to (VIN×0.7)</td>
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<td>Current</td>
<td>—</td>
<td>—</td>
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<tr>
<td>1</td>
<td>7 to 26</td>
<td>(VIN×0.143) to (VIN×0.7)</td>
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<td>Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>1</td>
<td>7 to 26</td>
<td>(VIN×0.143) to (VIN×0.5)</td>
<td>0.57</td>
<td>Current</td>
<td>—</td>
<td>—</td>
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<td>1</td>
<td>16 to 60</td>
<td>0.8 to 5.5</td>
<td>1.9 to 2.3</td>
<td>Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Other Functions:
- Output discharge, 100% duty, output voltage setting via pin selection
- Built-in input/output bypass switch, 100% duty

Other Functions:
- Max. output capacitance 10µF
- Max. output capacitance 100µF
- 100% duty

Other Functions:
- External Power Good
- Light Load Efficiency
- Recovery
- Latch
- Other Functions

Other Functions:
- Built-in input/output bypass switch, 100% duty
<table>
<thead>
<tr>
<th>Output Current (A)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Other Functions</th>
<th>Operating Temperature (°C)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>4 to 5.5</td>
<td>1.0 to 1.8</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>Latch</td>
<td>—</td>
<td>~25 to +85 MSOP8</td>
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<tr>
<td>1.2</td>
<td>4 to 5.5</td>
<td>1.0 to 1.8</td>
<td>1</td>
<td>Current</td>
<td>—</td>
<td>Latch</td>
<td>—</td>
<td>~25 to +85 MSOP8</td>
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<tr>
<td>1.2</td>
<td>2.7 to 5.5</td>
<td>0.85 to 1.2</td>
<td>1</td>
<td>Current</td>
<td>✓</td>
<td>Latch</td>
<td>—</td>
<td>Output voltage setting via 3bit parallel control</td>
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<td>1.2</td>
<td>6 to 28</td>
<td>$V_o$=0.06 to ($V_o$×0.7)</td>
<td>0.6</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>✓</td>
<td>~40 to +85 VSON008X2030D</td>
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<td>1.5</td>
<td>2.3 to 5.5</td>
<td>1.23</td>
<td>1</td>
<td>ON time</td>
<td>—</td>
<td>Recovery</td>
<td>✓</td>
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<td>—</td>
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<td>1.5</td>
<td>7 to 28</td>
<td>5.0</td>
<td>0.33</td>
<td>Current</td>
<td>—</td>
<td>Recovery</td>
<td>✓ Without Enable</td>
<td>~40 to +85 SOJ8</td>
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<td>8 to 35</td>
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<td>Recovery</td>
<td>100% duty</td>
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<td>Recovery</td>
<td>100% duty</td>
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<td>8 to 35</td>
<td>1.0 to ($0.8×(V_o$−1×$R_o$)</td>
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<td>Recovery</td>
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<td>1.0 to ($0.8×(V_o$−1×$R_o$)</td>
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<td>ON time</td>
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<td>0.5 to 0.8</td>
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<td>Recovery</td>
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<td>($V_o$×0.15) to ($V_o$×0.07)</td>
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Single Output Buck Converter Selection Guide

3A Output

PWM Mode

Light Load Efficiency

Input Voltage (V)

Part No.

Rated Input (V)

BD8962MUV
7

BD9132MUV
7

BD8963EFJ
7

BD9134MUV
7

BD9139MUV
7

BD9A300MUV
7

BD9A301MUV-LB
7

BD9B300MUV
7

BD9B301MUV-LB
7

BD9A302GWZ
7

BD9B304GWZ
7

BD9B305QUZ
7

BD9B311GWZ
7

BD9B333GWZ
7

BD9C301FJ
20

BD9C301FJ-LB
20

BD95831MUV
15.2

BD9D320EFJ
20

BD9D321EFJ
20

BD9D322GWZ
20

BD9D323GWZ
20

BD9859EFJ
15

BD9326EFJ
20

BD9326EFJ-LB
20

BD9E302EFJ
30

BD9E303EFJ-LB
40

BD9702CP-V5
36

BD9874CP-V5
36

BD95513MUV
30

BD9G341AEFJ
80

BD9G341AEFJ-LB
80

<2.5A Output

PWM Mode

Light Load Efficiency

Input Voltage (V)

Part No.

Rated Input (V)

BD8962MUV
7

BD9132MUV
7

BD8963EFJ
7

BD9134MUV
7

BD9139MUV
7

BD9A300MUV
7

BD9A301MUV-LB
7

BD9B300MUV
7

BD9B301MUV-LB
7

BD9A302GWZ
7

BD9B304GWZ
7

BD9B305QUZ
7

BD9B311GWZ
7

BD9B333GWZ
7

BD9C301FJ
20

BD9C301FJ-LB
20

BD95831MUV
15.2

BD9D320EFJ
20

BD9D321EFJ
20

BD9D322GWZ
20

BD9D323GWZ
20

BD9859EFJ
15

BD9326EFJ
20

BD9326EFJ-LB
20

BD9E302EFJ
30

BD9E303EFJ-LB
40

BD9702CP-V5
36

BD9874CP-V5
36

BD95513MUV
30

BD9G341AEFJ
80

BD9G341AEFJ-LB
80

*1 : Limitations will exist depending on the input/output voltage conditions.

* Under Development

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<th>Output Current (A)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Other Functions</th>
<th>Operating Temperature (°C)</th>
<th>Package</th>
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<td>2.7 to 5.5</td>
<td>0.8 to 2.5 (^{+1})</td>
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<td>HTSOP-J8</td>
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<td>—</td>
<td>—</td>
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<td>VQFN016V3003</td>
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<td>0.8 to (VIN×0.8)</td>
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<td>—</td>
<td>—</td>
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<td>0.8 to (VIN×0.8)</td>
<td>1</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
<td>~40 to +105</td>
<td>SOP-J8</td>
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<tr>
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<td>0.6 to (VIN×0.8)</td>
<td>1</td>
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<td>—</td>
<td>~40 to +105</td>
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<td>1.3</td>
<td>ON time</td>
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<td>—</td>
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<td>UCSP35L1 (1.98×1.8×0.4 (mm))</td>
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<td>SOP-J8</td>
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<td>0.8 to (VIN×0.5)</td>
<td>0.5 to 0.8</td>
<td>ON time</td>
<td>—</td>
<td>—</td>
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<td>0.765 to 7.0</td>
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<td>—</td>
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<td>ON time</td>
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<td>Output Voltage (V)</td>
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<td>Functions</td>
<td>Other Functions</td>
<td>Operating Temperature (°C)</td>
<td>Package (mm)</td>
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<td>Recovery</td>
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<td>Recovery</td>
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<td>Recovery</td>
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<td></td>
<td>-20 to +100</td>
<td>VQFN16V3030</td>
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<tr>
<td>6</td>
<td>4.5 to 18</td>
<td>0.8 to ((V_{in})×0.125)</td>
<td>0.5</td>
<td>ON time</td>
<td>Recovery</td>
<td></td>
<td>-40 to +105</td>
<td>HTSOP-J8</td>
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<tr>
<td>6</td>
<td>4.5 to 18</td>
<td>0.8 to ((V_{in})×0.7)</td>
<td>0.5</td>
<td>ON time</td>
<td>Recovery</td>
<td></td>
<td>-40 to +105</td>
<td>HTSOP-J8</td>
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<tr>
<td>8</td>
<td>4.5 to 28</td>
<td>0.765 to 13.5</td>
<td>0.3</td>
<td>ON time</td>
<td>Recovery</td>
<td></td>
<td>-40 to +105</td>
<td>VQFN11X3535A</td>
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<tr>
<td>Rated Input (V)</td>
<td>Output Current (A)</td>
<td>Input Voltage (V)</td>
<td>Output Voltage (V)</td>
<td>Switching Frequency (MHz)</td>
<td>Control Method</td>
<td>Functions</td>
<td>Other Functions</td>
<td>Operating Temperature (°C)</td>
</tr>
<tr>
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</tr>
<tr>
<td>7</td>
<td>Io1: 0.4 Io2: 0.3</td>
<td>2.55 to 5.5</td>
<td>Vo1: 2.55 Vo2: 1.8</td>
<td>1.65</td>
<td>Current</td>
<td>— —</td>
<td>Latch Recovery</td>
<td>— — 100% duty</td>
</tr>
<tr>
<td>7</td>
<td>Io1: 0.4 Io2: 0.8</td>
<td>2.8 to 5.5</td>
<td>Vo1: 1.8 Vo2: 1.2</td>
<td>1</td>
<td>Current</td>
<td>— — — —</td>
<td>Latch Latch</td>
<td>— — Voltage detector</td>
</tr>
<tr>
<td>7</td>
<td>Io1: 1.5 Io2: 1.5</td>
<td>4.75 to 5.5</td>
<td>Vo1: 3.3 Vo2: 0.8 to 25</td>
<td>1.5</td>
<td>Current</td>
<td>— — — —</td>
<td>Latch Latch</td>
<td>— — High side gate controller</td>
</tr>
<tr>
<td>30</td>
<td>Io1: 2.5 Io2: 1.5</td>
<td>8 to 26</td>
<td>Vo1: 5.0 Vo2: 0.8 to 4.0</td>
<td>1.5 to 2.5 ON time</td>
<td>— — — —</td>
<td>Recovery Recovery</td>
<td>— —</td>
<td>—</td>
</tr>
<tr>
<td>15.1</td>
<td>Io1: 3.0 Io2: 3.0</td>
<td>7.5 to 15</td>
<td>Vo1: 0.8 to 5.5 Vo2: 0.8 to 5.5</td>
<td>0.4 to 0.8 ON time</td>
<td>— — — —</td>
<td>Latch Recovery Latch</td>
<td>Recovery</td>
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<tr>
<th>Rated Input (V)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (MHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Other Functions</th>
<th>Operating Temperature (°C)</th>
<th>Package</th>
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<tbody>
<tr>
<td>20</td>
<td>4.2 to 18</td>
<td>1.25 to Vin⁰</td>
<td>0.1 to 0.8 Voltage</td>
<td>— — —</td>
<td>Voltage</td>
<td>— —</td>
<td>— — 40 to +85 MSOP8</td>
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<tr>
<td>30</td>
<td>4.5 to 28</td>
<td>0.85 to (Vin × 0.7) / (Vin × 0.7)²×12</td>
<td>0.3 ON time</td>
<td>— — —</td>
<td>Recovery</td>
<td>— — 40 to +85 SOP16</td>
<td>— — —</td>
<td>—</td>
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<tr>
<td>32</td>
<td>3 to 30</td>
<td>1.25 to Vin⁰</td>
<td>0.01 to 0.3 Voltage</td>
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<td>Recovery</td>
<td>— — 40 to +85 SOP-J8</td>
<td>— — —</td>
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<tr>
<td>60</td>
<td>10 to 56</td>
<td>1.0 to (Vin × 0.8)</td>
<td>0.05 to 0.5 Voltage</td>
<td>— — —</td>
<td>Recovery</td>
<td>— — 40 to +85 SOP-J8</td>
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<tr>
<td>30</td>
<td>5.5 to 28</td>
<td>1.0 to 5.5</td>
<td>0.15 to 0.5 ON time</td>
<td>— — —</td>
<td>Recovery</td>
<td>— — 40 to +85 SOP-J8</td>
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<tr>
<td>Allowable Switch Current (mA)</td>
<td>Input Voltage (V)</td>
<td>Output Voltage (V)</td>
<td>Switching Frequency (kHz)</td>
<td>Control Method</td>
<td>Functions</td>
<td>Package</td>
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<tr>
<td>10</td>
<td>1.75 to 4.5</td>
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<td>100</td>
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<td>SSOP5</td>
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<tr>
<td>300</td>
<td>1.8 to 5.5</td>
<td>3.3</td>
<td>600</td>
<td>Current ✔</td>
<td>✔</td>
<td>VSON010V3030</td>
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<td>300</td>
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<td>3.4</td>
<td>600</td>
<td>Current ✔</td>
<td>✔</td>
<td>VSON010V3030</td>
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<tr>
<td>500</td>
<td>0.6 to 4.5</td>
<td>3.3</td>
<td>800</td>
<td>Current ✔</td>
<td>✔</td>
<td>VSON010X3020</td>
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<tr>
<td>1,000</td>
<td>1.8 to 5.5</td>
<td>3.3</td>
<td>1500</td>
<td>Current ✔</td>
<td>✔</td>
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<tr>
<td>1,000</td>
<td>2.5 to 5.5</td>
<td>3.3</td>
<td>1600</td>
<td>Current ✔</td>
<td>✔</td>
<td>Latch ✔</td>
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<tr>
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<td>2.5 to 5.5</td>
<td>3.3</td>
<td>800</td>
<td>Current ✔</td>
<td>✔</td>
<td>Latch ✔</td>
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<tr>
<td>2,000</td>
<td>1.8 to 5.5</td>
<td>3.3</td>
<td>300 to 2,000</td>
<td>Voltage ✔</td>
<td>✔</td>
<td>Latch ✔</td>
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<tr>
<td>2,500</td>
<td>3.2 to 12</td>
<td>4.0</td>
<td>1,200</td>
<td>Voltage ✔</td>
<td>✔</td>
<td>Latch ✔</td>
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<tr>
<td>2,500</td>
<td>3.5 to 11</td>
<td>4.0</td>
<td>1,200</td>
<td>Voltage ✔</td>
<td>✔</td>
<td>Latch ✔</td>
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<tr>
<th>Rated Input (V)</th>
<th>Input Voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Switching Frequency (kHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Other Functions</th>
<th>Operating Temperature (°C)</th>
<th>Package</th>
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<tr>
<td>15</td>
<td>2.7 to 14</td>
<td>1.8 to 12</td>
<td>200 to 1,000</td>
<td>Voltage ✔</td>
<td>✔</td>
<td>✔</td>
<td>—</td>
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</tr>
<tr>
<td>20</td>
<td>4.2 to 18</td>
<td>1.0</td>
<td>10 to 1,000</td>
<td>Voltage ✔</td>
<td>✔</td>
<td>✔</td>
<td>—</td>
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<tr>
<td>20</td>
<td>4.2 to 18</td>
<td>1.0</td>
<td>10 to 1,000</td>
<td>Voltage ✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>36</td>
<td>3.6 to 35</td>
<td>2.5</td>
<td>10 to 1,000</td>
<td>Voltage ✔</td>
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<td>36</td>
<td>3.6 to 35</td>
<td>2.5</td>
<td>10 to 1,000</td>
<td>Voltage ✔</td>
<td>✔</td>
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<td>62</td>
<td>3.5 to 60</td>
<td>2.5</td>
<td>10 to 2,000</td>
<td>Voltage ✔</td>
<td>✔</td>
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# Isolated DC/DC Power Supplies

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Output Power (W)</th>
<th>Rated Input (V)</th>
<th>Allowable Switch Current (A)</th>
<th>Input Voltage (V)</th>
<th>Switching Frequency (kHz)</th>
<th>Control Method</th>
<th>Functions</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD7F100HFN-LB/BD7F100EFJ-LB</td>
<td>1W(at 5.0V VIN) 5W(at 24V VIN)</td>
<td>45</td>
<td>1.25</td>
<td>3.0 to 40</td>
<td>400</td>
<td>Adaptive ON time</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BD7F200HFN-LB/BD7F200EFJ-LB</td>
<td>2W(at 5.0V VIN) 10W(at 24V VIN)</td>
<td>45</td>
<td>2.75</td>
<td>5.0 to 40</td>
<td>400</td>
<td>Adaptive ON time</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>☆ BD7J200HFN-LA/☆ BD7J200EFJ-LA</td>
<td>10W(at 48V VIN)</td>
<td>80</td>
<td>1.38</td>
<td>8.0 to 80</td>
<td>400</td>
<td>Adaptive ON time</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- Under Development
For the full lineup of power supply ICs, please visit ROHM’s website, which offers technical materials and tools including datasheets, application notes, reference circuits, evaluation boards, and Spice models.

Tech Web, a dedicated technical site for power supply ICs, provides technical information useful for designers seeking basic knowledge on power ICs along with seminar information.
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