Panasonic offers a variety of devices as "Total Power simulations." Please visit the URL below to learn more about coil, capacitor, components for suppressing noise or surge, etc.

http://industrial.panasonic.com/ww/index_e.html

Panasonic offers a variety of devices as "Total Power simulations." Please visit Design Support Tools for more information.

- Power Device Simulator
- IC Designer
- Active Datasheet
- Buck Analyzer
- Power circuit simulation for DC-DC regulator IC
- Performance simulation for switching MOSFET
- Power circuit simulation for switching MOSFET
- Operation procedure

Panasonic will continue to offer the power solutions that satisfy our customers along with the "ENELEAD."
***DC-DC Regulator with Built-in Power MOS***

DC-DC regulators including both Fast-response control IC with hysteretic control and MOSFET with low ON-resistance in a single package (MCP).

### Feature 1: High efficiency

**Core Technology**

(1) Built-in MOSFET with low ON-resistance

**Trench-MOSFET**  The optimization of the structure reduces the capacity, and improves the Qg/ON-resistance significantly.

- **Reduction of power loss**
  - Conventional design: Square Source & Body
  - New design: Parallel Source & Body

<table>
<thead>
<tr>
<th>Process rule</th>
<th>RDS(on)</th>
<th>Gq</th>
<th>Ron+Gq</th>
</tr>
</thead>
<tbody>
<tr>
<td>250nm</td>
<td>1</td>
<td>0.6</td>
<td>0.01</td>
</tr>
<tr>
<td>110nm</td>
<td>1.0</td>
<td>0.4</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Improves the efficiency at light load.

- **Efficiency [%]**
  - Load current: 10mA
  - Efficiency: 87% at 10mA
  - Efficiency: 96% at 1A

### Feature 2: Fast response

**Core Technology**

Hysteretic control method

- **Load transient**
  - VIN = 5.0V, VOUT = 12V
  - Cout: 44μF
  - L: 1.0μH

- **Undershoot**: 9mV
- **Overshoot**: 11mV

Reduces the overshoot/undershoot due to load current transient to ±10mVpp.

- **Footprint**: 48mm²
  - MCP (Single-Chip Package)
  - 1 package

### Feature 3: Small size

**Core Technology**

MCP (Multi-Chip Package)

- **Footprint**: 16mm²
  - Both DC-DC control IC and MOSFET are included in a single package.
  - 1 package

- **Line-up**
  - Achieves low power consumption and low heat generation.
  - Small footprint, achieving miniaturization of equipments.

<table>
<thead>
<tr>
<th>NN3019A</th>
<th>NN3029A</th>
<th>NN30297A</th>
<th>NN30196A</th>
<th>NN30310AA</th>
<th>NN30320A</th>
<th>NN30321A</th>
<th>NN30341A</th>
<th>NN30332A</th>
<th>NN30312A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage 1</td>
<td>4.5 to 5.5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
<td>4.5 to 5V</td>
</tr>
<tr>
<td>Input voltage 2 (+1)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Absolute maximum rating</td>
<td>6V</td>
<td>33V</td>
<td>30V</td>
<td>33V</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Output voltage</td>
<td>0.6 to 3.5V</td>
<td>0.6 to 3.5V</td>
<td>0.6 to 3.5V</td>
<td>0.75 to 5.5V</td>
<td>0.75 to 5.5V</td>
<td>0.75 to 3.6V</td>
<td>0.75 to 5.5V</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Output current (max)</td>
<td>5A</td>
<td>5A</td>
<td>5A</td>
<td>6A</td>
<td>6A</td>
<td>6A</td>
<td>6A</td>
<td>9A</td>
<td>9A</td>
</tr>
<tr>
<td>Control method</td>
<td>Hysteric</td>
<td>Hysteric</td>
<td>Hysteric</td>
<td>Hysteric</td>
<td>Hysteric</td>
<td>Hysteric</td>
<td>Hysteric</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Run (D)</td>
<td>Hi/Lo</td>
<td>Hi/Lo</td>
<td>Hi/Lo</td>
<td>Hi/Lo</td>
<td>Hi/Lo</td>
<td>Hi/Lo</td>
<td>Hi/Lo</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Synchronous rectification</td>
<td>—</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Package</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Size</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Selectable frequency</td>
<td>0.5/1.0 MHz</td>
<td>0.5 to 2.0 MHz</td>
<td>0.5 to 2.0 MHz</td>
<td>0.5/1.0 MHz</td>
<td>0.5/1.0 MHz</td>
<td>0.5/1.0 MHz</td>
<td>0.5/1.0 MHz</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Function</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>OCP, OVD, SCP, UVLO, TSD</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Typical ratings (2)

- **Overshoot**: 11mV
- **Undershoot**: 9mV
- **Output voltage**: 3.3V
- **SW frequency**: 500kHz
- **Load current**: 6mA

(*) Ultra-high efficiency at light load achieved by a 5-V input voltage
(+) Skip mode: High efficiency mode at light load.