Applications for Standard & Custom Low Profile Power Modules

Aerospace & Military

Renewable Energy

Hybrids & Electrics

Welding

Induction Heating

Minimum Size—Maximum Performance!

Microsemi
The Microsemi Advantage

Inverters for renewable energy demand the most efficient semiconductor and power modules to send power from solar panels and wind turbines to the grid.

**Microsemi offers:**
- Mix of silicon (Trench & CoolMos) for better performance
- SiC diodes for greater efficiency
- High performance base modules versus baseless modules
- New three level topology

**Our Value Proposition:**
- Same height power module to realize the full inverter system
- SP1, SP3, SP6P offering same 12mm height as SOT-227
- Low stray inductance module for improved efficiency
- Standard configuration with SiC diodes integrated
- Temperature sensor built in
- New Multi Level Converter topology available (Neutral Point Clamped)

**Why and When Choose Silicon Carbide?**
- Real advantage in hard switching conditions
- Ultra low Qrr leads to reduced switching losses
- Temperature independent switching behavior
- Reduced system size and cost
- Improved system efficiency
- Improved cooling system

**Applications:**
- PFC
- Output rectifier,
- Freewheeling diode

Solutions for Solar Inverters 1kW to 50kW, Wind Turbines and Fuel Cells

**Sample Part Numbers**

<table>
<thead>
<tr>
<th>Input Rectifier</th>
<th>PFC</th>
<th>Resonant Converter</th>
<th>Output Rectifier</th>
<th>Inverter</th>
</tr>
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<tbody>
<tr>
<td>APTDR40X1601G</td>
<td>APT50GF80CU2</td>
<td>APTC60AM24T1G</td>
<td>APTDF100H4001G</td>
<td>APTGT100H60T3G</td>
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<td>APTDR90X1601G</td>
<td>APT70060CU2</td>
<td>APTGF90A120T1G</td>
<td>APTDF100H1201G</td>
<td>APTGL100H120T3G</td>
</tr>
</tbody>
</table>

Various topologies with same 12mm height packages
**Microsemi offers:**

- Low RDSon MOSFET High Current Diode
- UltraFast IGBT
- Low Cost Products
- Standard and Custom Copper Baseplate for:
  - Improved Thermal Performance
  - High power Cycling Capabilities

**Our Experience:**

- 30% of Power Module Sales
- 10 year old Design still on market
- Up to 50K EAU per Reference
- Very high customer satisfaction
- Zero field return

**Applications:**

- MIG/MAG Welders
- Plasma Cutters
- TIG AC & DC Welders
- STUD Welding
**Microsemi offers:**
- Thermal expansion material matching for increased power and temperature cycling performance.
- Flexibility in design to develop any kind of shape and size power module.
- Withstands temperatures from -60°C to +200°C
- Hermetic sealed modules capabilities
- Light material for aerospace application
- Short development cycle
- Qualification test and Screening to customer specification
- No quantity limitation

**Microsemi advantages:**
- Unique high voltage power MOSFET range:
  - 1000V and 1200V
- Easy paralleling of power modules
- Low profile package design dedicated to high frequency
- 500kHz operating frequency capability with MOSFET
- Various topologies available with series and parallel fast diodes
- Dedicated topologies for ZVS and ZCS mode application
- Fast IGBT combinations for resonant mode up to 100kHz

**Applications:**
- Induction heating from 10kW to 500kW

**Aerospace / Military**

**Applications:**
- Modules are used in aircraft for flight actuators, air conditioning, fuel pumps and cooling & chilling systems. They are also used in naval vessels, ground vehicles and back-up power systems.

**Microsemi**

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- Flexibility in design to develop any kind of shape and size power module.
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- Hermetic sealed modules capabilities
- Light material for aerospace application
- Short development cycle
- Qualification test and Screening to customer specification
- No quantity limitation

**Our Experience:**
- 15 year old design still on market
- Thousands in the field, no returns
- Numerous developments for demonstrator
- Strong technical expertise and support

**Applications:**
- Modules are used in aircraft for flight actuators, air conditioning, fuel pumps and cooling & chilling systems. They are also used in naval vessels, ground vehicles and back-up power systems.

**Material**

<table>
<thead>
<tr>
<th>Material</th>
<th>CTE (ppm/K)</th>
<th>Thermal conductivity (W/m.K)</th>
<th>Density (g/cc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuW</td>
<td>6.5</td>
<td>190</td>
<td>17</td>
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<tr>
<td>AlSiC</td>
<td>7</td>
<td>170</td>
<td>2.9</td>
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<tr>
<td>Cu</td>
<td>17</td>
<td>390</td>
<td>8.9</td>
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<tr>
<td>Si3N4</td>
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<tr>
<td>Die</td>
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<tr>
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<td>SiC</td>
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<td>270</td>
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</tbody>
</table>

**Silicon Discs (120 mm²)**

<table>
<thead>
<tr>
<th>Material</th>
<th>CTE (ppm/K)</th>
<th>Thermal conductivity (W/m.K)</th>
<th>Effic (KW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu/Al2O3</td>
<td>13/7</td>
<td>300/28</td>
<td>0.28</td>
</tr>
<tr>
<td>AlN/C/Al2O3</td>
<td>7/7</td>
<td>170/23</td>
<td>0.28</td>
</tr>
<tr>
<td>Cu/A,AlN</td>
<td>17/3</td>
<td>390/170</td>
<td>0.31</td>
</tr>
<tr>
<td>AlN/C/AIN</td>
<td>7/3</td>
<td>170/170</td>
<td>0.31</td>
</tr>
<tr>
<td>AlN/C/SiN4</td>
<td>7/3</td>
<td>170/60</td>
<td>0.31</td>
</tr>
</tbody>
</table>

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