Mitsubishi Electric to Begin Shipment of Silicon Carbide Power Module Samples

Modules contribute to downsized and more efficient electronic equipment for industries, homes

Tokyo, July 9, 2012 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today it that it will begin shipping samples of five kinds of power modules for home appliances and industrial equipment starting on July 31, 2012. The modules use silicon carbide (SiC), a next generation semiconductor material expected to significantly reduce power loss in diode and metal oxide semiconductor field effect transistor (MOSFET) chips.

The modules will be showcased at POWER SYSTEM JAPAN 2012 in TECHNO-FRONTIER 2012, an exhibition on electro-mechanical parts and devices to be held on July 11-13 at Tokyo Big Sight in Japan.

Inverters are widely used in home appliances like air conditioners and refrigerators, as well as in industrial devices, to increase energy efficiency. While Mitsubishi Electric already offers a wide variety of low-loss power semiconductor modules for inverters, the SiC modules offer significant reductions in power loss and improvements in high speed switching, achieving even higher efficiency and downsizing.

Of the five new types of SiC power module samples, three types are for home appliances, while two are for industrial devices such as inverters and servos.
### Summary of Sale

<table>
<thead>
<tr>
<th>Applications</th>
<th>Product name</th>
<th>Specifications</th>
<th>Begging of sample shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home appliances</td>
<td>Hybrid SiC DIPIPM*1</td>
<td>600V/15A 6in1</td>
<td>July 31, 2012</td>
</tr>
<tr>
<td></td>
<td>Hybrid SiC DIPPFC*2</td>
<td>600V/20Arms Interleave</td>
<td>August 2012</td>
</tr>
<tr>
<td></td>
<td>Full SiC DIPPFC</td>
<td>600V/20Arms Interleave</td>
<td>August 2012</td>
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<td>Industrial devices</td>
<td>Hybrid SiC-IPM</td>
<td>1200V/75A 6in1</td>
<td>October 2012</td>
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<td></td>
<td>Full SiC Module</td>
<td>1200V /800A 2in1</td>
<td>January 2013</td>
</tr>
</tbody>
</table>

*1. DIPIPM: Dual-in-line package intelligent power module
*2. DIPPFC: Dual-in-line package power factor correction

### Product Features

1. **SiC power module for home electronics**

1-1. **Hybrid SiC DIPIPM**

- A SiC Schottky Barrier Diode (SBD) is used for the diode.
- Power loss is reduced by about 12% compared to DIPIPM using silicon (Si).
- The shape, size and pin configuration are the same as those of the Super mini DIPIPM.
- Offers the same protection as the Super mini DIPIPM using Si.

1-2. **Hybrid SiC DIPPFC**

- A SiC-SBD is used for the diode and achieves a maximum of 30kHz high-frequency switching.
- High-frequency switching contributes to the downsizing of peripheral components such as reactors and heat-sinks.
- The installation of a power factor correction (PFC) and driving IC contributes to downsizing through reduction of the mounting surface area and simplified wire patterning.
- Offers package compatibility with the Super mini DIPIPM using Si.

1-3. **Full SiC DIPPFC**

- SiC-MOSFET is used for the transistor, while SiC-SBD is used for the diode.
- Power loss is reduced by about 45% compared to products using Si.
- The adoption of SiC achieves a maximum of 50kHz high-frequency switching.
- High-frequency switching contributes to the downsizing of peripheral components such as reactors and heat-sinks.
- The installation of a PFC and driving IC contributes to downsizing through the reduction of mounting surface area and simplified wire patterning.
- Offers package compatibility with the Super mini DIPIPM using Si.
2. SiC power module for general industry

2-1. Hybrid SiC-IPM
- SiC-SBD is used for the diode.
- Power loss is reduced by about 25% compared to its predecessor PM75CL1A120 of the IPM L1 series, and contributes to the downsizing and improved product efficiency.
- The shape, size and pin configuration are the same as those of its predecessor PM75CL1A120 of the IPM L1 series.
- Offers the same protection as its predecessor PM75CL1A120 of the IPM L1 series.

2-2. Full SiC-Module
- SiC-MOSFET is used for the transistor and SiC-SBD is used for the diode.
- Power loss is reduced by about 70% compared to its predecessor CM400DY-24NF of the IGBT module (used in a parallel configuration), and contributes to improved product efficiency.
- Significantly reduces the size of packages, while reducing the mounting area by about 60% compared to its predecessor CM400DY-24NF of the IGBT module (used in a parallel configuration), and contributes to downsizing and weight reduction.
- Adopts a low inductance package to fully utilize the superior performance of SiC.

Specifications

<table>
<thead>
<tr>
<th>Product name</th>
<th>Voltage rating</th>
<th>Current rating</th>
<th>Connection</th>
<th>Size (W)×(D)</th>
<th>Protections, other feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid SiC DIPPIM</td>
<td>600V</td>
<td>15A</td>
<td>6in1</td>
<td>24×38mm</td>
<td>• Built-in gate driver</td>
</tr>
<tr>
<td>Hybrid SiC DIPPFC</td>
<td>600V</td>
<td>20Arms</td>
<td>Interleave</td>
<td></td>
<td>• Under-voltage protection</td>
</tr>
<tr>
<td>Full SiC DIPPFC</td>
<td>600V</td>
<td>20Arms</td>
<td>Interleave</td>
<td></td>
<td>• Short-circuit protection</td>
</tr>
<tr>
<td>Hybrid SiC-IPM</td>
<td>1200V</td>
<td>75A</td>
<td>6in1</td>
<td>67×131mm</td>
<td>• Built-in gate driver</td>
</tr>
<tr>
<td>Full SiC Module</td>
<td>1200V</td>
<td>800A</td>
<td>2in1</td>
<td>62×152mm</td>
<td>• Under-voltage protection</td>
</tr>
</tbody>
</table>

*3. Applies only to the hybrid SiC DIPPFC module

Environmental awareness
The SiC products are compliant with the European Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS).
About Mitsubishi Electric
With over 90 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology.

The company recorded consolidated group sales of 3,639.4 billion yen (US$ 44.4 billion*) in the fiscal year ended March 31, 2012. For more information visit http://www.MitsubishiElectric.com

*At an exchange rate of 82 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2012