CCS050M12CM2
1.2 kV, 50 A All-SiC Six-Pack Module
Ideal for Three-Phase Inverters

Summary

CCS050M12CM2 replaces silicon IGBT six-pack modules in three-phase inverter applications where reliable, efficient power conversion is needed at a lower total system cost.

Key Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cree CCS050M12CM2</th>
<th>Infineon FSS0R12KT4</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices</td>
<td>All SiC MOSFET + JBS</td>
<td>Si IGBT + Si PiN</td>
<td>SiC unipolar devices</td>
</tr>
<tr>
<td>$V_{(BR)DSS}$</td>
<td>1.2 kV</td>
<td>1.2 kV</td>
<td>Same</td>
</tr>
<tr>
<td>$V_{DS(on)}$ or $V_{CE(sat)}$</td>
<td>2.0</td>
<td>2.0</td>
<td>Same</td>
</tr>
<tr>
<td>$I_D = 50A @ 150^\circ C$</td>
<td>2.0</td>
<td>2.0</td>
<td>Same</td>
</tr>
<tr>
<td>$E_{SW(total)}$ @ 150°C</td>
<td>1.7 mJ</td>
<td>10.3 mJ</td>
<td>6.0x lower</td>
</tr>
</tbody>
</table>

System Benefits

- High efficiency operation
- Reduced thermal design complexity, cost
- High frequency operation shrinks system size, weight and cost
- Long term stability and reliability

Target Applications

- Motor drives
- Solar inverters
- UPS
- General 3Φ power conversion to 50 kW

Competitive Comparison
### 30 HP Motor Drive Simulation

#### Three Phase Voltage Source Inverter:
- \( V_{bus} = 675 \text{ V} \), \( f_{sw} = 8 \text{ kHz} \)
- \( R_{\theta HS} = 0.16 \degree \text{C/W} \) (forced air)
- \( T_{amb} = 40 \degree \text{C} \)
- \( P_{out} = 30 \text{ HP (22.9 kW)} \)

**SiC MOS**
- \( P_{Loss \ Total} = 121 \text{ W} \)
- \( T_J = 67.5 \degree \text{C} \)
- \( \eta = 99.5\% \)

**Si IGBT 4**
- \( P_{Loss \ Total} = 396 \text{ W} \)
- \( T_J = 136.2 \degree \text{C} \)
- \( \eta = 98.2\% \)

**SiC MOS is 1.3% more efficient and runs 68\degree \text{C cooler than Si IGBT}**

#### Design Options to Monetize SiC Benefits

**Option 1**
- **Higher Power**
- 50 HP instead of 30 HP

**Option 2**
- **Smaller Cooling**
- at same 30 HP

**Option 3**
- **Smaller Cooling, Higher Frequency**
- at same 30 HP

- **SiC Drive**
  - \( f_{sw} = 8 \text{ kHz} \)
  - \( R_{\theta HS} = 0.16 \degree \text{C/W} \)
  - \( P_{Loss \ Total} = 369 \text{ W} \)
  - \( T_J = 127 \degree \text{C} \)

- **Si Heat sink**
  - \( f_{sw} = 8 \text{ kHz} \)
  - \( R_{\theta HS} = 0.55 \degree \text{C/W} \) (1/3 size)
  - \( P_{Loss \ Total} = 153 \text{ W} \)
  - \( T_J = 135 \degree \text{C} \)

- **SiC HS**
  - \( f_{sw} = 35 \text{ kHz} \) (>4×)
  - \( R_{\theta HS} = 0.4 \degree \text{C/W} \) (2/3 size)
  - \( P_{Loss \ Total} = 204 \text{ W} \)
  - \( T_J = 136 \degree \text{C} \)