C2M0160120D
Silicon Carbide Power MOSFET
C2M™ MOSFET Technology
N-Channel Enhancement Mode

Features
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

Benefits
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications
- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- LED Lighting Power Supplies

Maximum Ratings \((T_c = 25 \, ^\circ \text{C} \text{ unless otherwise specified})\)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
<th>Test Conditions</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_{DS\text{max}})</td>
<td>Drain - Source Voltage</td>
<td>1200</td>
<td>V</td>
<td>(V_{GS} = 0 , \text{V}, , I_D = 100 , \mu\text{A})</td>
<td></td>
</tr>
<tr>
<td>(V_{GS\text{max}})</td>
<td>Gate - Source Voltage</td>
<td>-10/+25</td>
<td>V</td>
<td>Absolute maximum values</td>
<td></td>
</tr>
<tr>
<td>(V_{GSOp})</td>
<td>Gate - Source Voltage</td>
<td>-5/+20</td>
<td>V</td>
<td>Recommended operational values</td>
<td></td>
</tr>
<tr>
<td>(I_D)</td>
<td>Continuous Drain Current</td>
<td>19</td>
<td>A</td>
<td>(V_{GS} = 20 , \text{V}, , T_C = 25^\circ \text{C})</td>
<td>Fig. 19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.5</td>
<td></td>
<td>(V_{GS} = 20 , \text{V}, , T_C = 100^\circ \text{C})</td>
<td></td>
</tr>
<tr>
<td>(I_D(\text{pulse}))</td>
<td>Pulsed Drain Current</td>
<td>40</td>
<td>A</td>
<td>Pulse width (t_p) limited by (T_{j\text{max}})</td>
<td>Fig. 22</td>
</tr>
<tr>
<td>(P_D)</td>
<td>Power Dissipation</td>
<td>125</td>
<td>W</td>
<td>(T_c=25^\circ \text{C} , , T_s = 150 , ^\circ \text{C})</td>
<td>Fig. 20</td>
</tr>
<tr>
<td>(T_j, , T_{stg})</td>
<td>Operating Junction and Storage Temperature</td>
<td>-55 to +150</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(T_L)</td>
<td>Solder Temperature</td>
<td>260</td>
<td>°C</td>
<td>1.6mm (0.063”) from case for 10s</td>
<td></td>
</tr>
<tr>
<td>(M_d)</td>
<td>Mounting Torque</td>
<td>8.8</td>
<td>Nm lbf-in</td>
<td>M3 or 6-32 screw</td>
<td></td>
</tr>
</tbody>
</table>

Package
- TO-247-3

Part Number | Package
---|---
C2M0160120D | TO-247-3
### Electrical Characteristics \((T_c = 25^\circ C\) unless otherwise specified)\)

| Symbol \(V_{(BR)DSS}\) | Parameter \(V_{GS(Th)}\) | Symbol \(I_{DSS}\) | Symbol \(I_{GSS}\) | Symbol \(R_{DS(on)}\) | Symbol \(g_s\) | Symbol \(C_{iss}\) | Symbol \(E_{iss}\) | Symbol \(E_{AS}\) | Symbol \(t_{d(on)}\) | Symbol \(t_r\) | Symbol \(t_{d(off)}\) | Symbol \(t_f\) | Symbol \(R_{G(int)}\) | Symbol \(Q_{gs}\) | Symbol \(Q_{gd}\) | Symbol \(Q_{总}\) |
|---------------------|----------------------|------------------|------------------|------------------------|----------------|-----------------|-----------------|-----------------|------------------|----------------|------------------|----------------|------------------|----------------|----------------|----------------|----------------|
| Drain-Source Breakdown Voltage | 1200 | Gate Threshold Voltage | 2.0 2.1 | Zero Gate Voltage Drain Current | 1 | 250 | Drain-Source On-State Resistance | 160 290 | Transconductance | 4.8 4.3 | Input Capacitance | 525 | Output Capacitance | 47 | Reverse Transfer Capacitance | 4 | Avalanche Stored Energy | 25 | Turn-On Switching Energy | 9 | Rise Time | 11 |
| \(V_{GS} = 0 \ V, I_D = 100 \ \mu A\) | \(V_{DS} = V_{GS}, I_D = 2.5 \ mA\) | \(V_{DS} = V_{GS}, I_D = 2.5 \ mA, T_J = 150^\circ C\) | \(V_{DS} = 1200 \ V, V_{GS} = 0 \ V\) | \(V_{DS} = 20 \ V, I_D = 10 \ A\) | \(V_{DS} = 20 \ V, I_D = 10 A, T_J = 150^\circ C\) | \(V_{DD} = 50 V\) | \(V_{DD} = 800 \ V, V_{DS} = -5/20 \ V, I_D = 10A, R_{G(int)} = 2.5 \Omega, L = 256 \mu H\) | \(I_D = 10 A\) | \(V_{DS} = 800 \ V, V_{GS} = -5/20 \ V\) | \(I_D = 10 A\) | \(V_{DS} = 800 \ V, V_{GS} = -5/20 \ V\) | \(I_D = 10 A\) | \(V_{DS} = 800 \ V, V_{GS} = -5/20 \ V\) | \(I_D = 10 A\) | \(V_{DS} = 800 \ V, V_{GS} = -5/20 \ V\) | \(I_D = 10 A\) | \(V_{DS} = 800 \ V, V_{GS} = -5/20 \ V\) | \(I_D = 10 A\) |

#### Reverse Diode Characteristics

<table>
<thead>
<tr>
<th>Symbol (V_{SD})</th>
<th>Parameter Diode Forward Voltage</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Test Conditions</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Diode Forward Current</td>
<td>19</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>23</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>105</td>
<td>nC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Reverse Recovery Current</td>
<td>9</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol (R_{JAC})</th>
<th>Parameter Thermal Resistance from Junction to Case</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Test Conditions</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Resistance From Junction to Ambient</td>
<td>0.9</td>
<td>1.0</td>
<td>K/W</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note (1): When using SiC Body Diode the maximum recommended \(V_{GS} = -5V\)
Typical Performance

Figure 1. Output Characteristics $T_J = -55 \, ^\circ C$

Figure 2. Output Characteristics $T_J = 25 \, ^\circ C$

Figure 3. Output Characteristics $T_J = 150 \, ^\circ C$

Figure 4. Normalized On-Resistance vs. Temperature

Figure 5. On-Resistance vs. Drain Current For Various Temperatures

Figure 6. On-Resistance vs. Temperature For Various Gate Voltage
Typical Performance

Figure 8. Body Diode Characteristic at -55 °C

Figure 9. Body Diode Characteristic at 25 °C

Figure 10. Body Diode Characteristic at 150 °C

Figure 11. Threshold Voltage vs. Temperature

Figure 12. Gate Charge Characteristics
Typical Performance

**Figure 13. 3rd Quadrant Characteristic at -55 °C**

**Figure 14. 3rd Quadrant Characteristic at 25 °C**

**Figure 15. 3rd Quadrant Characteristic at 150 °C**

**Figure 16. Output Capacitor Stored Energy**

**Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)**

**Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)**
Typical Performance

![Figure 19. Continuous Drain Current Derating vs. Case Temperature](chart1)

![Figure 20. Maximum Power Dissipation Derating vs. Case Temperature](chart2)

![Figure 21. Transient Thermal Impedance (Junction - Case)](chart3)

![Figure 22. Safe Operating Area](chart4)

![Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DS} = 800 V)](chart5)

![Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DS} = 600 V)](chart6)
Typical Performance

Figure 25. Clamped Inductive Switching Energy vs. \( R_{G(\text{ext})} \)

Figure 26. Clamped Inductive Switching Energy vs. Temperature

Figure 27. Switching Times vs. \( R_{G(\text{ext})} \)

Figure 28. Switching Times Definition

Figure 29. Single Avalanche SOA curve
ESD Ratings

<table>
<thead>
<tr>
<th>ESD Test</th>
<th>Total Devices Sampled</th>
<th>Resulting Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD-HBM</td>
<td>All Devices Passed 1000V</td>
<td>2 (&gt;2000V)</td>
</tr>
<tr>
<td>ESD-MM</td>
<td>All Devices Passed 400V</td>
<td>C (&gt;400V)</td>
</tr>
<tr>
<td>ESD-CDM</td>
<td>All Devices Passed 1000V</td>
<td>IV (&gt;1000V)</td>
</tr>
</tbody>
</table>
Notes

• **RoHS Compliance**
The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Cree representative or from the Product Documentation sections of [www.cree.com](http://www.cree.com).

• **REACh Compliance**
REACh substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a Cree representative to insure you get the most up-to-date REACh SVHC Declaration. REACh banned substance information (REACh Article 67) is also available upon request.

• This product has not been designed or tested for use in, and is not intended for use in, applications implanted into the human body nor in applications in which failure of the product could lead to death, personal injury or property damage, including but not limited to equipment used in the operation of nuclear facilities, life-support machines, cardiac defibrillators or similar emergency medical equipment, aircraft navigation or communication or control systems, air traffic control systems.

Related Links

• C2M PSPICE Models: [http://wolfspeed.com/power/tools-and-support](http://wolfspeed.com/power/tools-and-support)
• SiC MOSFET Isolated Gate Driver reference design: [http://wolfspeed.com/power/tools-and-support](http://wolfspeed.com/power/tools-and-support)
• SiC MOSFET Evaluation Board: [http://wolfspeed.com/power/tools-and-support](http://wolfspeed.com/power/tools-and-support)