



**THE DATASHEET OF  
CPM2-1200-0080B**



# CPM2-1200-0080B

## Silicon Carbide Power MOSFET

### C2M™ MOSFET Technology

N-Channel Enhancement Mode

|                          |        |
|--------------------------|--------|
| $V_{DS}$                 | 1200 V |
| $I_D @ 25^\circ\text{C}$ | 36 A   |
| $R_{DS(on)}$             | 80 mΩ  |

#### Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness

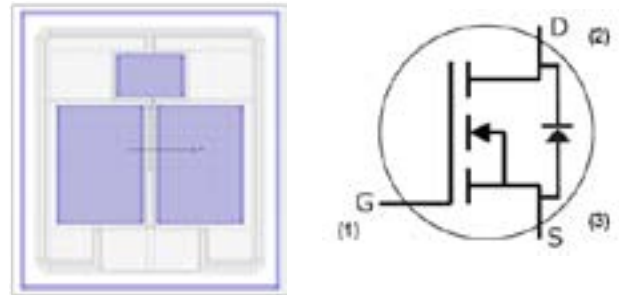
#### Benefits

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

#### Applications

- Solar Inverters
- High Voltage DC/DC Converters
- Motor Drives
- Switch Mode Power Supplies
- Pulsed Power applications

#### Chip Outline



| Part Number     | Die Size (mm) |
|-----------------|---------------|
| CPM2-1200-0080B | 3.10 x 3.36   |

#### Maximum Ratings ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

| Symbol         | Parameter                                  | Value       | Unit             | Test Conditions                                   | Note   |
|----------------|--|-------------|------------------|---|--------|
| $V_{DSmax}$    | Drain - Source Voltage                     | 1200        | V                | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$     |        |
| $V_{GSmax}$    | Gate - Source Voltage                      | -10/+25     | V                | Absolute maximum values, AC ( $f > 1\text{ Hz}$ ) |        |
| $V_{GSop}$     | Gate - Source Voltage                      | -5/+20      | V                | Recommended operational values                    |        |
| $I_D$          | Continuous Drain Current                   | 36          | A                | $V_{GS} = 20\text{ V}, T_C = 25^\circ\text{C}$    | Note 1 |
|                |  | 27          |                  | $V_{GS} = 20\text{ V}, T_C = 100^\circ\text{C}$   |        |
| $I_{D(pulse)}$ | Pulsed Drain Current                       | 80          | A                | Pulse width $t_p$ limited by $T_{jmax}$           |        |
| $T_J, T_{stg}$ | Operating Junction and Storage Temperature | -55 to +175 | $^\circ\text{C}$ |   |        |
| $T_{Proc}$     | Maximum Processing Temperature             | 325         | $^\circ\text{C}$ | 10 min. maximum                                   |        |

Note (1): Assumes a  $R_{\theta JC} < 0.65\text{ K/W}$

**Electrical Characteristics** ( $T_c = 25^\circ\text{C}$  unless otherwise specified)

| Symbol        | Parameter                        | Min. | Typ. | Max. | Unit          | Test Conditions  | Note         |
|---------------|----------------------------------|------|------|------|---------------|--|--------------|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage   | 1200 |      |      | V             | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$  |              |
| $V_{GS(th)}$  | Gate Threshold Voltage           | 2.0  | 2.6  | 4    | V             | $V_{DS} = V_{GS}, I_D = 5\ \text{mA}$  | Fig. 11      |
|               |                                  |      | 2.1  |      | V             | $V_{DS} = V_{GS}, I_D = 5\ \text{mA}, T_J = 175^\circ\text{C}$   |              |
| $I_{DSS}$     | Zero Gate Voltage Drain Current  |      | 1    | 100  | $\mu\text{A}$ | $V_{DS} = 1200\ \text{V}, V_{GS} = 0\ \text{V}$  |              |
| $I_{GSS}$     | Gate-Source Leakage Current      |      |      | 250  | nA            | $V_{GS} = 20\ \text{V}, V_{DS} = 0\ \text{V}$  |              |
| $R_{DS(on)}$  | Drain-Source On-State Resistance |      | 80   | 98   | m $\Omega$    | $V_{GS} = 20\ \text{V}, I_D = 20\ \text{A}$  | Fig. 4, 5, 6 |
|               |                                  |      | 153  |      |               | $V_{GS} = 20\ \text{V}, I_D = 20\ \text{A}, T_J = 175^\circ\text{C}$   |              |
| $g_{fs}$      | Transconductance                 |      | 8.1  |      | S             | $V_{DS} = 20\ \text{V}, I_{DS} = 20\ \text{A}$   | Fig. 7       |
|               |                                  |      | 7.7  |      |               | $V_{DS} = 20\ \text{V}, I_{DS} = 20\ \text{A}, T_J = 175^\circ\text{C}$  |              |
| $C_{ISS}$     | Input Capacitance                |      | 950  |      | pF            | $V_{GS} = 0\ \text{V}$<br>$V_{DS} = 1000\ \text{V}$<br>$f = 1\ \text{MHz}$   | Fig. 17, 18  |
| $C_{OSS}$     | Output Capacitance               |      | 80   |      |               |  |              |
| $C_{RSS}$     | Reverse Transfer Capacitance     |      | 7.6  |      |               |  |              |
| $E_{OSS}$     | $C_{OSS}$ Stored Energy          |      | 45   |      | $\mu\text{J}$ | $V_{AC} = 25\ \text{mV}$   | Fig. 16      |
| $E_{AS}$      | Avalanche Energy, Single Pluse   |      | 1    |      | J             | $I_D = 20\ \text{A}, V_{DD} = 50\ \text{V}$  |              |
| $E_{ON}$      | Turn-On Switching Energy         |      | 265  |      | $\mu\text{J}$ | $V_{DS} = 800\ \text{V}, V_{GS} = -5/20\ \text{V}, I_D = 20\ \text{A},$<br>$R_{G(ext)} = 2.5\ \Omega, L = 142\ \mu\text{H}$<br>(TO-247-3 Package)  | Note 3       |
| $E_{OFF}$     | Turn Off Switching Energy        |      | 135  |      |               |  |              |
| $t_{d(on)}$   | Turn-On Delay Time               |      | 11   |      | ns            | $V_{DD} = 800\ \text{V}, V_{GS} = -5/20\ \text{V}$<br>$I_D = 20\ \text{A}, R_{G(ext)} = 2.5\ \Omega,$<br>$R_L = 40\ \Omega,$ Timing relative to $V_{DS}$<br>Per IEC60747-8-4 pg 83<br>(TO-247-3 Package) | Note 3       |
| $t_r$         | Rise Time                        |      | 20   |      |               |  |              |
| $t_{d(off)}$  | Turn-Off Delay Time              |      | 23   |      |               |  |              |
| $t_f$         | Fall Time                        |      | 19   |      |               |  |              |
| $R_{G(int)}$  | Internal Gate Resistance         |      | 4.6  |      | $\Omega$      | $f = 1\ \text{MHz}, V_{AC} = 25\ \text{mV}$  |              |
| $Q_{gs}$      | Gate to Source Charge            |      | 15   |      | nC            | $V_{DS} = 800\ \text{V}, V_{GS} = -5/20\ \text{V}$<br>$I_D = 20\ \text{A}$<br>Per IEC60747-8-4 pg 21   | Fig. 12      |
| $Q_{gd}$      | Gate to Drain Charge             |      | 23   |      |               |  |              |
| $Q_g$         | Total Gate Charge                |      | 62   |      |               |  |              |

**Reverse Diode Characteristic**

| Symbol    | Parameter                        | Typ. | Max. | Unit | Test Conditions  | Note          |
|-----------|----------------------------------|------|------|------|--|---------------|
| $V_{SD}$  | Diode Forward Voltage            | 3.3  |      | V    | $V_{GS} = -5\ \text{V}, I_{SD} = 10\ \text{A}$   | Fig. 8, 9, 10 |
|           |                                  | 3.1  |      | V    | $V_{GS} = -5\ \text{V}, I_{SD} = 10\ \text{A}, T_J = 175^\circ\text{C}$                                      |               |
| $I_S$     | Continuous Diode Forward Current |      | 36   | A    | $T_c = 25^\circ\text{C}$   | Note 2        |
| $t_{rr}$  | Reverse Recover time             | 32   |      | ns   | $V_{GS} = -5\ \text{V}, I_{SD} = 20\ \text{A}, V_R = 800\ \text{V}$<br>$dif/dt = 2400\ \text{A}/\mu\text{s}$ | Note 2        |
| $Q_{rr}$  | Reverse Recovery Charge          | 192  |      | nC   |  |               |
| $I_{rrm}$ | Peak Reverse Recovery Current    | 10   |      | A    |  |               |

Note (2): When using SiC Body Diode the maximum recommended  $V_{GS} = -5\text{V}$

Note (3): For inductive and resistive switching data and waveforms please refer to datasheet for packaged device - Part Number C2M0080120D.

## Typical Performance

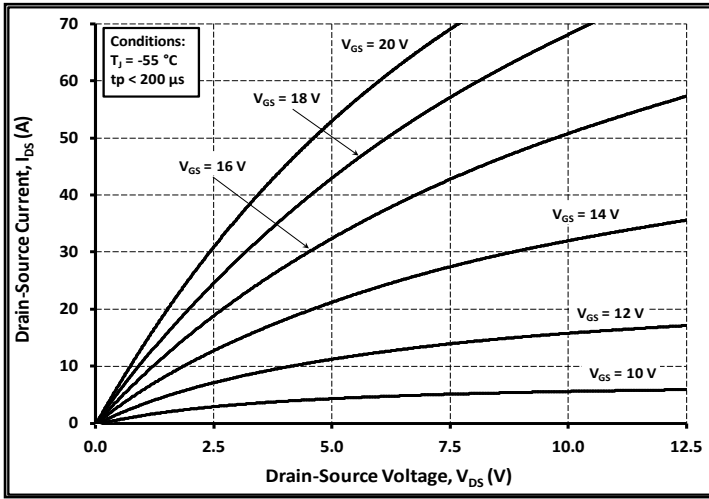


Figure 1. Output Characteristics  $T_J = -55\text{ }^\circ\text{C}$

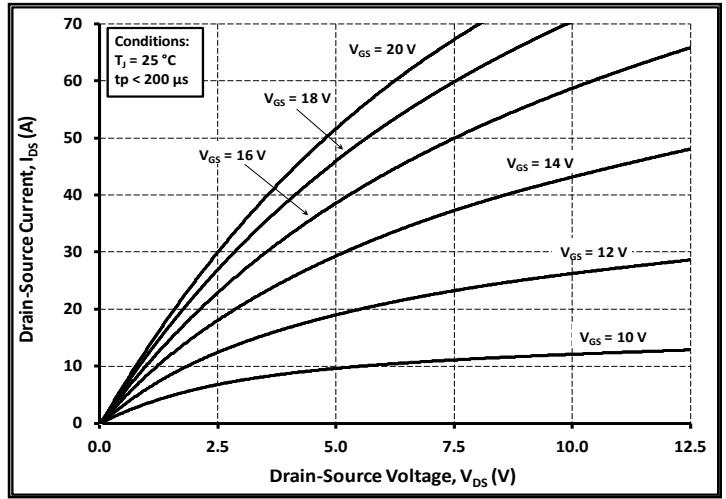


Figure 2. Output Characteristics  $T_J = 25\text{ }^\circ\text{C}$

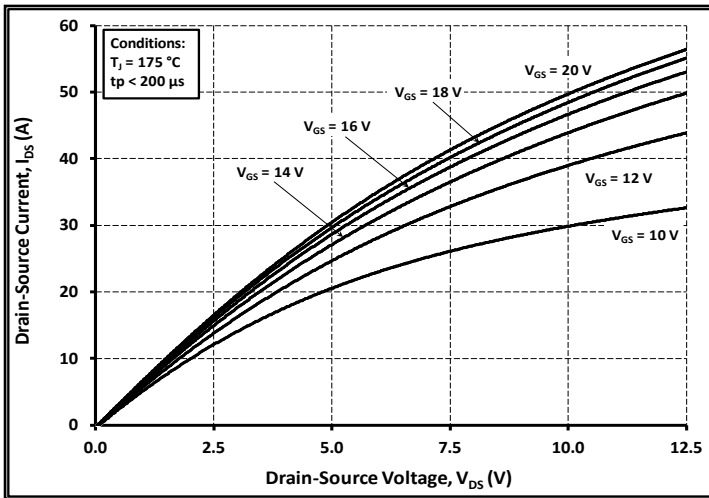


Figure 3. Output Characteristics  $T_J = 175\text{ }^\circ\text{C}$

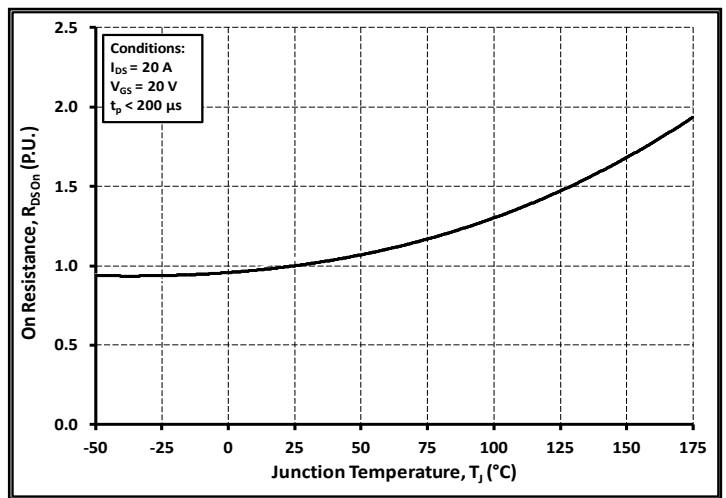


Figure 4. Normalized On-Resistance vs. Temperature

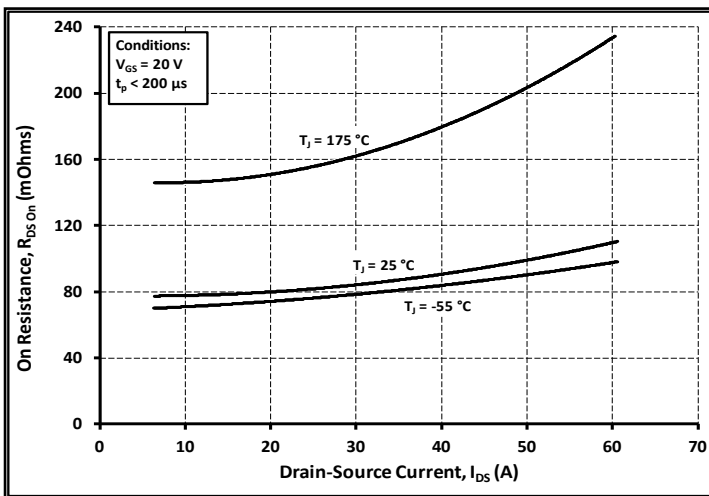


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

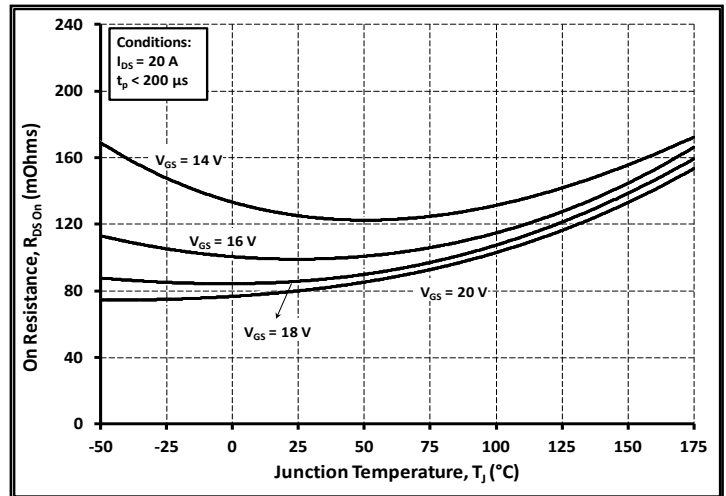


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

## Typical Performance

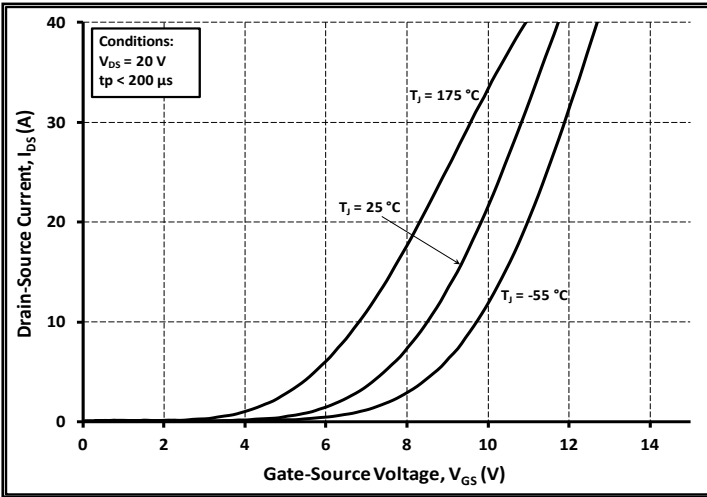


Figure 7. Transfer Characteristic for Various Junction Temperatures

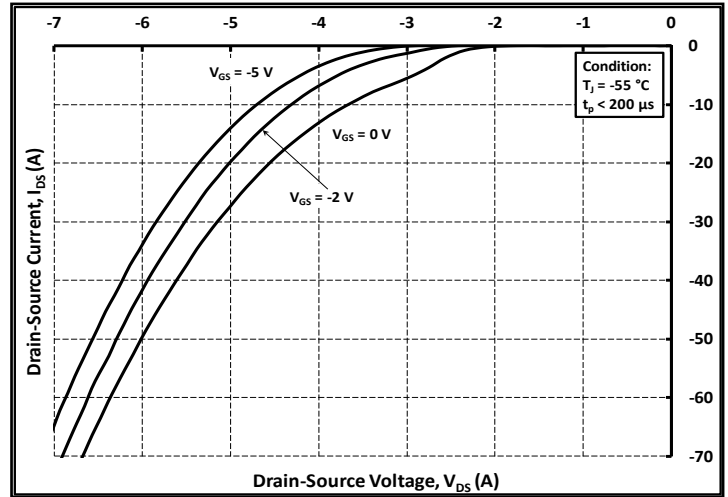


Figure 8. Body Diode Characteristic at -55 °C

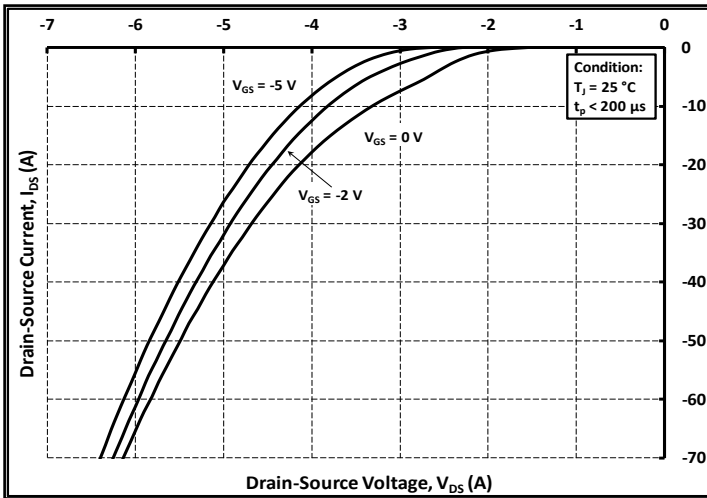


Figure 9. Body Diode Characteristic at 25 °C

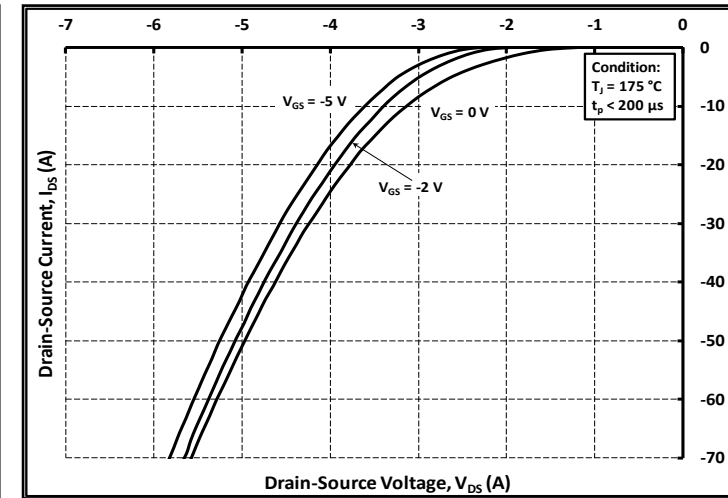


Figure 10. Body Diode Characteristic at 175 °C

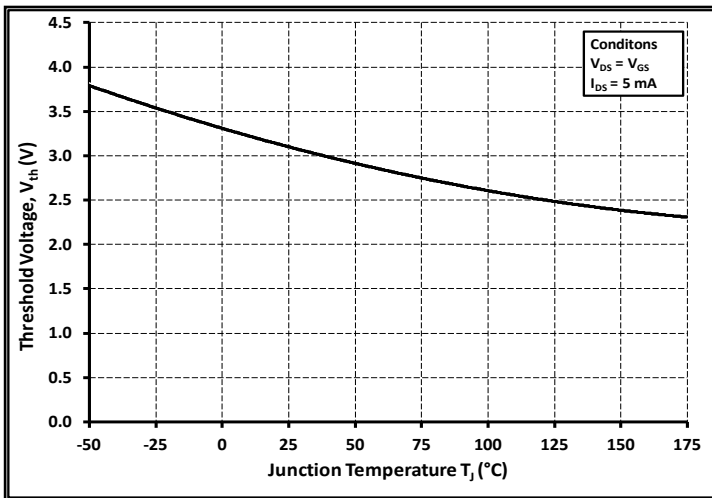


Figure 11. Threshold Voltage vs. Temperature

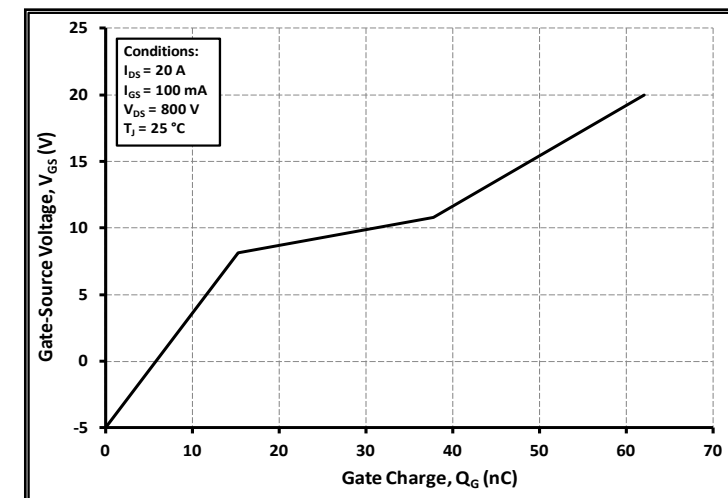


Figure 12. Gate Charge Characteristics

## Typical Performance

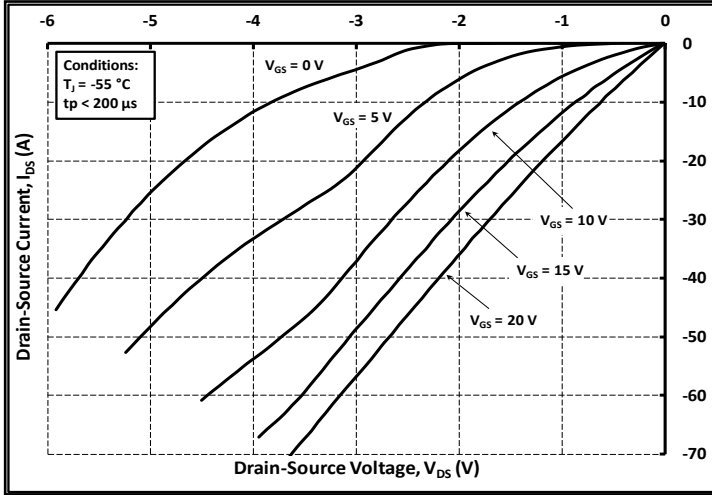


Figure 13. 3rd Quadrant Characteristic at  $-55\text{ }^\circ\text{C}$

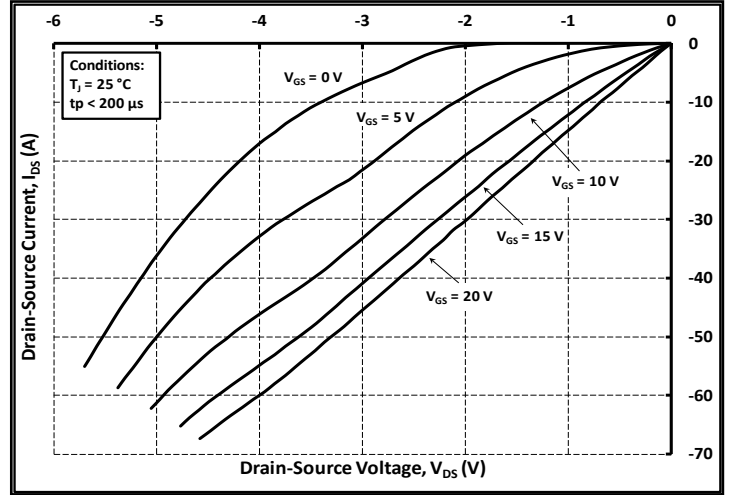


Figure 14. 3rd Quadrant Characteristic at  $25\text{ }^\circ\text{C}$

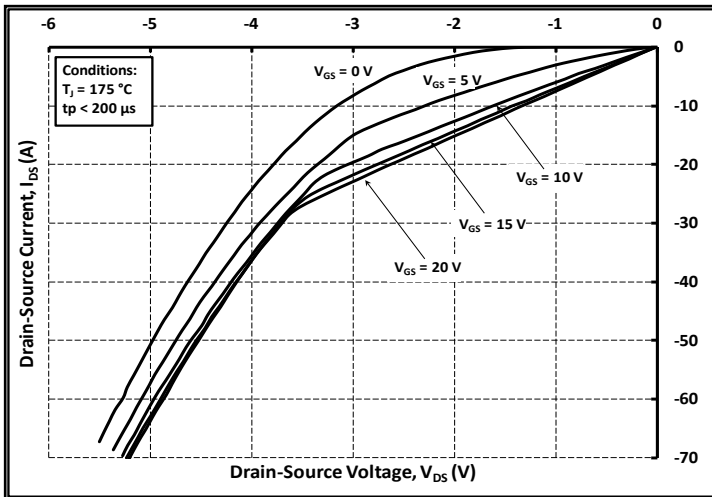


Figure 15. 3rd Quadrant Characteristic at  $175\text{ }^\circ\text{C}$

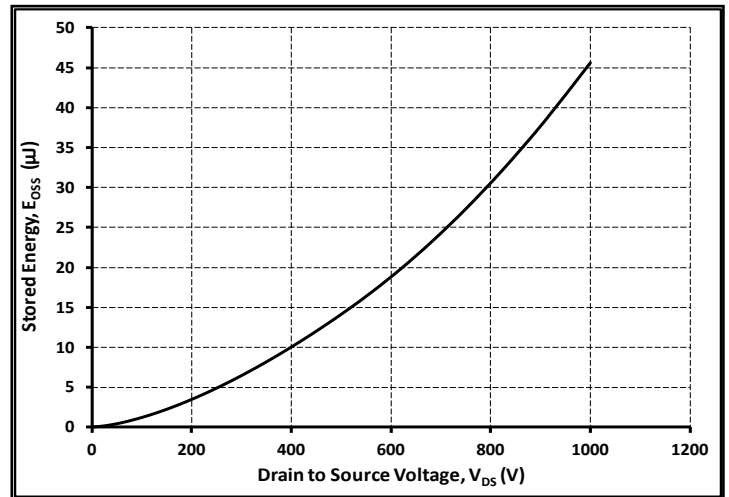


Figure 16. Output Capacitor Stored Energy

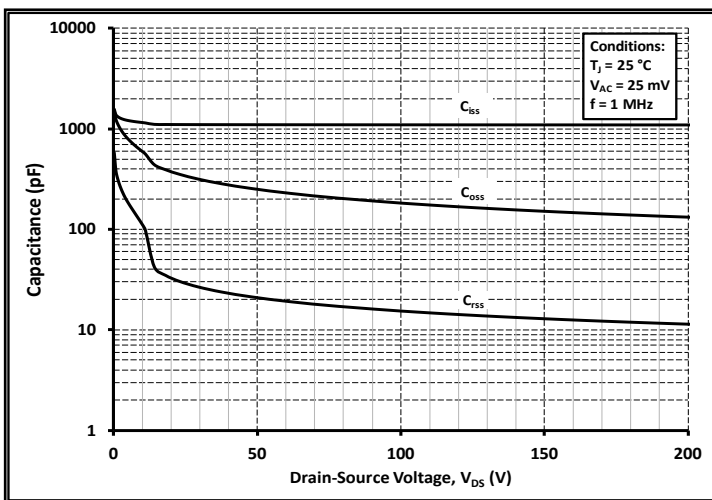


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

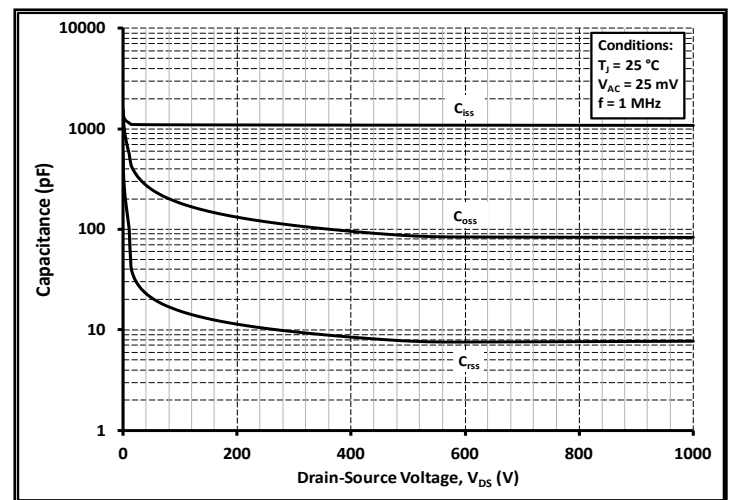
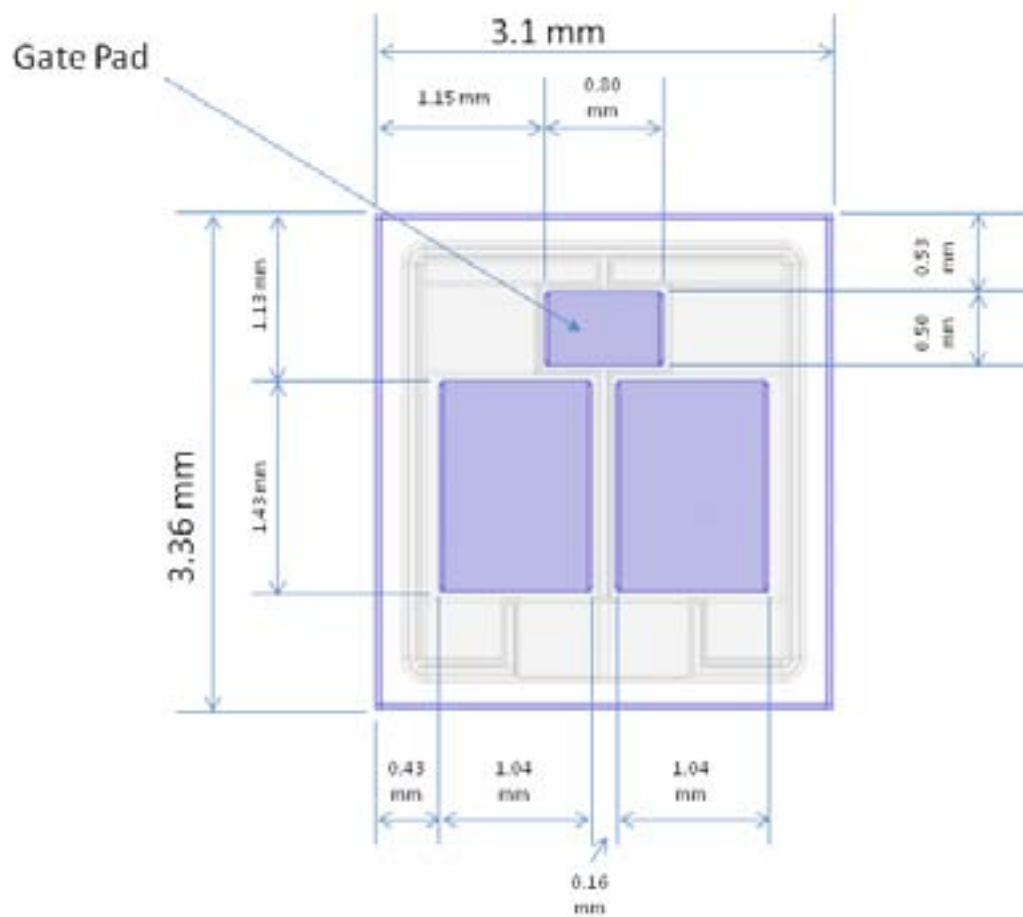


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

## Mechanical Parameters

| Parameter                                      | Typical Value | Unit |
|--|---------------|------|
| Die Dimensions (L x W)                         | 3.10 × 3.36   | mm   |
| Exposed Source Pad Metal Dimensions (LxW) Each | 1.04 × 1.43   | mm   |
| Gate Pad Dimensions (L x W)                    | 0.80 × 0.50   | mm   |
| Die Thickness                                  | 180 ± 40      | μm   |
| Top Side Source metallization (Al)             | 4             | μm   |
| Top Side Gate metallization (Al)               | 4             | μm   |
| Bottom Drain metallization (Ni/Ag)             | 0.8 / 0.6     | μm   |

## Chip Dimensions



## Notes

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- **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

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- **C2M PSPICE Models:** <http://wolfspeed.com/power/tools-and-support>
- **SiC MOSFET Isolated Gate Driver reference design:** <http://wolfspeed.com/power/tools-and-support>
- **SiC MOSFET Evaluation Board:** <http://wolfspeed.com/power/tools-and-support>

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