# Dual Common Source SiC Power Module

## MSCSM330DUM07D3NG

## Product Overview

The MSCSM330DUM07D3NG device is a dual common source 3300V, 295A Silicon Carbide (SiC) power module.

The following figures show the electrical diagram and pinout location of the device.

**Figure 1.** Electrical Diagram

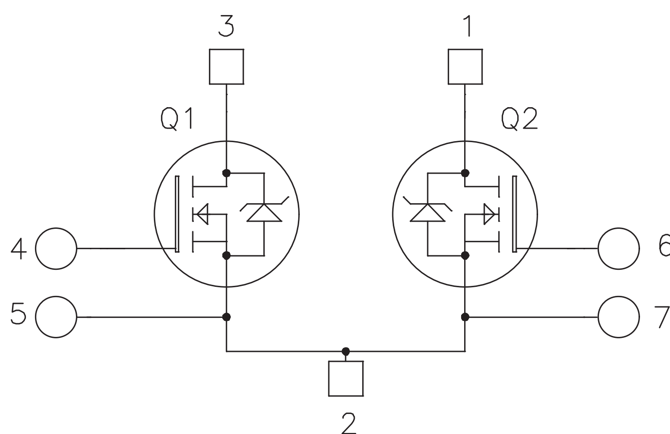
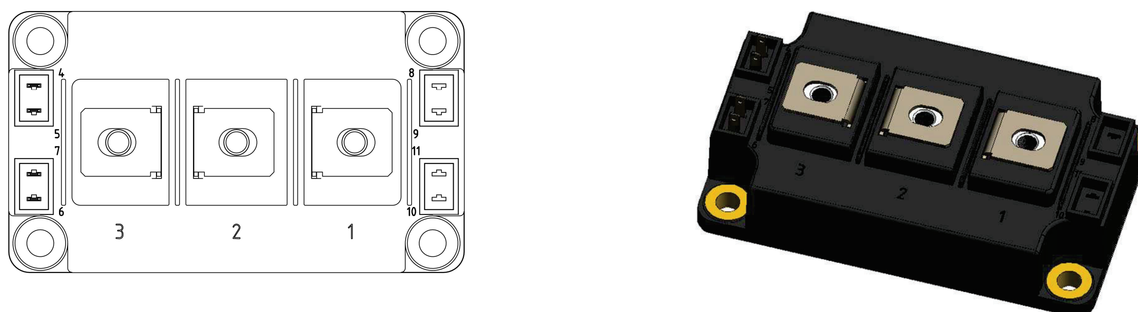



**Figure 2.** Pinout Location




**Note:** All ratings are at $T_J$ = 25 °C, unless otherwise specified.

These devices are sensitive to electrostatic discharge. Proper handling procedures must be followed.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## Features

The MSCSM330DUM07D3NG device has the following key features:

- SiC Power MOSFET
  - Low $R_{DS(on)}$
  - Superior $R_{DS(on)}$ over temperature performance
- CTI600 Plastic Enclosure with increased creepage & clearance
- Kelvin source to simplify gate drive
- $Si_3N_4$ substrate for improved reliability—thermal, power cycling
- Copper baseplate
- M6 power connectors

## Benefits

The MSCSM330DUM07D3NG device has the following benefits:

- Outstanding performance at high temperature
- Direct mounting to heatsink (isolated package)
- Low junction-to-case thermal resistance
- RoHS Compliant

## Application

The MSCSM330DUM07D3NG device has the following applications:

- Solid State Circuit Breakers


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# 1. Electrical Specifications

The following sections show the electrical specifications of the MSCSM330DUM07D3NG device.

## 1.1. SiC MOSFET Characteristics (Per SiC MOSFET)

The following table lists the absolute maximum ratings (per SiC MOSFET) of the MSCSM330DUM07D3NG device.

**Table 1-1.** Absolute Maximum Ratings

| Symbol | Parameter | | Maximum Ratings | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-source voltage | | 3300 | V |
| $I_D$ | Continuous drain current | $T_C$ = 25 °C | 295 | A |
| | | $T_C$ = 80 °C | 234 | |
| $I_{DM}$ | Pulsed drain current | | 600 | |
| $V_{GS}$ | Gate-source voltage | | –10/23 | V |
| $R_{DS(on)}$ | Drain-source ON resistance | | 7.8 | mΩ |
| $P_D$ | Power dissipation | $T_C$ = 25 °C | 1918 | W |

The following table lists the electrical characteristics (per SiC MOSFET) of the MSCSM330DUM07D3NG device.

**Table 1-2.** Electrical Characteristics

| Symbol | Characteristic | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0V; $V_{DS}$ = 3300V | | — | — | 400 | µA |
| $R_{DS(on)}$ | Drain–source ON resistance | $V_{GS}$ = 20V<br>$I_D$ = 300A | $T_J$ = 25 °C | — | 6.8 | 7.8 | mΩ |
| | | | $T_J$ = 150 °C | — | 16.3 | — | |
| | | | $T_J$ = 175 °C | — | 19.4 | — | |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{GS}$ = $V_{DS}$; $I_D$ = 28 mA | | 1.9 | 2.7 | — | V |
| $I_{GSS}$ | Gate–source leakage current | $V_{GS}$ = 20V; $V_{DS}$ = 0V | | — | — | 400 | nA |


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The following table lists the dynamic characteristics (per SiC MOSFET) of the MSCSM330DUM07D3NG device.

**Table 1-3.** Dynamic Characteristics

| Symbol | Characteristic | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 2640V<br>f = 200 kHz | | — | 35 | — | nF |
| $C_{oss}$ | Output capacitance | | | — | 0.78 | — | |
| $C_{rss}$ | Reverse transfer capacitance | | | — | 0.04 | — | |
| $Q_g$ | Total gate charge | $V_{GS}$ = –5/20V<br>$V_{Bus}$ = 2640V<br>$I_D$ = 280A | | — | 1640 | — | nC |
| $Q_{gs}$ | Gate-source charge | | | — | 552 | — | |
| $Q_{gd}$ | Gate-drain charge | | | — | 532 | — | |
| $t_{d(on)}$ | Turn-on delay time | $V_{GS}$ = –5/20V<br>$V_{Bus}$ = 1800V<br>$I_D$ = 300A<br>$R_{Gon}$ = 8.2Ω<br>$R_{Goff}$ = 2.7Ω | $T_J$ = 25 °C | — | 122 | — | ns |
| | | | $T_J$ = 150 °C | — | 132 | — | |
| $t_r$ | Rise time | | $T_J$ = 25 °C | — | 63 | — | |
| | | | $T_J$ = 150 °C | — | 68 | — | |
| $t_{d(off)}$ | Turn-off delay time | | $T_J$ = 25 °C | — | 254 | — | |
| | | | $T_J$ = 150 °C | — | 426 | — | |
| $t_f$ | Fall time | | $T_J$ = 25 °C | — | 70 | — | |
| | | | $T_J$ = 150 °C | — | 86 | — | |
| $E_{on}$ | Turn-on energy | $V_{GS}$ = –5/20V<br>$V_{Bus}$ = 1800V<br>$I_D$ = 300A<br>$R_{Gon}$ = 8.2Ω<br>$R_{Goff}$ = 2.7Ω<br>di/dt = 4 kA/μs<br>dv/dt = 26 kV/μs | $T_J$ = 25 °C | — | 47.8 | — | mJ |
| | | | $T_J$ = 150 °C | — | 80 | — | |
| $E_{off}$ | Turn-off energy | | $T_J$ = 25 °C | — | 21.8 | — | |
| | | | $T_J$ = 150 °C | — | 33.4 | — | |
| $R_{Gint}$ | Internal gate resistance | | | — | 1.4 | — | Ω |
| $R_{thJC}$ | Junction-to-case thermal resistance | | | — | — | 0.078 | °C/W |

The following table lists the body diode ratings and characteristics (per SiC switch) of the MSCSM330DUM07D3NG device.

**Table 1-4.** Body Diode Ratings and Characteristics

| Symbol | Characteristic | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode forward voltage | $V_{GS}$ = –5V<br>$I_{SD}$ = 300A | $T_J$ = 25 °C | — | 4.3 | — | V |
| | | | $T_J$ = 175 °C | — | 3.7 | — | |
| $I_{rrm}$ | Reverse recovery current | $V_{GS}$ = –5V<br>$V_{Bus}$ = 1800V<br>$I_{SD}$ = 300A<br>$R_{Gon}$ = 8.2Ω<br>di/dt = 4 kA/μs | $T_J$ = 25 °C | — | 86 | — | A |
| | | | $T_J$ = 150 °C | — | 274 | — | |
| $Q_{rr}$ | Reverse recovery charge | | $T_J$ = 25 °C | — | 7.6 | — | μC |
| | | | $T_J$ = 150 °C | — | 31.7 | — | |
| $E_{rr}$ | Reverse recovery energy | | $T_J$ = 25 °C | — | 5.2 | — | mJ |
| | | | $T_J$ = 150 °C | — | 26.1 | — | |


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## 1.2. Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM330DUM07D3NG device.

**Table 1-5.** Thermal and Package Characteristics

| Symbol | Characteristic | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{ISOL}$ | RMS isolation voltage, any terminal-to-case t = 1 min, 50/60 Hz | | 6 | — | — | kV |
| PDT | Partial discharge extinction voltage, RMS 50/60 Hz, $Q_{PD}$ < 10 pC | | 2.6 | — | — | |
| CTI | Comparative tracking index | | 600 | — | — | — |
| $L_{stray}$ | Module stray inductance between $V_{Bus}$ and $0/V_{Bus}$ | | — | 16 | — | nH |
| $d_{creep}$ | Creepage distance terminal-to-terminal | | — | 23 | — | mm |
| | Creepage distance terminal-to-baseplate | | — | 28.3 | — | |
| $d_{clear}$ | Clearance distance terminal-to-terminal | | — | 8.1 | — | |
| | Clearance distance terminal-to-baseplate | | — | 23.4 | — | |
| $R_{DS}$ | Lead resistance terminal-to-chip | $T_C$ = 25 °C, per switch | — | 0.5 | — | mΩ |
| $T_J$ | Operating junction temperature range | | –40 | — | 175 | °C |
| $T_{JOP}$ | Recommended junction temperature under switching conditions | | –40 | — | $T_{Jmax}$–25 | |
| $T_{STG}$ | Storage temperature range | | –40 | — | 125 | |
| $T_C$ | Operating case temperature | | –40 | — | 125 | |
| τM | Mounting torque | To heatsink M6 | 3 | — | 5 | N.m |
| | | For terminals M6 | 3 | — | 5 | |
| Wt | Package weight | | — | 350 | — | g |


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## 1.3. Typical SiC MOSFET Performance Curve

This section shows the typical SiC MOSFET performance curves of the MSCSM330DUM07D3NG device.

**Figure 1-1.** Output Characteristics, $T_J$ = 25 °C

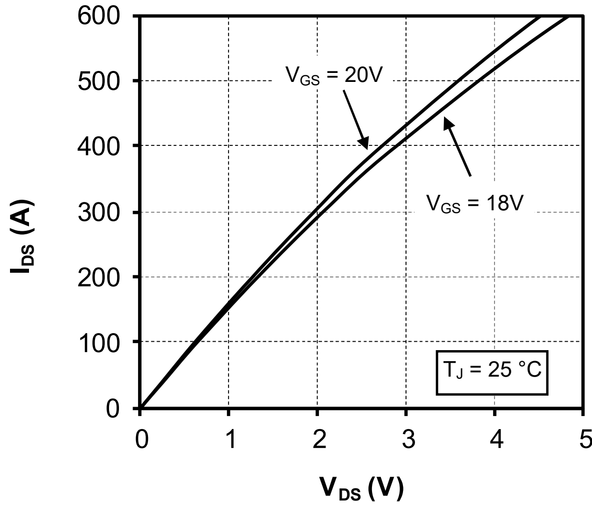


**Figure 1-2.** Output Characteristics, $T_J$ = 150 °C

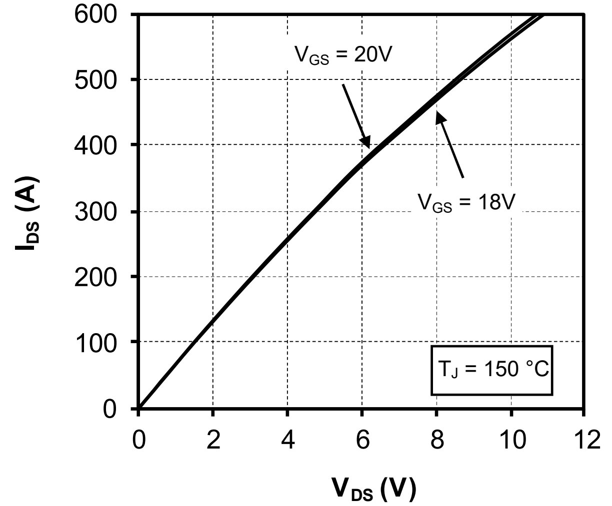


**Figure 1-3.** Output Characteristics, $T_J$ = 175 °C

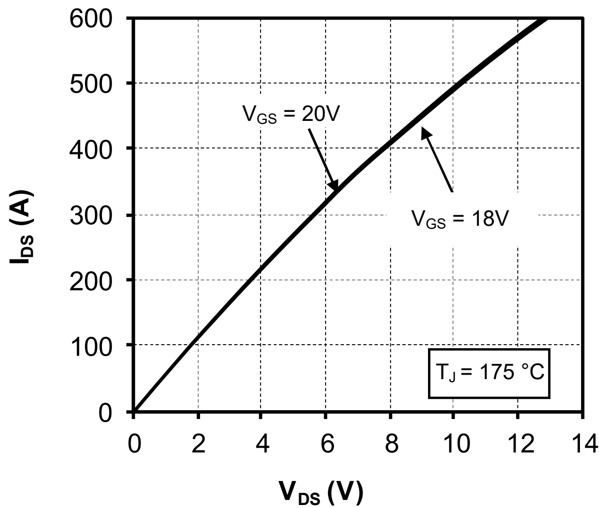


**Figure 1-4.** Normalized $R_{DS(on)}$ vs. Temperature

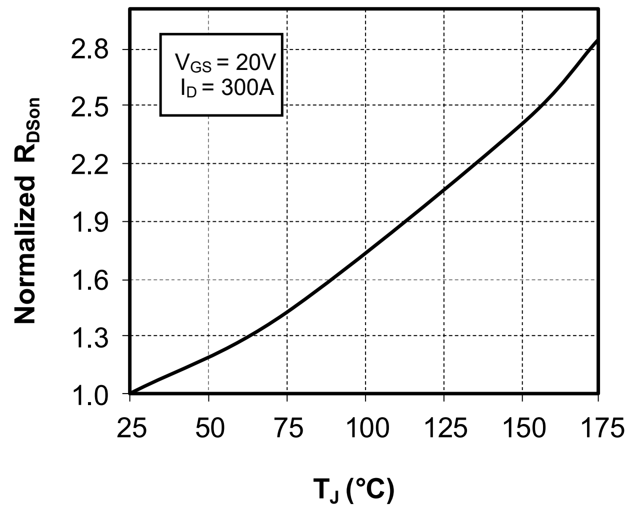



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**Figure 1-5.** Switching Energy $E_{on}$ vs. $R_G$

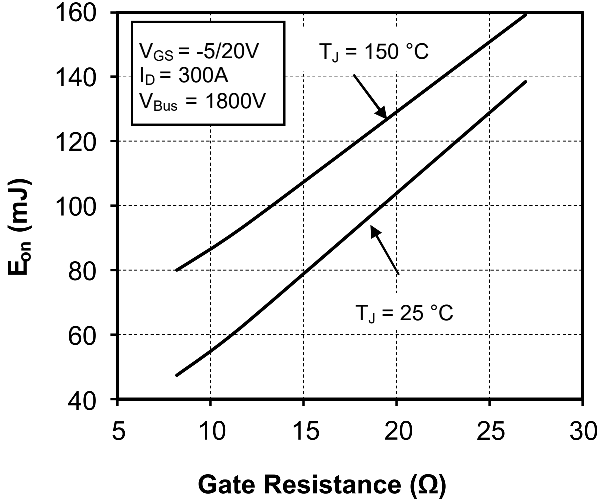


**Figure 1-6.** Switching Energy $E_{off}$ vs. $R_G$

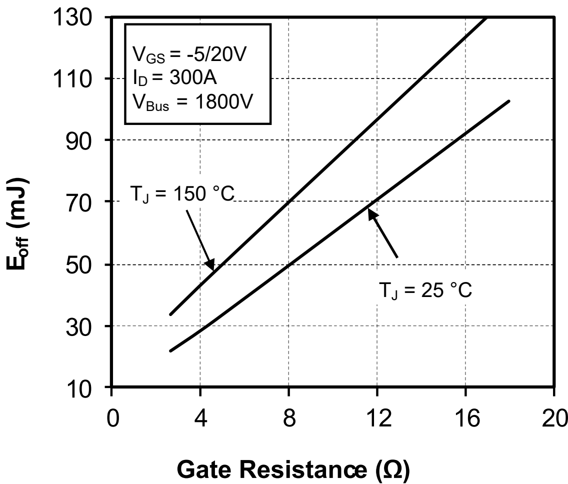


**Figure 1-7.** Switching Energy vs. Current

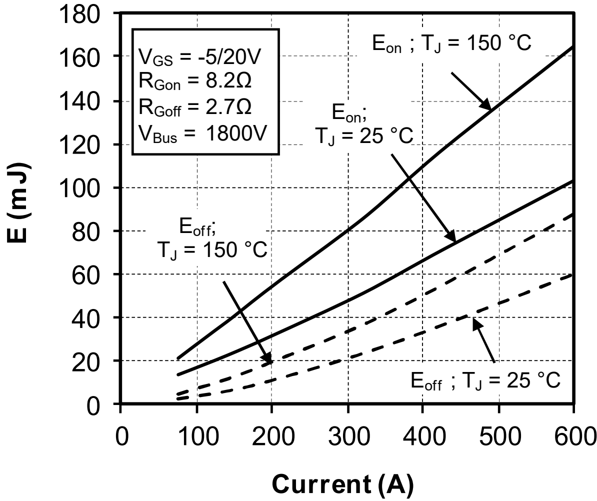


**Figure 1-8.** Operating Frequency vs. Drain Current

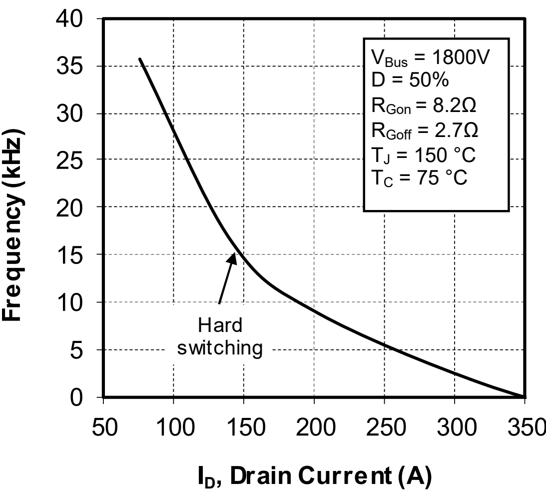



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**Figure 1-9.** Capacitance vs. Drain Source Voltage

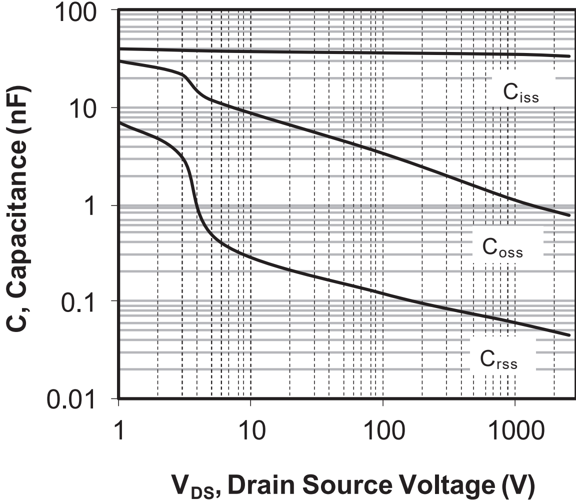


**Figure 1-10.** Gate Charge vs. Gate Source Voltage

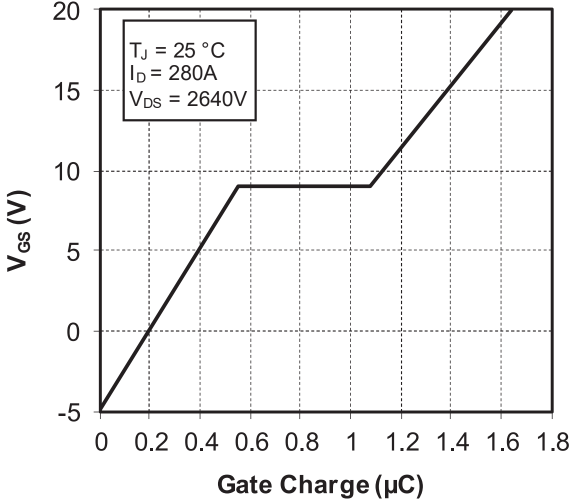


**Figure 1-11.** Reverse Recovery Energy vs. Current

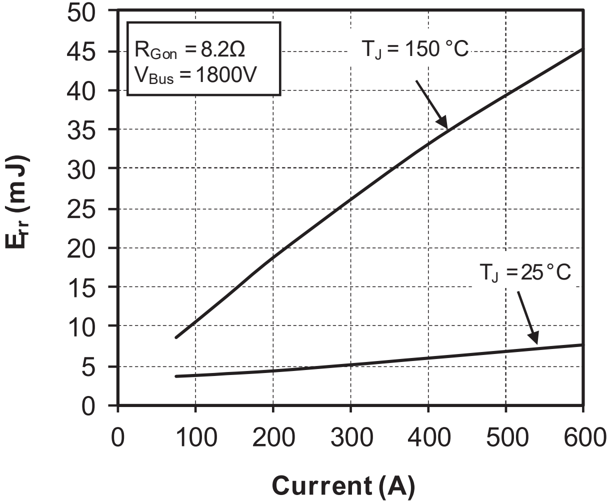


**Figure 1-12.** Reverse Recovery Energy vs. Gate Resistance

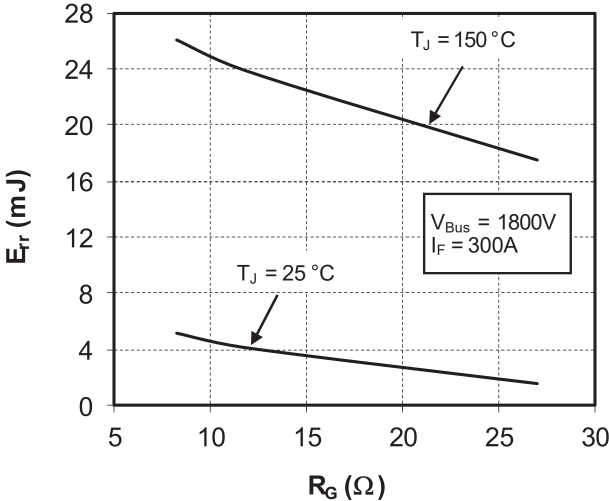



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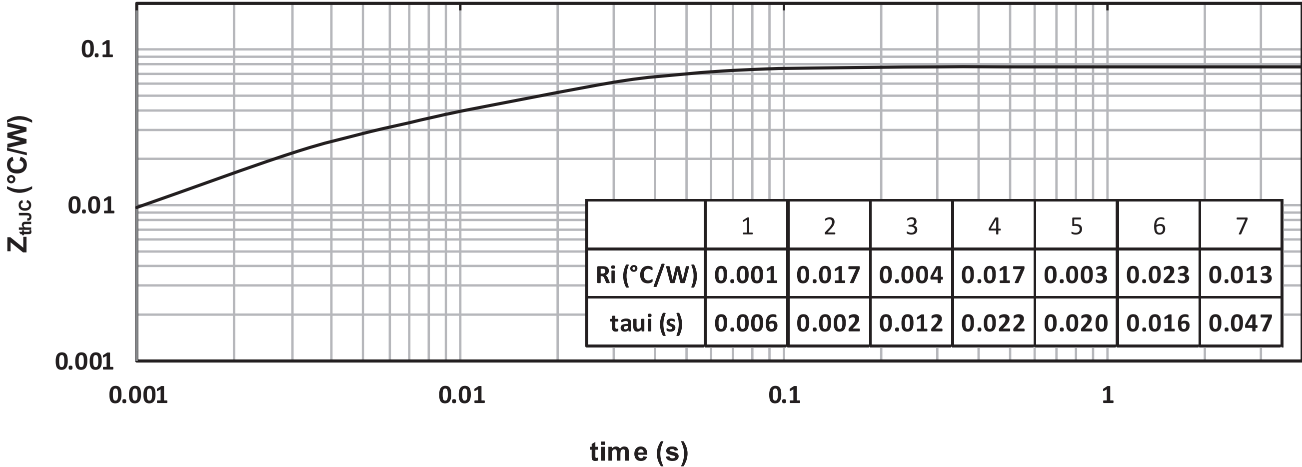
**Figure 1-13.** Maximum Thermal Impedance




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Ri (°C/W) | 0.001 | 0.017 | 0.004 | 0.017 | 0.003 | 0.023 | 0.013 |
| taui (s) | 0.006 | 0.002 | 0.012 | 0.022 | 0.020 | 0.016 | 0.047 |

**Figure 1-14.** 3rd Quadrant Characteristics, $T_J$ = 25 °C

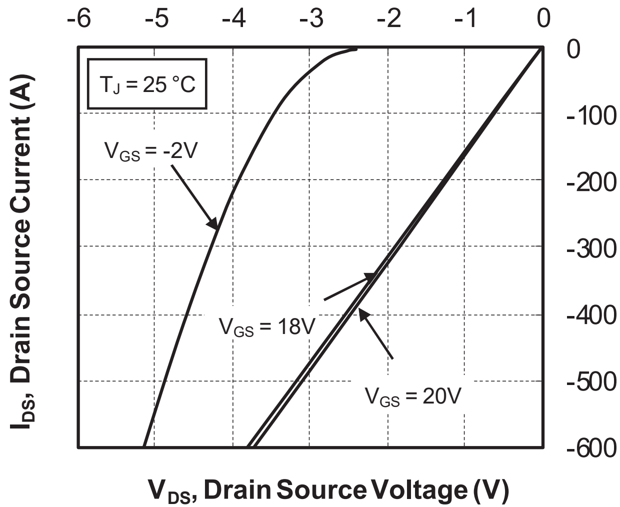



**Figure 1-15.** 3rd Quadrant Characteristics, $T_J$ = 150 °C

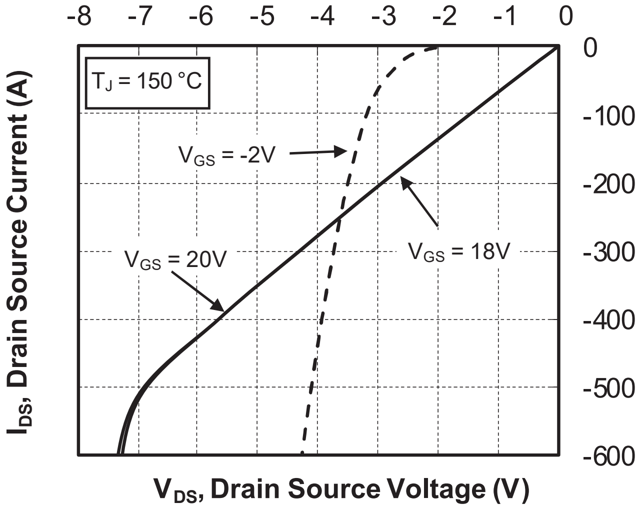




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**Figure 1-16.** 3rd Quadrant Characteristics, $T_J$ = 175 °C

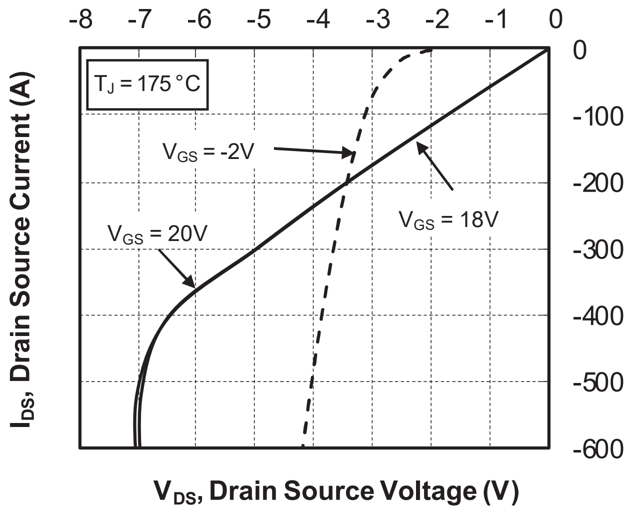



**Figure 1-17.** Body Diode Characteristics, $T_J$ = 25 °C

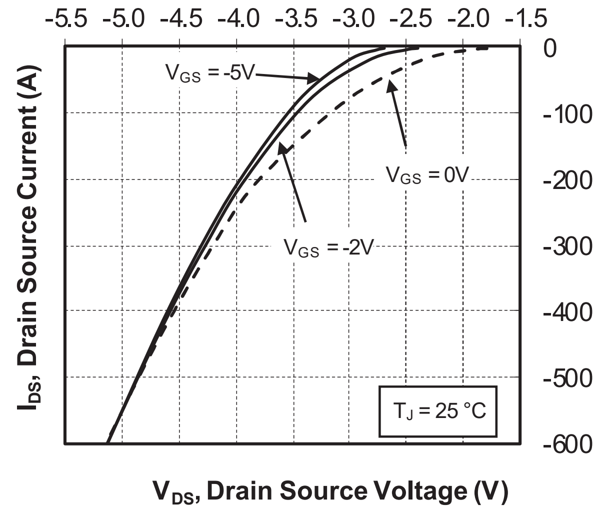



**Figure 1-18.** Body Diode Characteristics, $T_J$ = 150 °C

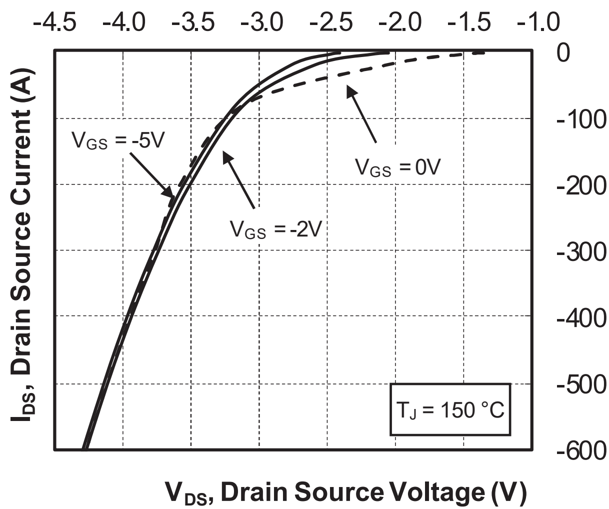
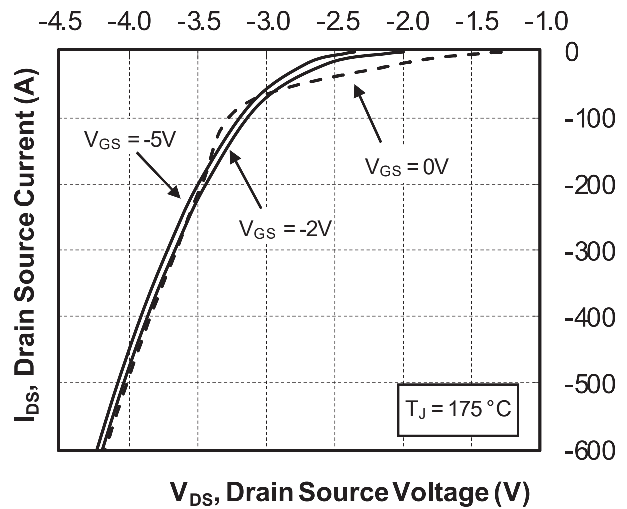



**Figure 1-19.** Body Diode Characteristics, $T_J$ = 175 °C





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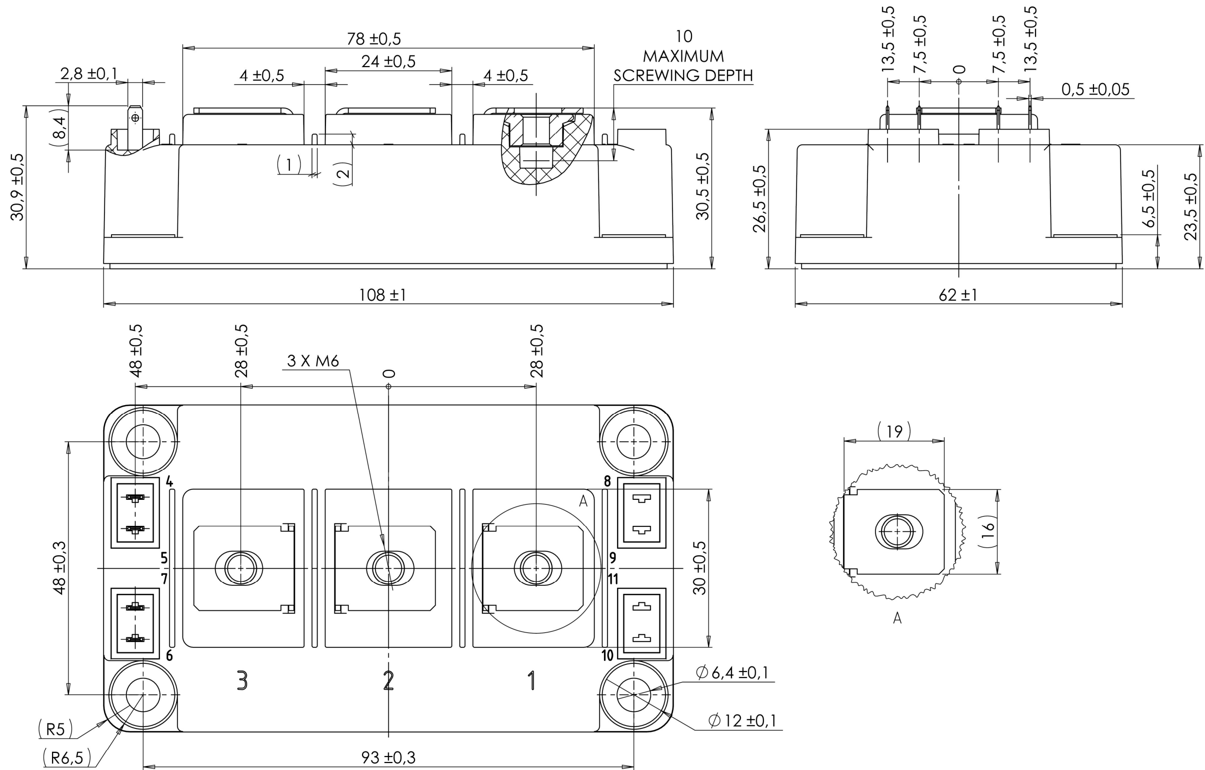
# 2. Package Specifications

The following section shows the package specification of the MSCSM330DUM07D3NG device.

## 2.1. Package Outline

The following figure shows the package outline drawing of the MSCSM330DUM07D3NG device. The dimensions in the following figure are in millimeters.

**Figure 2-1.** Package Outline Drawing




**Note:** For more information, see the latest application note on mounting instruction for D3 and D4 power modules, available on the Microchip website.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# 3. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

| Revision | Date | Description |
|---|---|---|
| A | 10/2025 | Initial Revision |


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