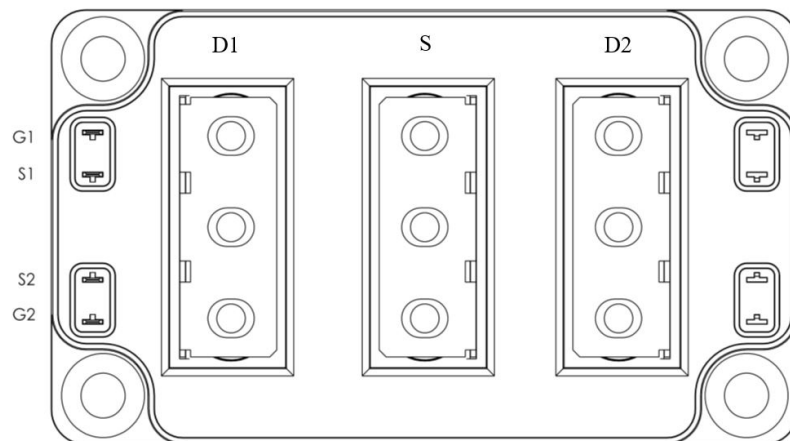
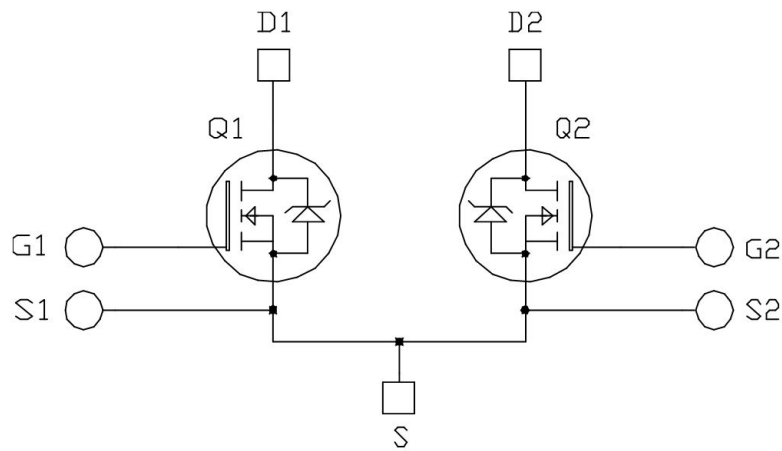


## Dual Common Source SiC MOSFET Power Module

### Product Overview

The MSCSM170DUM039AG device is a 1700V/523A dual common source silicon carbide (SiC) MOSFET power module.



**Note:** All ratings at  $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified.



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

## Features

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The following are the key features of MSCSM170DUM039AG device:

- SiC Power MOSFET
  - Low  $R_{DS(on)}$
  - High temperature performance
- Kelvin source for easy drive
- Low stray inductance
- High level of integration
- Aluminum Nitride (AlN) substrate for improved thermal performance
- M5 power connectors

## Benefits

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The following are the benefits of MSCSM170DUM039AG device:

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction-to-case thermal resistance
- Low profile
- RoHS compliant

## Application

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The following are the applications of MSCSM170DUM039AG device:

- AC switches
- Switched mode power supplies
- Uninterruptible power supplies

## 1. Electrical Specifications

This section provides the electrical specifications of the MSCSM170DUM039AG device.

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

The following table lists the absolute maximum ratings of MSCSM170DUM039AG device.

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

Symbol	Parameter	Maximum Ratings	Unit
$V_{DSS}$	Drain-Source voltage	1700	V
$I_D$	Continuous drain current	$T_C = 25\text{ }^\circ\text{C}$	523
		$T_C = 80\text{ }^\circ\text{C}$	416
$I_{DM}$	Pulsed drain current	1000	
$V_{GSmax}$	Gate-Source voltage	-10/23	V
$R_{DS(on)}$	Drain-Source ON resistance	5	m $\Omega$
$P_D$	Power dissipation	$T_C = 25\text{ }^\circ\text{C}$	2400

The following table lists the electrical characteristics of MSCSM170DUM039AG device.

**Table 1-2. Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0V$ $V_{DS} = 1700V$	—	90	900	$\mu\text{A}$	
$R_{DS(on)}$	Drain-Source on resistance	$V_{GS} = 20V$ $I_D = 270A$	$T_J = 25\text{ }^\circ\text{C}$	—	3.9	5	m $\Omega$
			$T_J = 175\text{ }^\circ\text{C}$	—	6.8	—	
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}$ $I_D = 22.5\text{ mA}$	1.8	3.3	—	V	
$I_{GSS}$	Gate-Source leakage current	$V_{GS} = 20V$ $V_{DS} = 0V$	—	—	900	nA	

# MSCSM170DUM039AG

## Electrical Specifications

The following table lists the dynamic characteristics of MSCSM170DUM039AG device.

**Table 1-3. Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
C <sub>iss</sub>	Input capacitance	V <sub>GS</sub> = 0V	—	29.7	—	nF	
C <sub>oss</sub>	Output capacitance	V <sub>DS</sub> = 1000V	—	1.3	—		
C <sub>rss</sub>	Reverse transfer capacitance	f = 1 MHz	—	0.09	—		
Q <sub>g</sub>	Total gate charge	V <sub>GS</sub> = -5V/20V	—	1602	—	nC	
Q <sub>gs</sub>	Gate-Source charge	V <sub>Bus</sub> = 850V	—	441	—		
Q <sub>gd</sub>	Gate-Drain charge	I <sub>D</sub> = 270A	—	243	—		
T <sub>d(on)</sub>	Turn-on delay time	V <sub>GS</sub> = -5V/20V	T <sub>J</sub> = 150 °C	—	75	—	ns
T <sub>r</sub>	Rise time	V <sub>Bus</sub> = 900V		—	75	—	
T <sub>d(off)</sub>	Turn-off delay time	I <sub>D</sub> = 450A		—	153	—	
T <sub>f</sub>	Fall time	R <sub>Gon</sub> = 3.2Ω R <sub>Goff</sub> = 1.8Ω		—	56	—	
E <sub>on</sub>	Turn-on energy	V <sub>GS</sub> = -5V/20V	T <sub>J</sub> = 150 °C	—	24.3	—	mJ
E <sub>off</sub>	Turn-off energy	V <sub>Bus</sub> = 900V I <sub>D</sub> = 450A R <sub>Gon</sub> = 3.2Ω R <sub>Goff</sub> = 1.8Ω	T <sub>J</sub> = 150 °C	—	10.8	—	
R <sub>Gint</sub>	Internal gate resistance		—	0.65	—	Ω	
R <sub>thJC</sub>	Junction-to-case thermal resistance		—	—	0.063	°C/W	

The following table lists the body diode ratings and characteristics of MSCSM170DUM039AG device.

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

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>SD</sub>	Diode forward voltage	V <sub>GS</sub> = 0V I <sub>SD</sub> = 270A	—	3.7	—	V
		V <sub>GS</sub> = -5V I <sub>SD</sub> = 270A	—	3.9	—	
t <sub>rr</sub>	Reverse recovery time	I <sub>SD</sub> = 270A	—	27	—	ns
Q <sub>rr</sub>	Reverse recovery charge	V <sub>GS</sub> = -5V	—	5.9	—	μC
I <sub>rr</sub>	Reverse recovery current	V <sub>R</sub> = 900V di <sub>F</sub> /dt = 9000A/μs	—	414	—	A

### 1.2 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM170DUM039AG device.

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

Symbol	Characteristic		Min.	Max.	Unit	
V <sub>ISOL</sub>	RMS isolation voltage, any terminal to case t = 1 min, 50 Hz/60 Hz		4000	—	V	
T <sub>J</sub>	Operating junction temperature range		−40	175	°C	
T <sub>JOP</sub>	Recommended junction temperature under switching conditions		−40	T <sub>Jmax</sub> −25		
T <sub>STG</sub>	Storage case temperature		−40	125		
T <sub>C</sub>	Operating case temperature		−40	125		
Torque	Mounting torque	To heatsink	M6	3	5	N.m
		For terminals	M5	2	3.5	
Wt	Package weight		—	320	g	

### 1.3 Typical SiC MOSFET Performance Curve (Per SiC MOSFET)

This section shows the typical SiC MOSFET performance curves of the MSCSM170DUM039AG device.

Figure 1-1. Junction-to-Heatsink Thermal Impedance

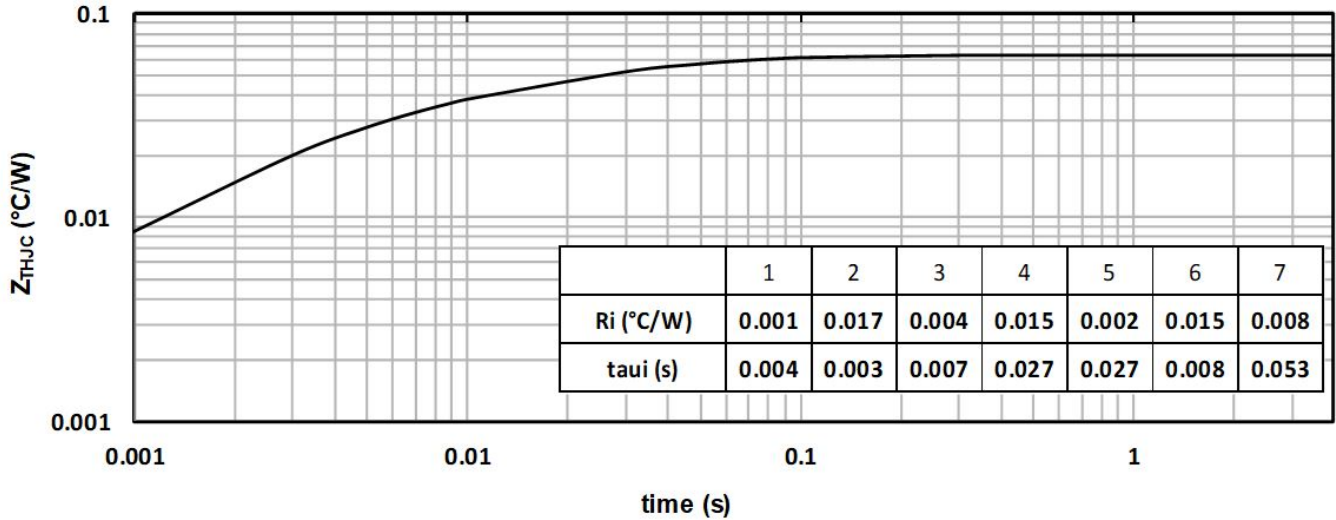


Figure 1-2. Output Characteristics,  $T_J = 25^\circ\text{C}$

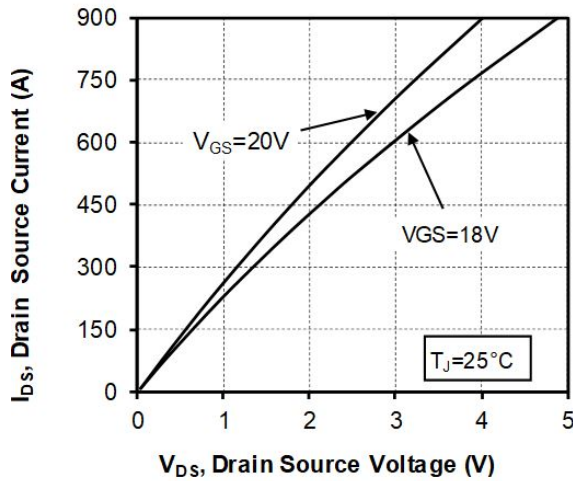


Figure 1-3. Output Characteristics,  $T_J = 175^\circ\text{C}$

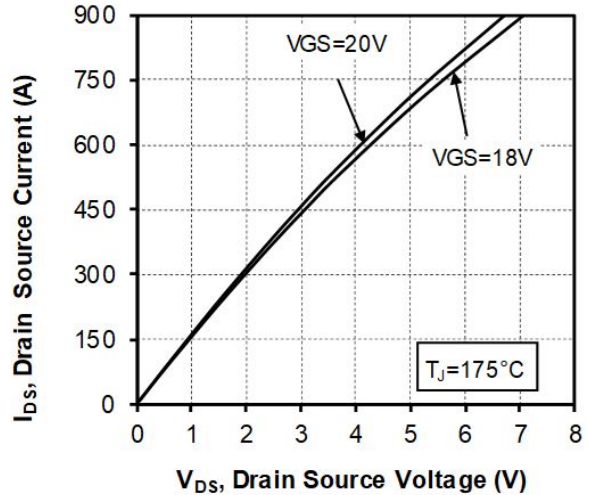


Figure 1-4. Normalized  $R_{DS(on)}$  vs. Temperature

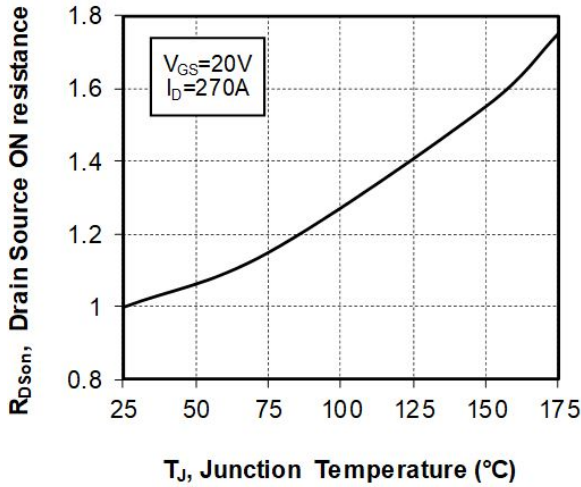


Figure 1-5. Transfer Characteristics

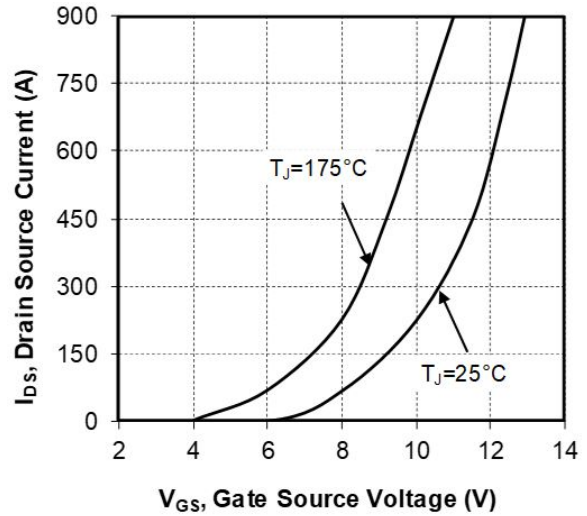


Figure 1-6. Switching Energy vs.  $R_g$

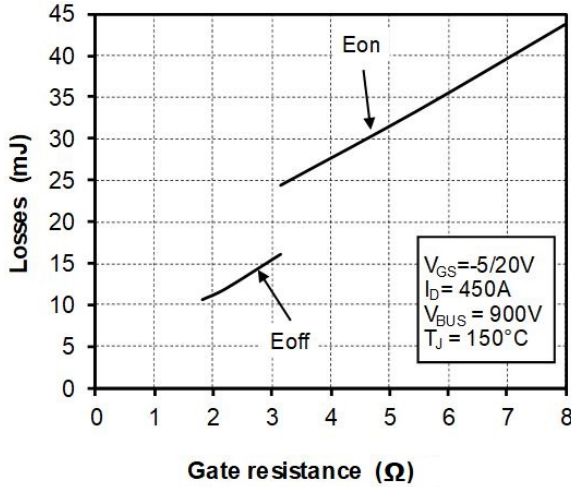


Figure 1-7. Switching Energy vs. Current

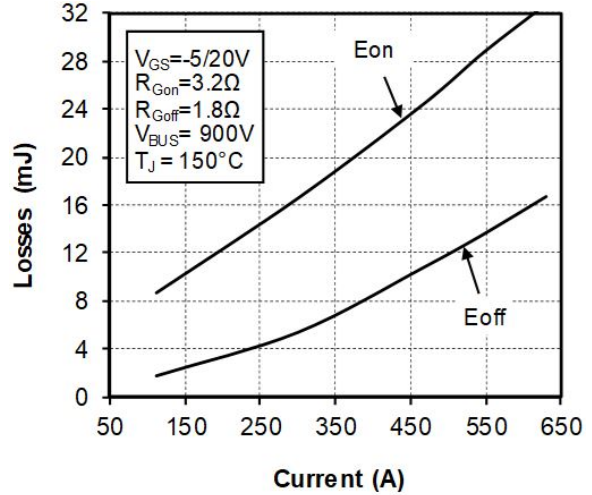


Figure 1-8. Capacitance vs. Drain Source Voltage

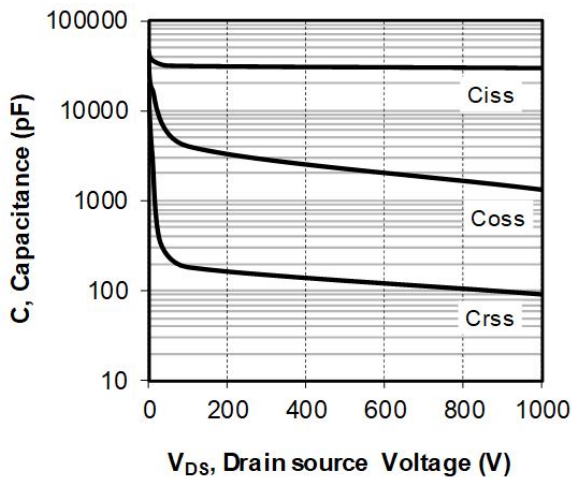


Figure 1-9. Gate Charge vs. Gate Source Voltage

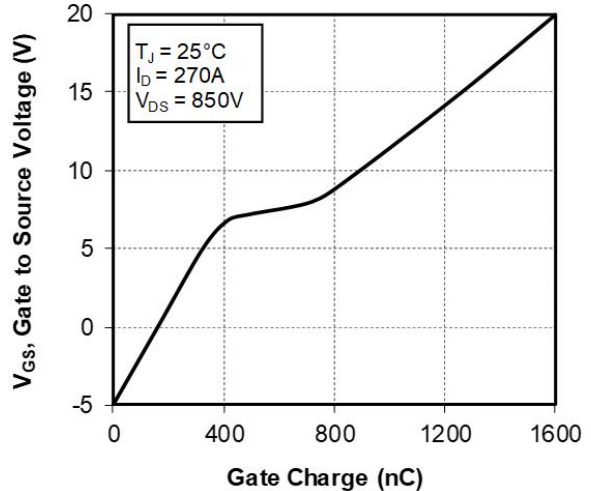


Figure 1-10. Body Diode Characteristics,  $T_J = 25\text{ }^\circ\text{C}$

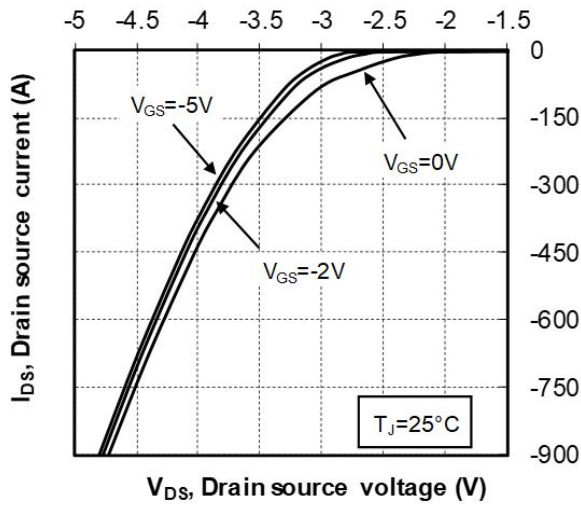


Figure 1-11. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 25\text{ }^\circ\text{C}$

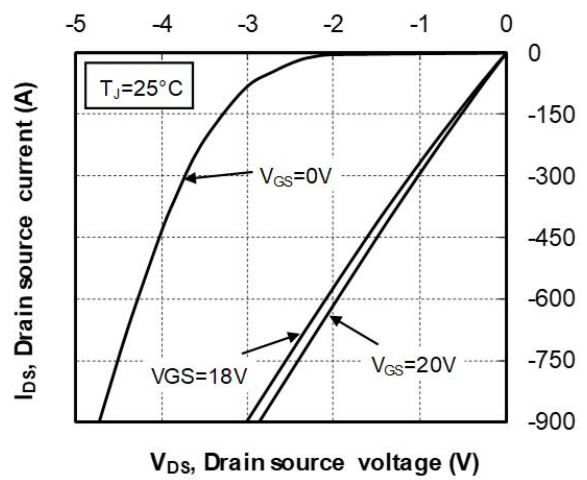


Figure 1-12. Body Diode Characteristics,  $T_J = 175\text{ }^\circ\text{C}$

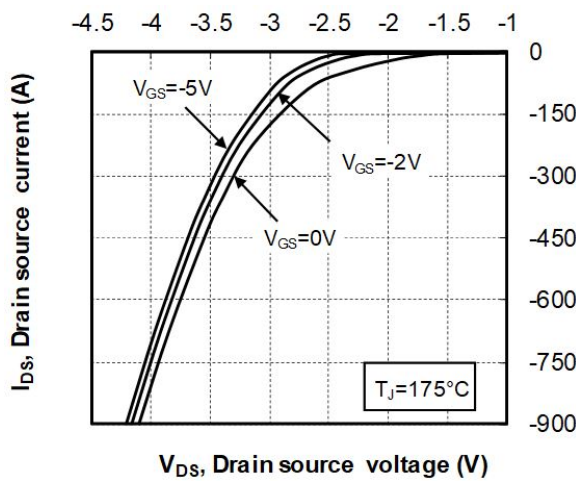


Figure 1-13. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 175\text{ }^\circ\text{C}$

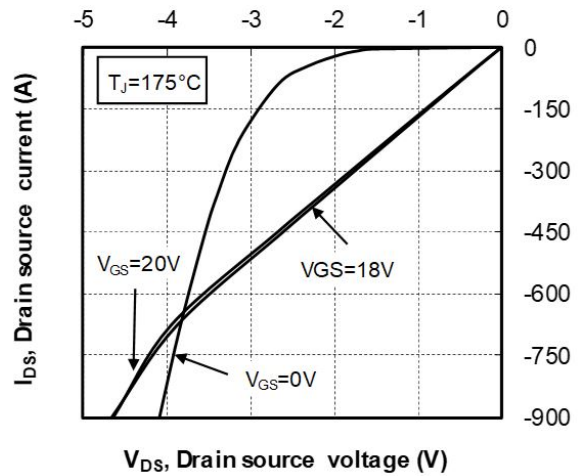
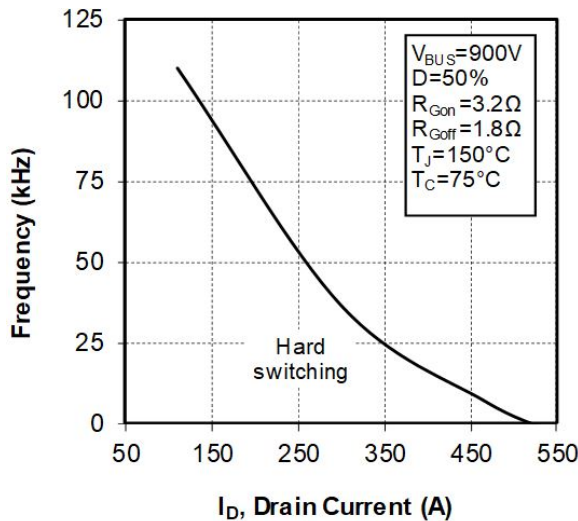


Figure 1-14. Operating Frequency vs. Drain Current





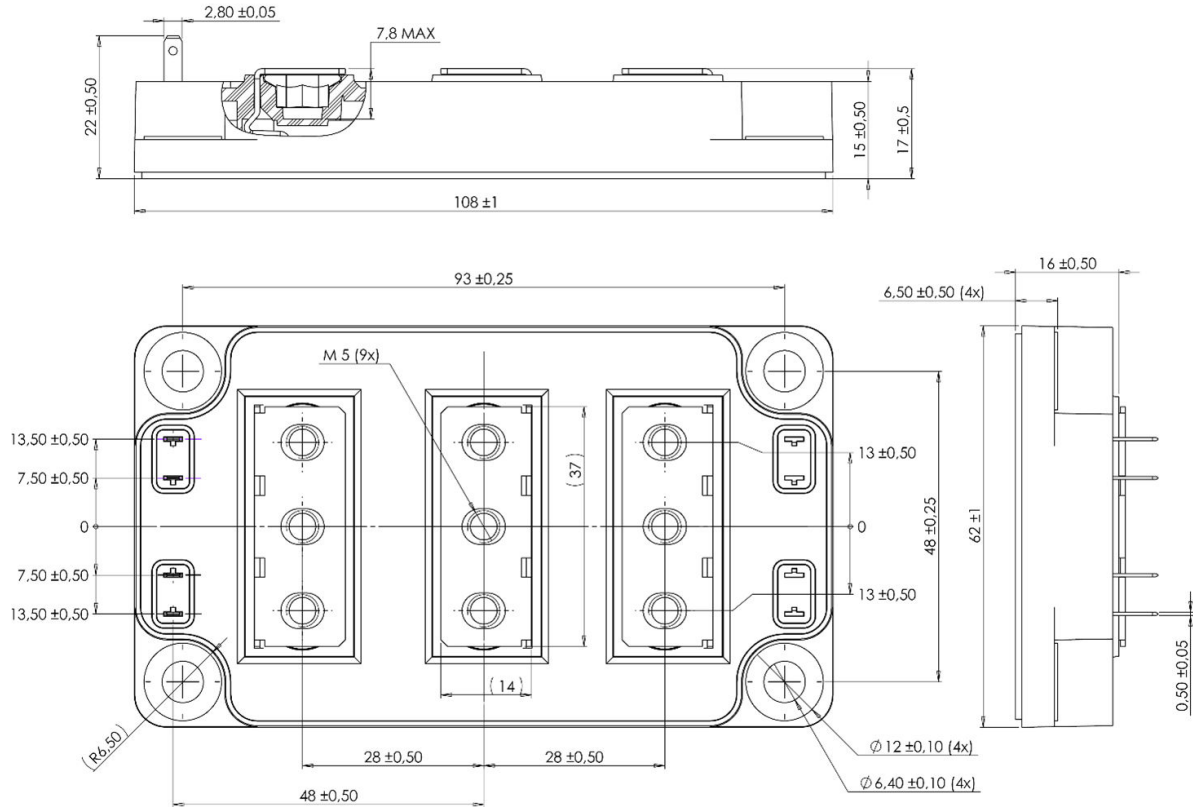
## 2. Package Specifications

The following section shows the package specification of the MSCSM170DUM039AG device.

### 2.1 Package Outline

The following figure shows the package outline drawing of the MSCSM170DUM039AG device. The dimensions in the following figure are in millimeters.

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



**3. Revision History**

Revision	Date	Description
A	12/2021	Initial Revision

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