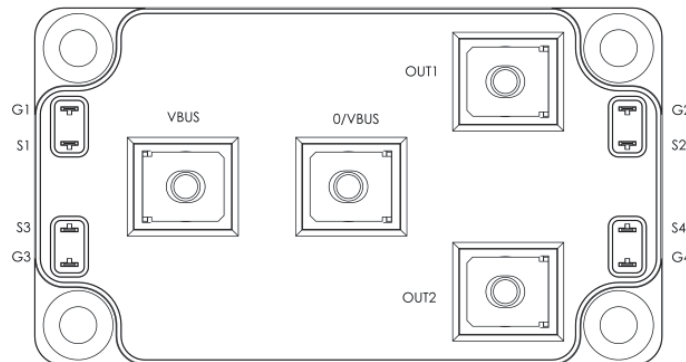
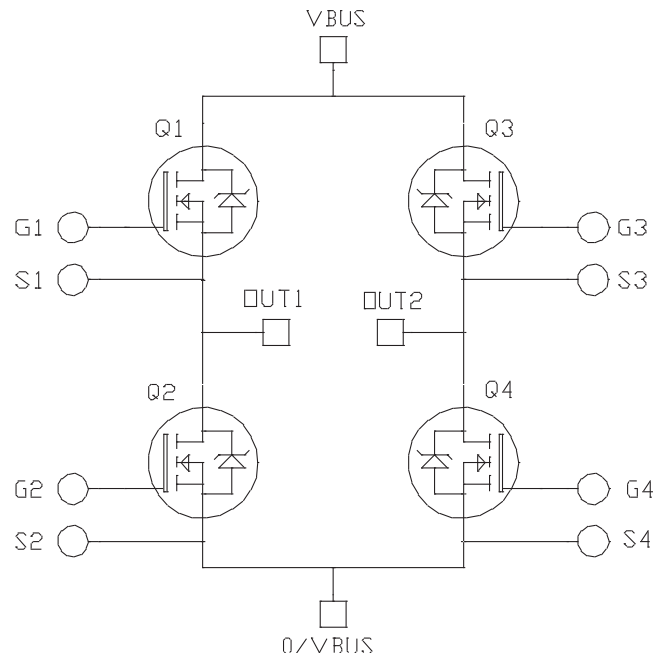


## Full Bridge SiC Power Module

### Product Overview

The MSCSM70HM038AG device is a full bridge 700V, 464A silicon carbide (SiC) 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 key features of the MSCSM70HM038AG device:

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

## Benefits

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The following are the benefits of MSCSM70HM038AG device:

- High efficiency converter
- Outstanding performance at high frequency operation
- Stable temperature behavior
- Direct mounting to heatsink (isolated package)
- Low junction-to-case thermal resistance
- RoHS compliant

## Application

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The MSCSM70HM038AG device is designed for the following applications:

- Welding converters
- Switched mode power supplies
- Uninterruptible power supplies
- EV motor and traction drive

## 1. Electrical Specifications

This section provides the electrical specifications of the MSCSM70HM038AG device.

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

The following table lists the absolute maximum ratings per SiC MOSFET of the MSCSM70HM038AG device.

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

Symbol	Parameter	Maximum Ratings	Unit
$V_{DSS}$	Drain-Source voltage	700	V
$I_D$	Continuous drain current	$T_C = 25\text{ }^\circ\text{C}$	464
		$T_C = 80\text{ }^\circ\text{C}$	369
$I_{DM}$	Pulsed drain current	900	
$V_{GS}$	Gate-Source voltage	-10/23	V
$R_{DS(on)}$	Drain-Source ON resistance	4.8	m $\Omega$
$P_D$	Power dissipation	$T_C = 25\text{ }^\circ\text{C}$	1277

The following table lists the electrical characteristics per SiC MOSFET of the MSCSM70HM038AG device.

**Table 1-2. Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0V$ $V_{DS} = 700V$	—	—	400	$\mu\text{A}$	
$R_{DS(on)}$	Drain-Source on resistance	$V_{GS} = 20V$ $I_D = 160A$	$T_J = 25\text{ }^\circ\text{C}$	—	3.8	4.8	m $\Omega$
			$T_J = 175\text{ }^\circ\text{C}$	—	4.8	—	
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}$ $I_D = 16\text{ mA}$	1.9	2.4	—	V	
$I_{GSS}$	Gate-Source leakage current	$V_{GS} = 20V; V_{DS} = 0V$	—	—	400	nA	

# MSCSM70HM038AG

## Electrical Specifications

The following table lists the dynamic characteristics per SiC MOSFET of the MSCSM70HM038AG device.

**Table 1-3. Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
$C_{iss}$	Input capacitance	$V_{GS} = 0V$	—	18	—	nF	
$C_{oss}$	Output capacitance	$V_{DS} = 700V$	—	2	—		
$C_{rss}$	Reverse transfer capacitance	$f = 1\text{ MHz}$	—	0.11	—		
$Q_g$	Total gate charge	$V_{GS} = -5V/20V$	—	860	—	nC	
$Q_{gs}$	Gate-Source charge	$V_{Bus} = 470V$	—	232	—		
$Q_{gd}$	Gate-Drain charge	$I_D = 160A$	—	140	—		
$T_{d(on)}$	Turn-on delay time	$V_{GS} = -5V/20V$	$T_J = 150\text{ }^\circ\text{C}$	—	78	—	ns
$T_r$	Rise time	$V_{Bus} = 400V$		—	125	—	
$T_{d(off)}$	Turn-off delay time	$I_D = 320A$		—	214	—	
$T_f$	Fall time	$R_{G(on)} = 18\Omega$ $R_{G(off)} = 4\Omega$		—	92	—	
$E_{on}$	Turn-on energy	$V_{GS} = -5V/20V$	$T_J = 150\text{ }^\circ\text{C}$	—	6.7	—	mJ
$E_{off}$	Turn-off energy	$V_{Bus} = 400V$ $I_D = 320A$ $R_{G(on)} = 18\Omega$ $R_{G(off)} = 4\Omega$		—	7	—	
$R_{Gint}$	Internal gate resistance		—	1.4	—	$\Omega$	
$R_{thJC}$	Junction-to-case thermal resistance		—	—	0.117	$^\circ\text{C/W}$	

The following table lists the body diode ratings and characteristics per SiC MOSFET of the MSCSM70HM038AG device.

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

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Diode forward voltage	$V_{GS} = 0V; I_{SD} = 160A$	—	3.4	—	V
		$V_{GS} = -5V; I_{SD} = 160A$	—	3.8	—	
$t_{rr}$	Reverse recovery time	$I_{SD} = 160A; V_{GS} = -5V$	—	40	—	ns
$Q_{rr}$	Reverse recovery charge	$V_R = 400V; di_F/dt = 4000\text{ A}/\mu\text{s}$	—	2	—	$\mu\text{C}$
$I_{rr}$	Reverse recovery current		—	76	—	A

### 1.2 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM70HM038AG device.

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

Symbol	Characteristics	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 temperature range	-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	—	300	g		

### 1.3 Typical SiC MOSFET Performance Curve

This section shows the typical SiC MOSFET performance curves of the MSCSM70HM038AG device.

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

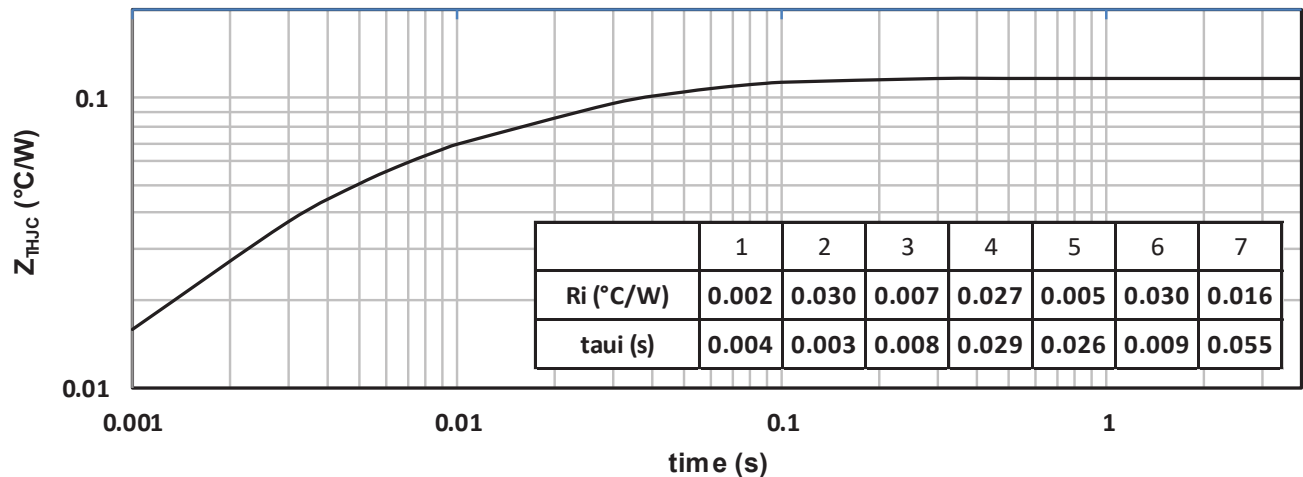


Figure 1-2. Output Characteristics,  $T_J = 25^\circ\text{C}$

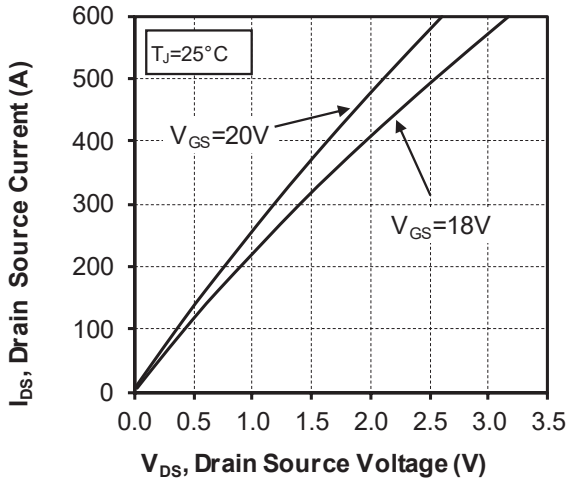


Figure 1-3. Output Characteristics,  $T_J = 175^\circ\text{C}$

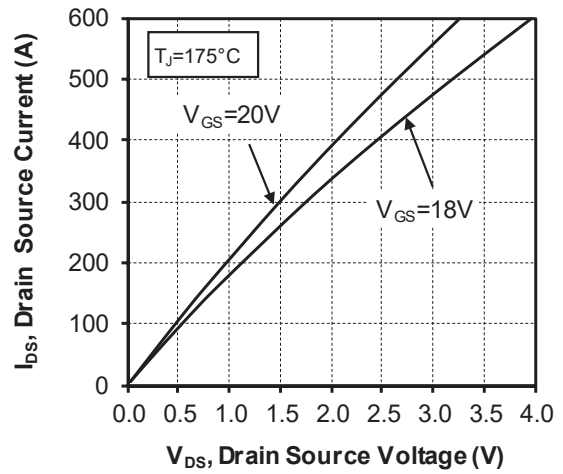


Figure 1-4. Normalized  $R_{DS(on)}$  vs. Temperature

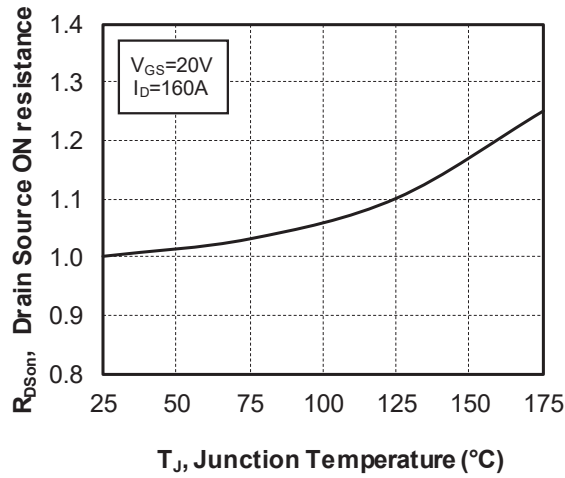


Figure 1-5. Transfer Characteristics

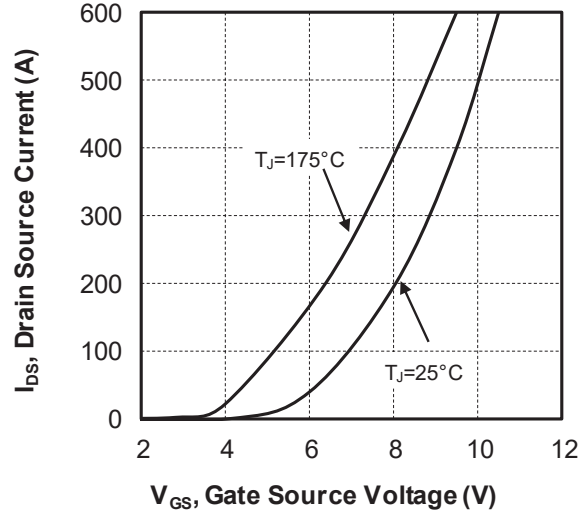


Figure 1-6. Switching Energy vs. Current

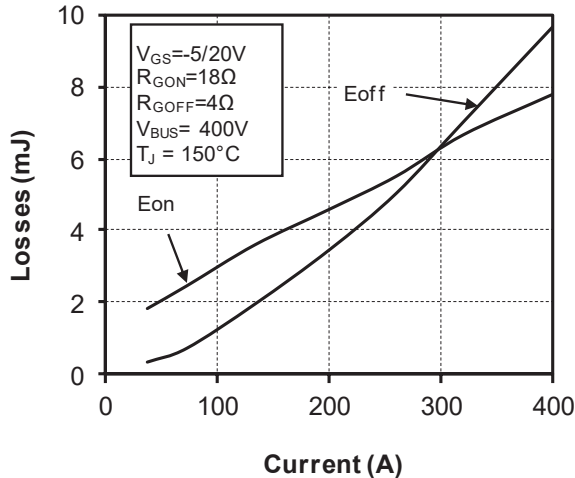
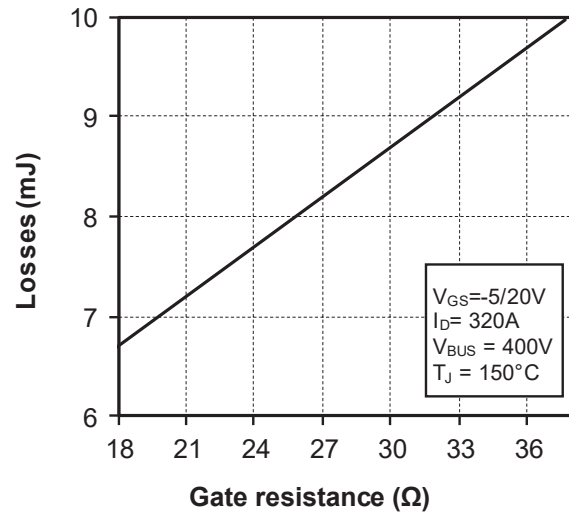


Figure 1-7. Turn On Energy vs.  $R_g$



# MSCSM70HM038AG

## Electrical Specifications

Figure 1-8. Capacitance vs. Drain Source Voltage

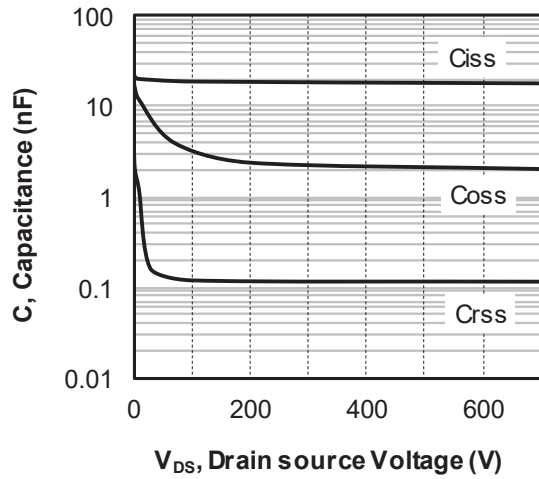


Figure 1-9. Gate Charge vs. Gate Source Voltage

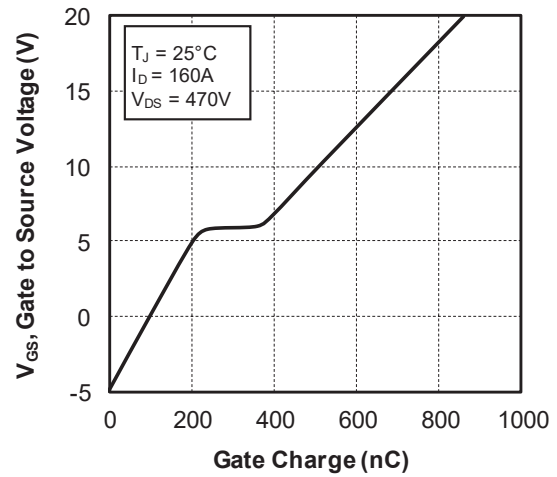


Figure 1-10. Body Diode Characteristics, T<sub>J</sub> = 25 °C

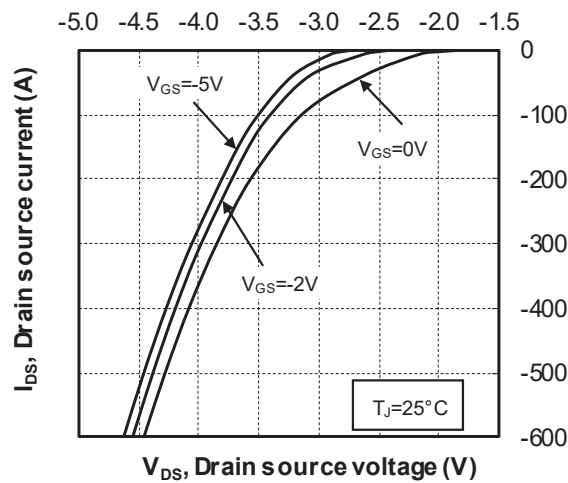


Figure 1-11. 3<sup>rd</sup> Quadrant Characteristics, T<sub>J</sub> = 25 °C

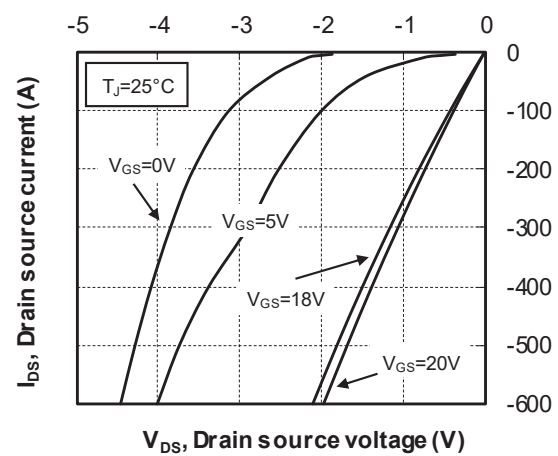


Figure 1-12. Body Diode Characteristics, T<sub>J</sub> = 175 °C

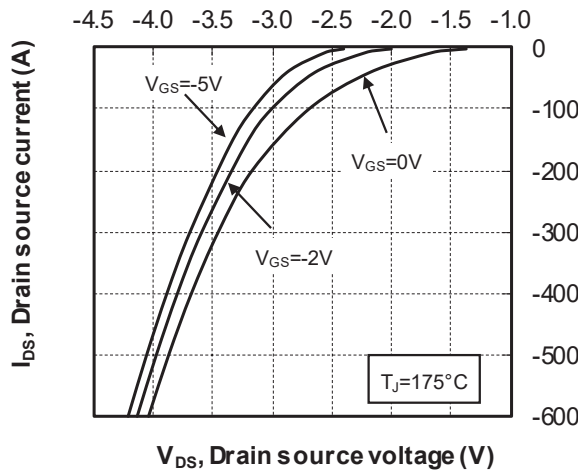


Figure 1-13. 3<sup>rd</sup> Quadrant Characteristics, T<sub>J</sub> = 175 °C

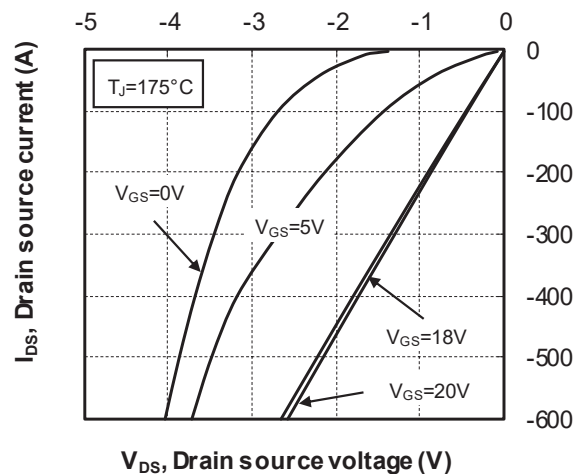
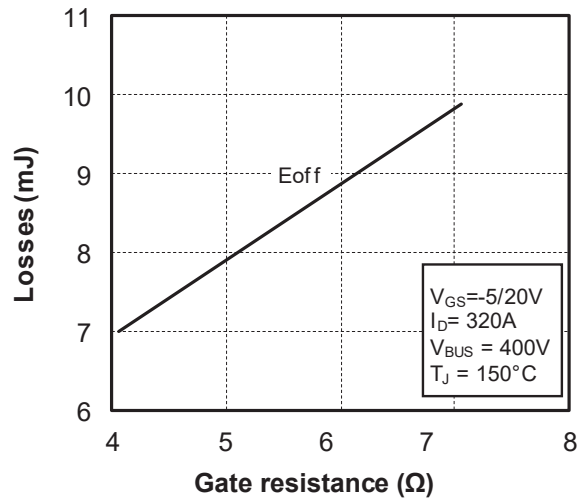
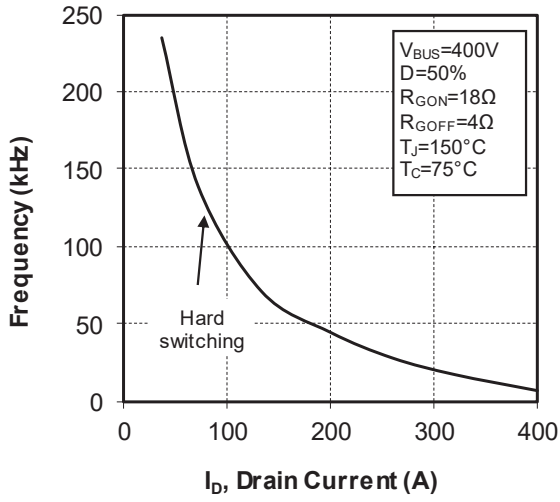


Figure 1-14. Operating Frequency vs. Drain Current      Figure 1-15. Turn Off Energy vs. Rg





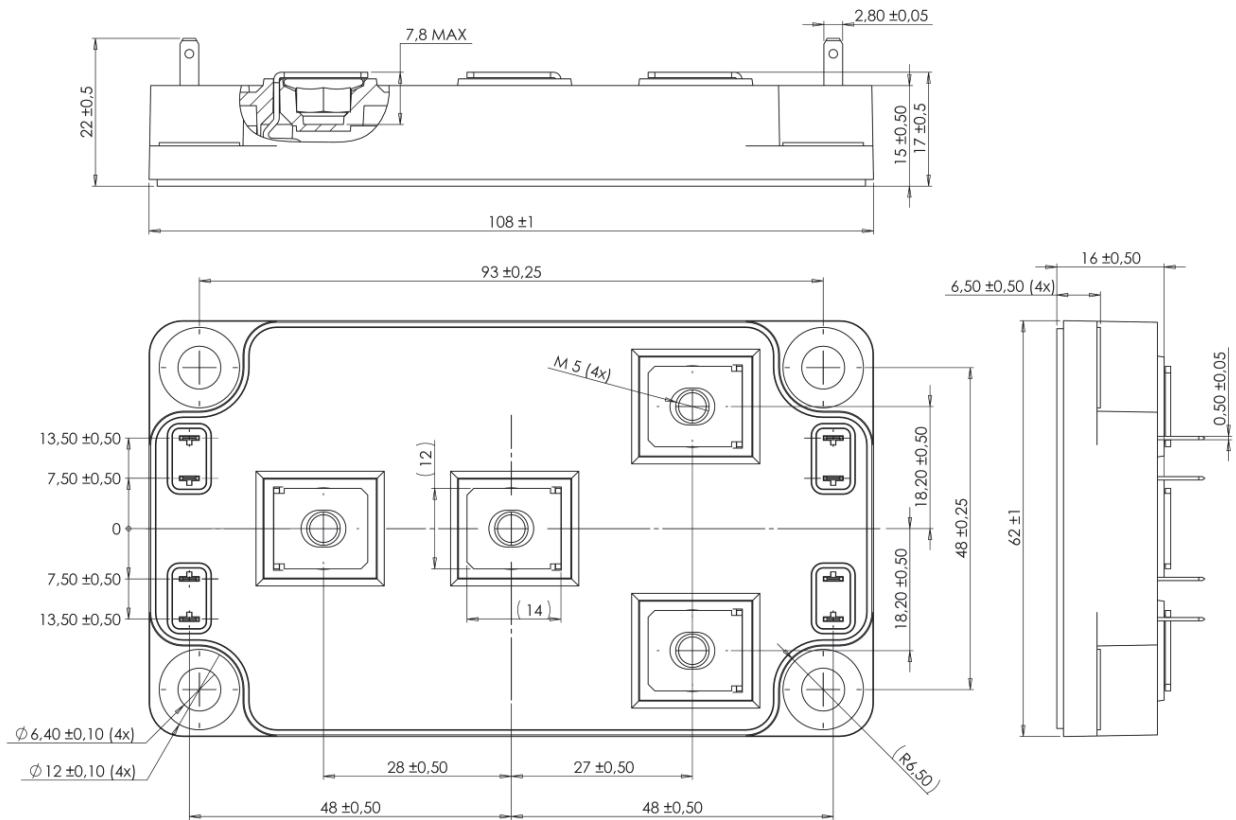
## 2. Package Specifications

The following section shows the package specification of the MSCSM70HM038AG device.

### 2.1 Package Outline

The following figure shows the package outline drawing of the MSCSM70HM038AG device. The dimensions in the following figure are in millimeters.

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



**Note:** See [APT0601—Mounting Instructions for SP6 Power Modules](#) for more information.

**3. Revision History**

Revision	Date	Description
A	06/2022	Initial Revision

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ISBN: 978-1-6683-0620-8

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