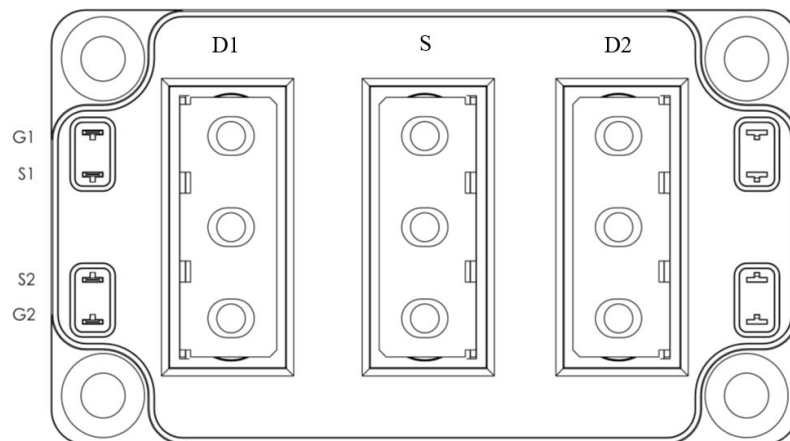
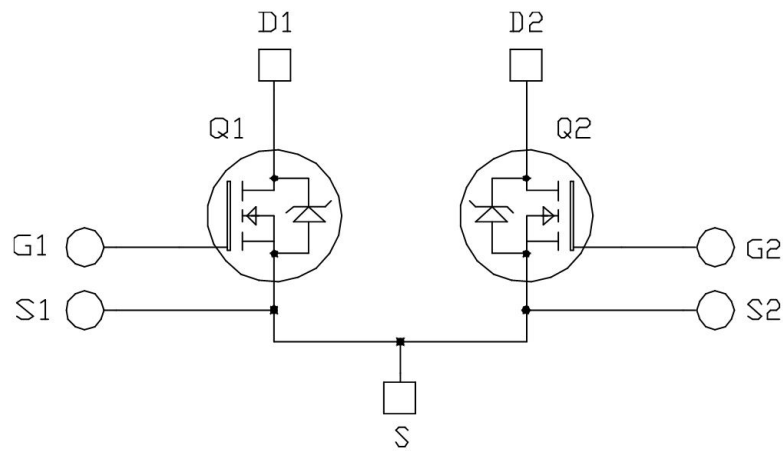


## Dual Common Source SiC MOSFET Power Module

### 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	A
		$T_C = 80\text{ }^{\circ}\text{C}$	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	W

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	$\mu A$
$R_{DS(on)}$	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

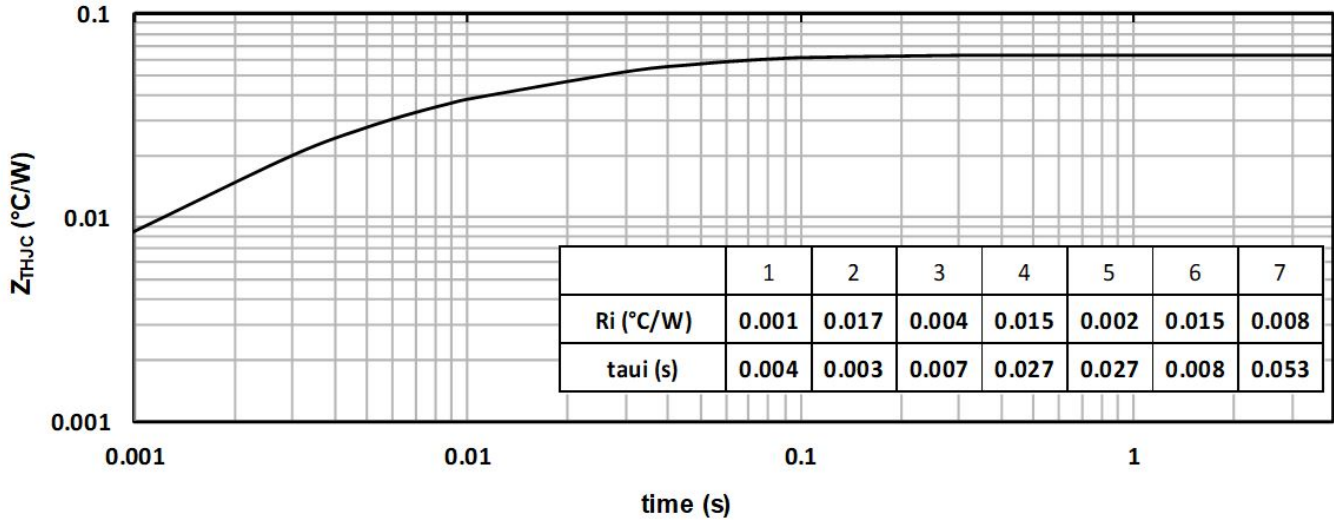


Figure 1-2. Output Characteristics,  $T_J = 25^\circ\text{C}$

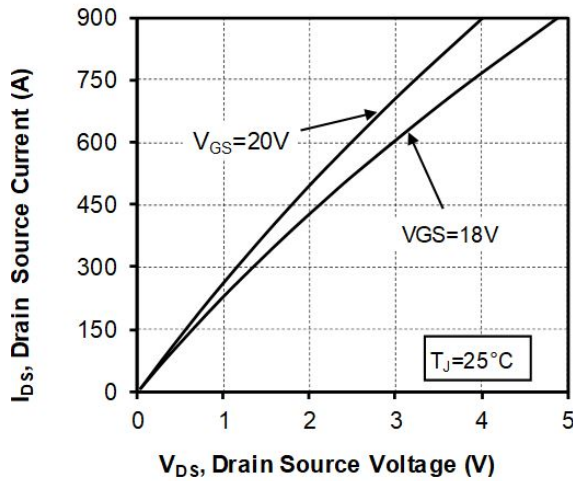


Figure 1-3. Output Characteristics,  $T_J = 175^\circ\text{C}$

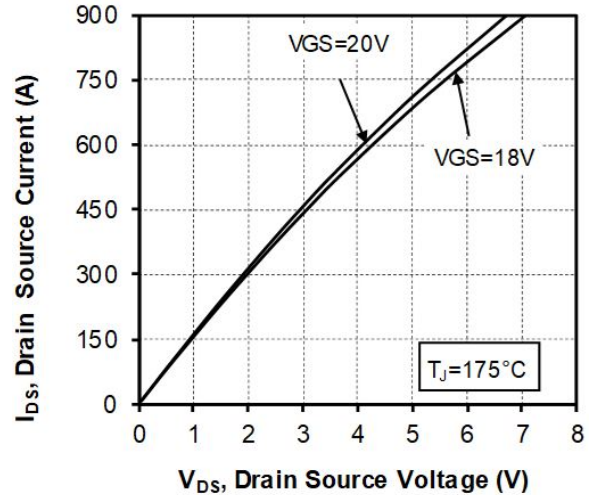


Figure 1-4. Normalized  $R_{DS(on)}$  vs. Temperature

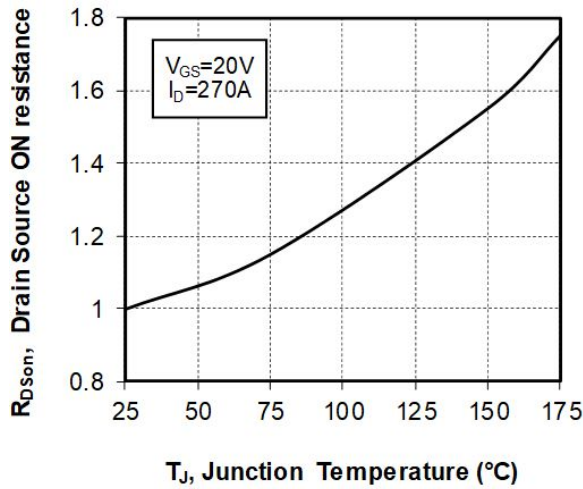


Figure 1-5. Transfer Characteristics

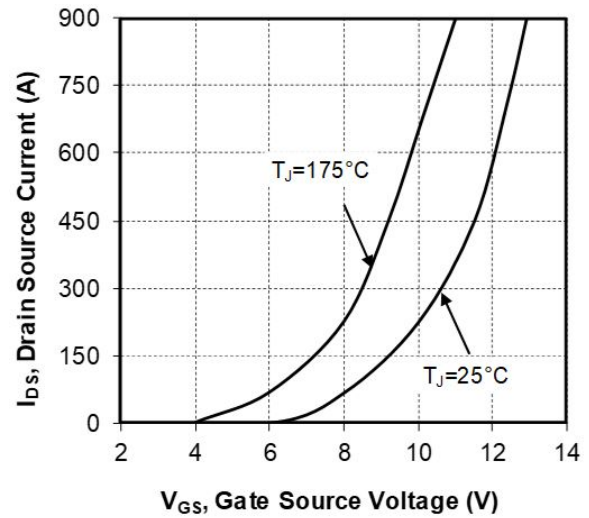


Figure 1-6. Switching Energy vs.  $R_g$

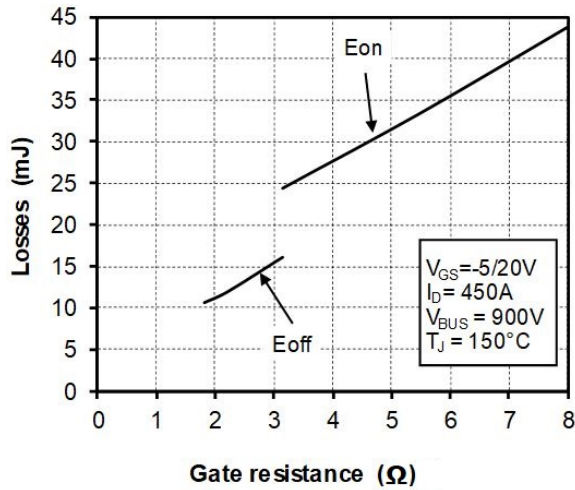


Figure 1-7. Switching Energy vs. Current

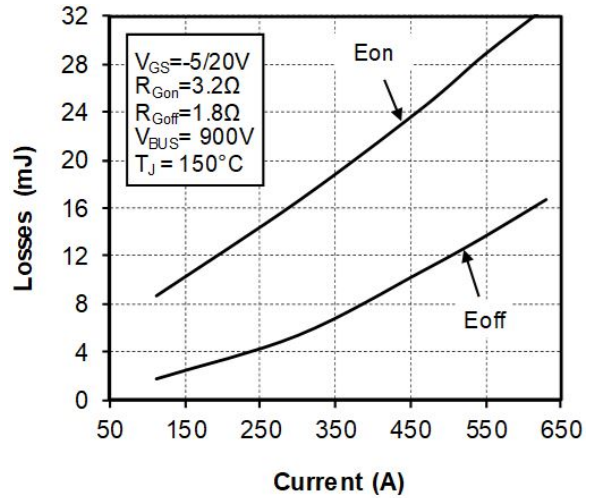


Figure 1-8. Capacitance vs. Drain Source Voltage

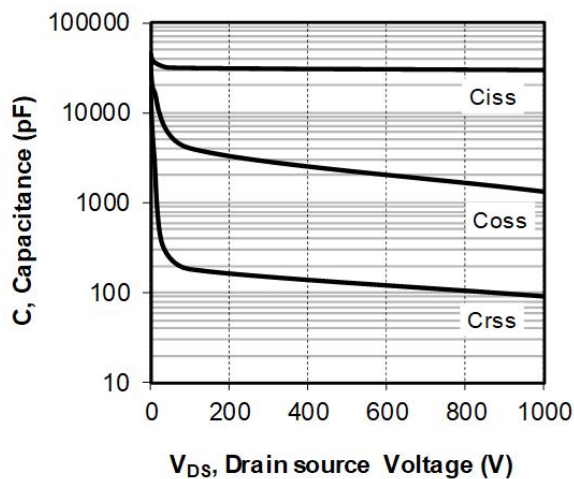


Figure 1-9. Gate Charge vs. Gate Source Voltage

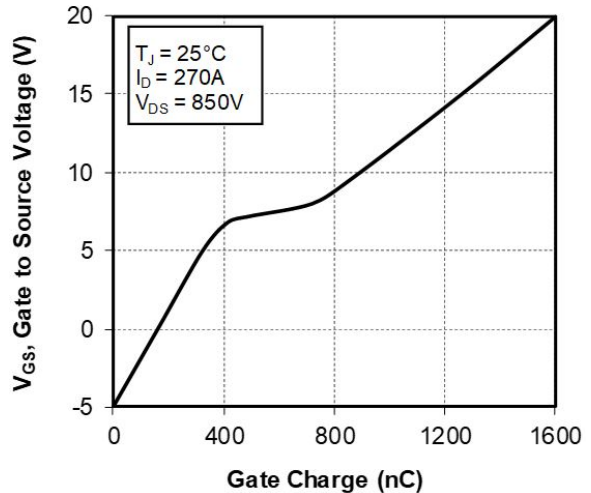


Figure 1-10. Body Diode Characteristics,  $T_J = 25^\circ\text{C}$

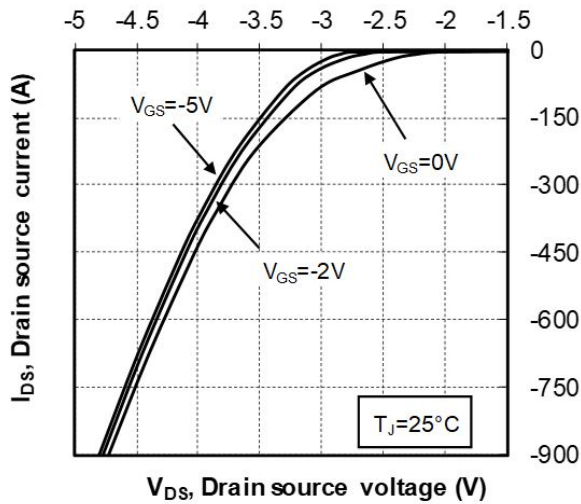


Figure 1-11. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 25^\circ\text{C}$

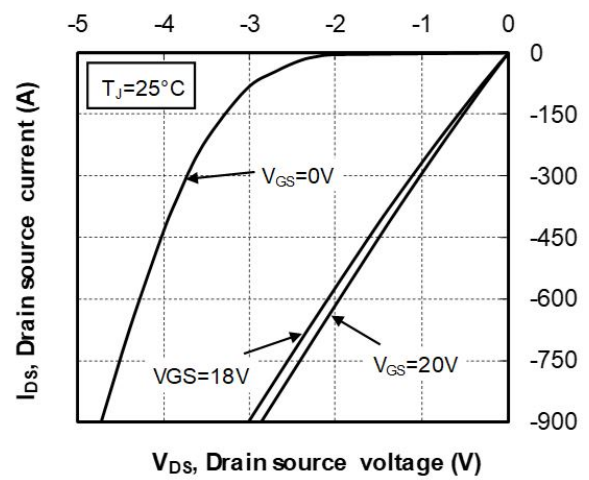


Figure 1-12. Body Diode Characteristics,  $T_J = 175^\circ\text{C}$

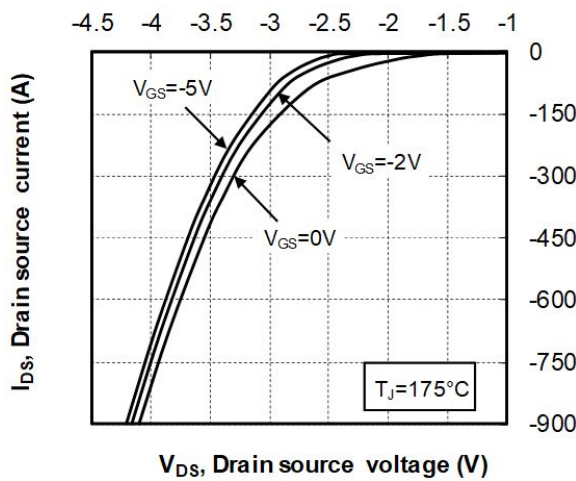


Figure 1-13. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 175^\circ\text{C}$

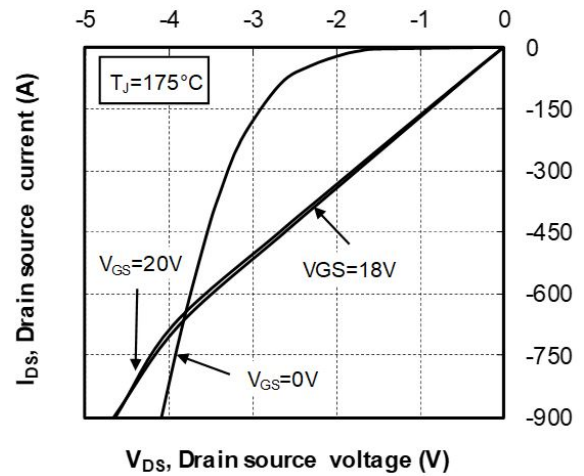
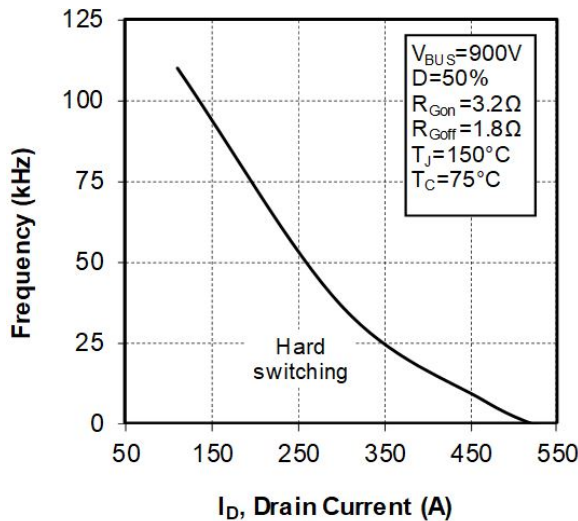


Figure 1-14. Operating Frequency vs. Drain Current



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

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

[illegible]

**3. Revision History**

Revision	Date	Description
A	12/2021	Initial Revision

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