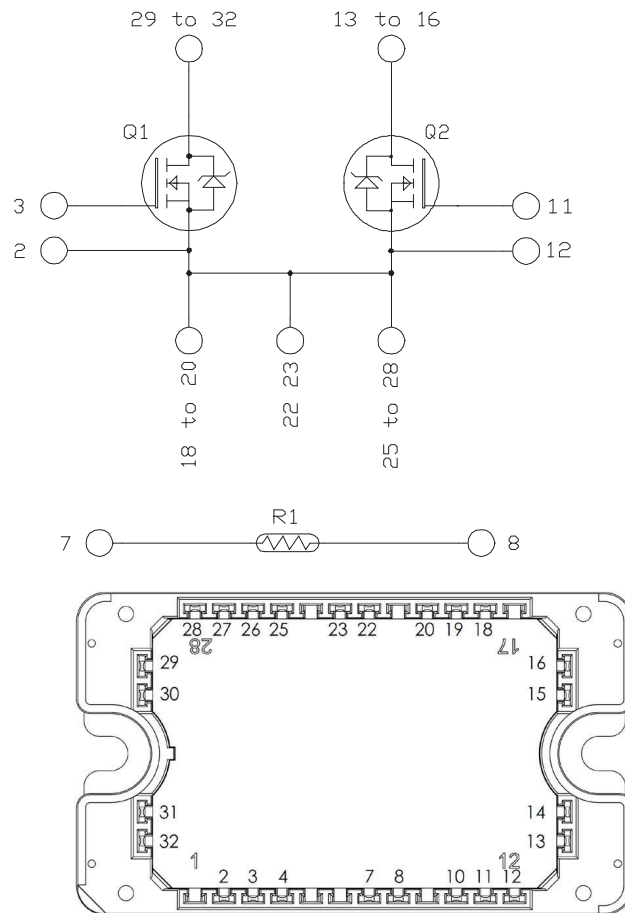


## Dual Common Source SiC MOSFET Power Module

### Product Overview

The MSCSM70DUM07T3AG device is a 700V/353A dual common source silicon carbide (SiC) MOSFET power module.



All multiple inputs and outputs must be shorted together  
 13/14/15/16 ; 18/19/20/22/23/25/26/27/28  
 ; 29/30/31/32

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 MSCSM70DUM07T3AG 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
- Internal thermistor for temperature monitoring

## Benefits

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The following are the benefits of MSCSM70DUM07T3AG device:

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction-to-case thermal resistance
- Low profile
- RoHS compliant
- Solderable terminals both for power and signal for easy PCB mounting

## Application

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The following are the applications of MSCSM70DUM07T3AG device:

- AC switches

## 1. Electrical Specifications

This section provides the electrical specifications of the MSCSM70DUM07T3AG device.

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

The following table lists the absolute maximum ratings of the MSCSM70DUM07T3AG device.

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

Symbol	Parameter	Maximum Ratings	Unit
$V_{DSS}$	Drain-Source voltage	700	V
$I_D$	Continuous drain current	$T_C = 25\text{ }^\circ\text{C}$	353
		$T_C = 80\text{ }^\circ\text{C}$	281
$I_{DM}$	Pulsed drain current	700	
$V_{GS}$	Gate-Source voltage	-10/25	V
$R_{DS(on)}$	Drain-Source ON resistance	6.4	m $\Omega$
$P_D$	Power dissipation	$T_C = 25\text{ }^\circ\text{C}$	988

The following table lists the electrical characteristics of the MSCSM70DUM07T3AG device.

**Table 1-2. Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{V}$ $V_{DS} = 700\text{V}$	—	—	300	$\mu\text{A}$
$R_{DS(on)}$	Drain-Source on resistance	$V_{GS} = 20\text{V}$ $I_D = 120\text{A}$	$T_J = 25\text{ }^\circ\text{C}$	—	5	6.4
			$T_J = 175\text{ }^\circ\text{C}$	—	6.3	—
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}$ $I_D = 12\text{ mA}$	1.9	2.4	—	V
$I_{GSS}$	Gate-Source leakage current	$V_{GS} = 20\text{V}$ $V_{DS} = 0\text{V}$	—	—	300	nA

# MSCSM70DUM07T3AG

## Electrical Specifications

The following table lists the dynamic characteristics of the MSCSM70DUM07T3AG 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	—	13.5	—	nF
C <sub>oss</sub>	Output capacitance	V <sub>DS</sub> = 700V	—	1.5	—	
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	—	645	—	nC
Q <sub>gs</sub>	Gate-Source charge	V <sub>Bus</sub> = 470V	—	174	—	
Q <sub>gd</sub>	Gate-Drain charge	I <sub>D</sub> = 120A	—	105	—	
T <sub>d(on)</sub>	Turn-on delay time	V <sub>GS</sub> = -5V/20V	—	40	—	ns
T <sub>r</sub>	Rise time	V <sub>Bus</sub> = 400V		35		
T <sub>d(off)</sub>	Turn-off delay time	I <sub>D</sub> = 240A		50		
T <sub>f</sub>	Fall time	R <sub>Gon</sub> = 9Ω R <sub>Goff</sub> = 1.6Ω		20		
E <sub>on</sub>	Turn-on energy	V <sub>GS</sub> = -5V/20V	—	1.9	—	mJ
E <sub>off</sub>	Turn-off energy	V <sub>Bus</sub> = 400V I <sub>D</sub> = 240A R <sub>Gon</sub> = 9Ω R <sub>Goff</sub> = 1.6Ω	—	0.56	—	
R <sub>Gint</sub>	Internal gate resistance		—	1.9	—	Ω
R <sub>thJC</sub>	Junction-to-case thermal resistance		—	—	0.152	°C/W

The following table lists the body diode ratings and characteristics of the MSCSM70DUM07T3AG 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> = 120A	—	3.4	—	V
		V <sub>GS</sub> = -5V I <sub>SD</sub> = 120A	—	3.8	—	
t <sub>rr</sub>	Reverse recovery time	I <sub>SD</sub> = 120A	—	38	—	ns
Q <sub>rr</sub>	Reverse recovery charge	V <sub>GS</sub> = -5V	—	954	—	nC
I <sub>rr</sub>	Reverse recovery current	V <sub>R</sub> = 470V di <sub>F</sub> /dt = 3000A/μs	—	44	—	A

### 1.2 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM70DUM07T3AG 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	M4	2	3	N.m
Wt	Package weight	—	110	g		

The following table lists the temperature sensor NTC of the MSCSM70DUM07T3AG device.

**Table 1-6. Temperature Sensor NTC**

Symbol	Characteristic	Min.	Typ.	Max.	Unit
R <sub>25</sub>	Resistance at 25 °C	—	50	—	kΩ
ΔR <sub>25</sub> /R <sub>25</sub>	—	—	5	—	%
B <sub>25/85</sub>	T <sub>25</sub> = 298.15K	—	3952	—	K
ΔB/B	—	T <sub>C</sub> = 100 °C	4	—	%

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right]}$$

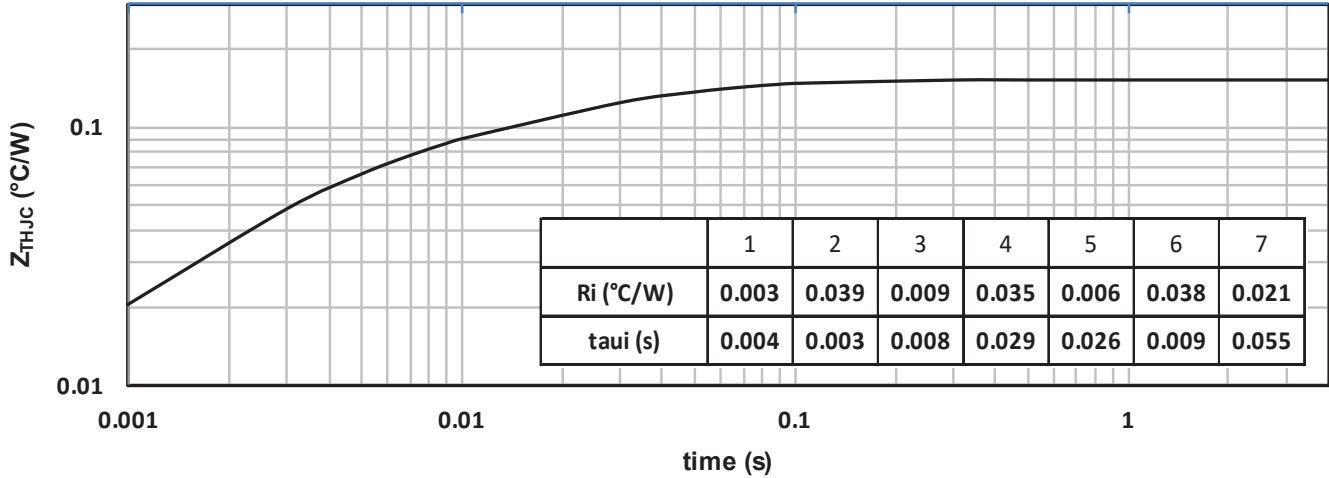
T: Thermistor temperature  
R<sub>T</sub>: Thermistor value at T

**Note:** See [APT0406—Using NTC Temperature Sensor Integrated into Power Module](#) for more information.

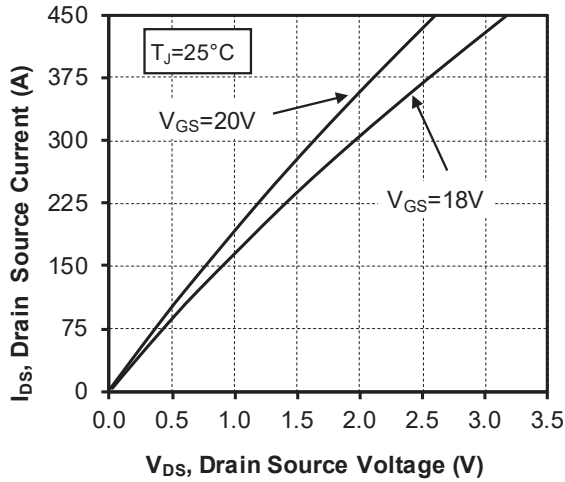
### 1.3 Typical SiC MOSFET Performance Curve (Per SiC MOSFET)

This section shows the typical SiC MOSFET performance curves of the MSCSM70DUM07T3AG device.

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



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



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

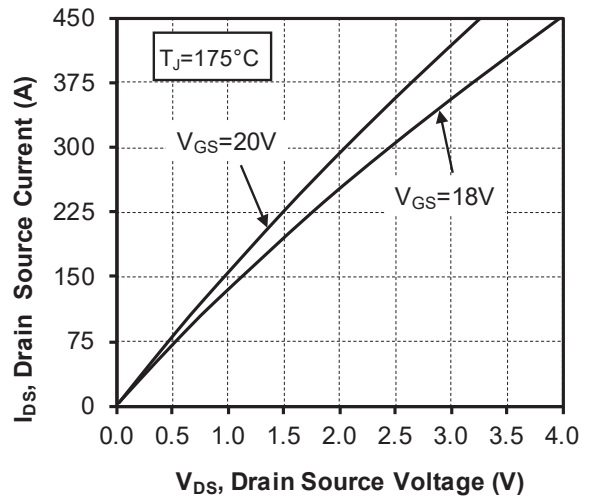


Figure 1-4. Normalized  $R_{DS(on)}$  vs. Temperature

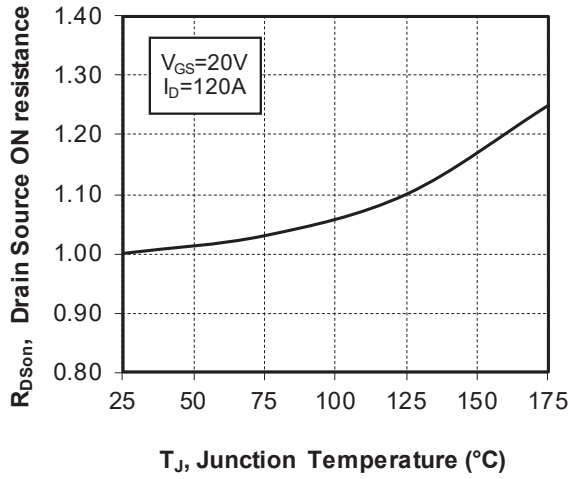


Figure 1-5. Transfer Characteristics

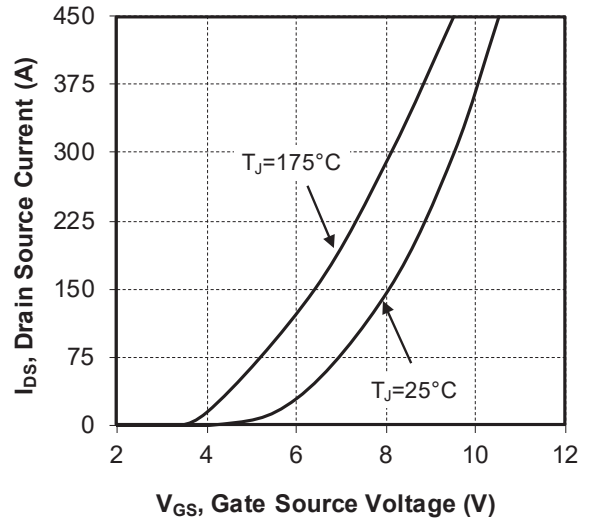


Figure 1-6. Capacitance vs. Drain Source Voltage

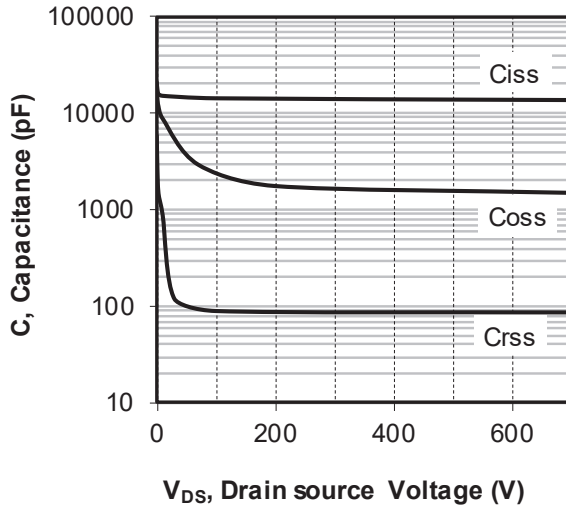


Figure 1-7. Gate Charge vs. Gate Source Voltage

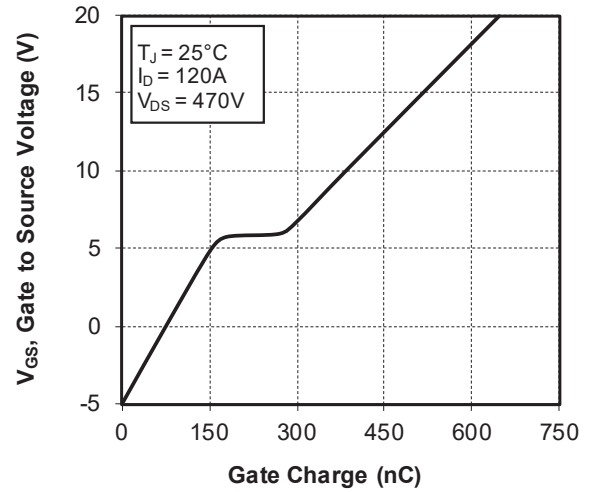


Figure 1-8. Body Diode Characteristics,  $T_J = 25^\circ\text{C}$

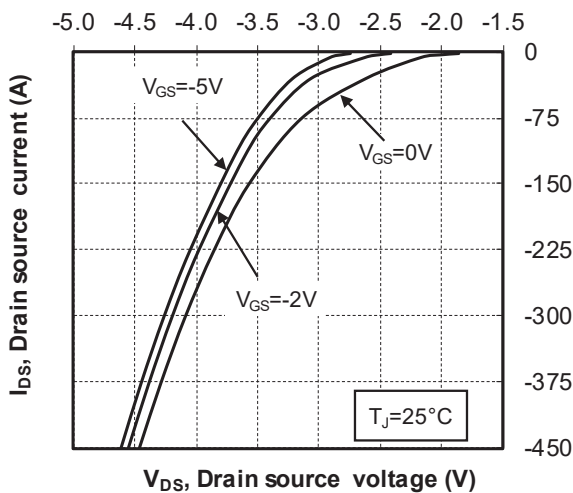


Figure 1-9. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 25^\circ\text{C}$

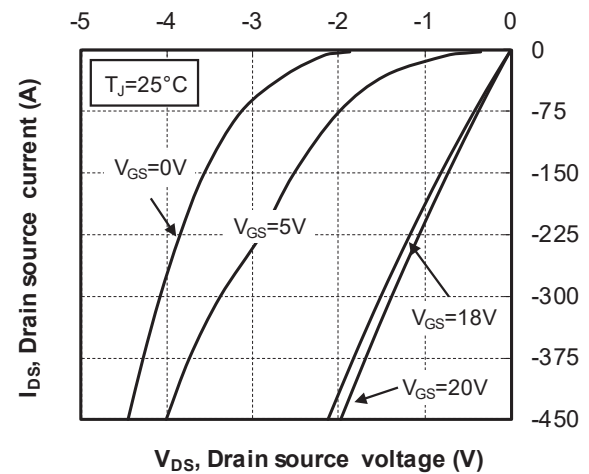


Figure 1-10. Body Diode Characteristics,  $T_J = 175^\circ\text{C}$

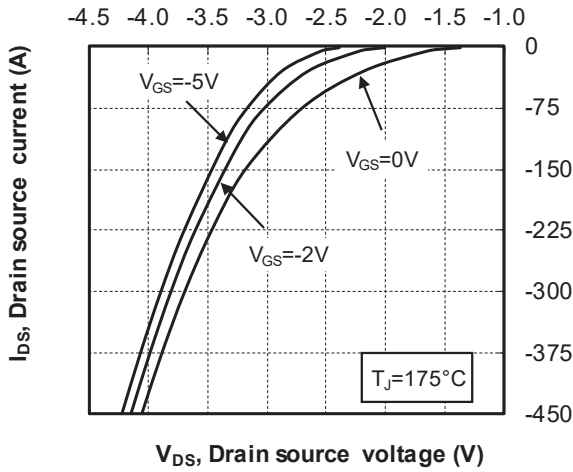


Figure 1-11. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 175^\circ\text{C}$

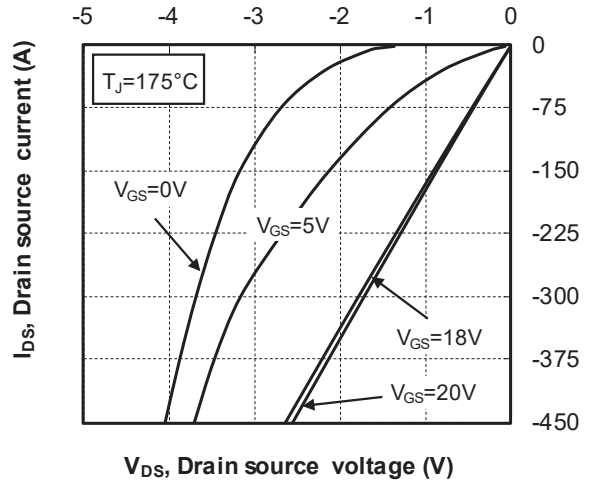


Figure 1-12. Turn On Energy vs. Rg

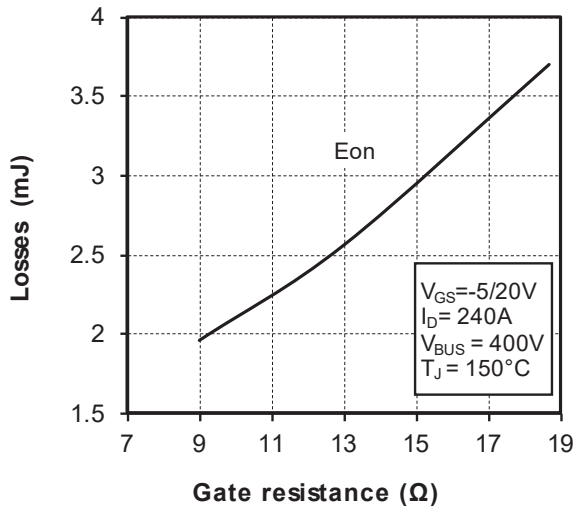


Figure 1-13. Turn Off Energy vs. Rg

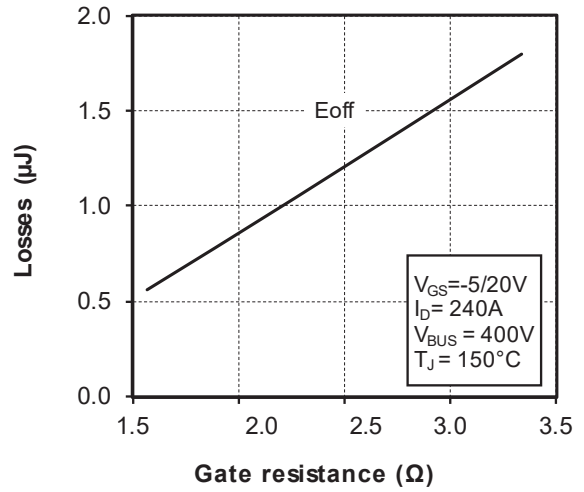


Figure 1-14. Switching Energy vs. Current

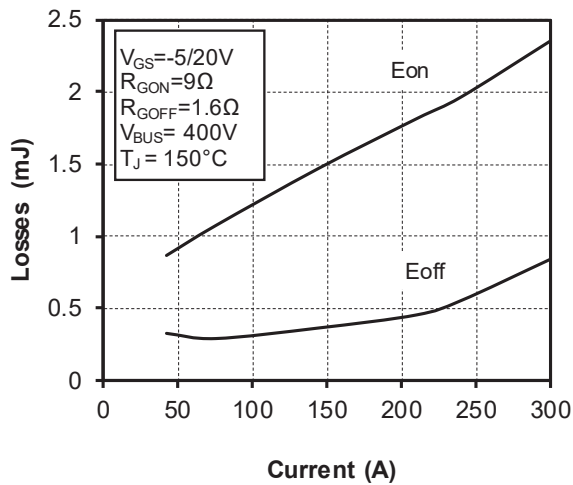
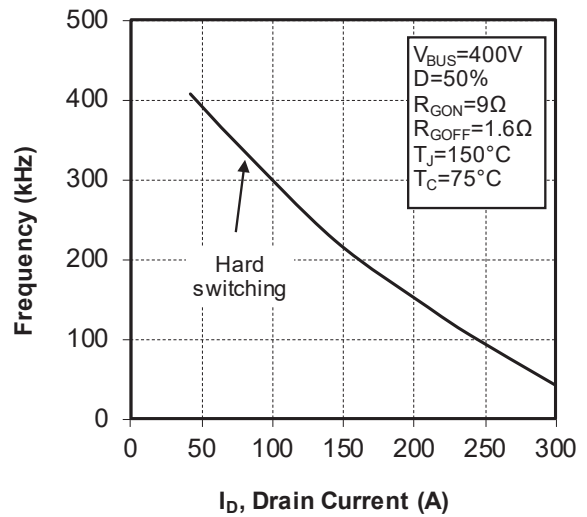


Figure 1-15. Operating Frequency vs. Drain Current





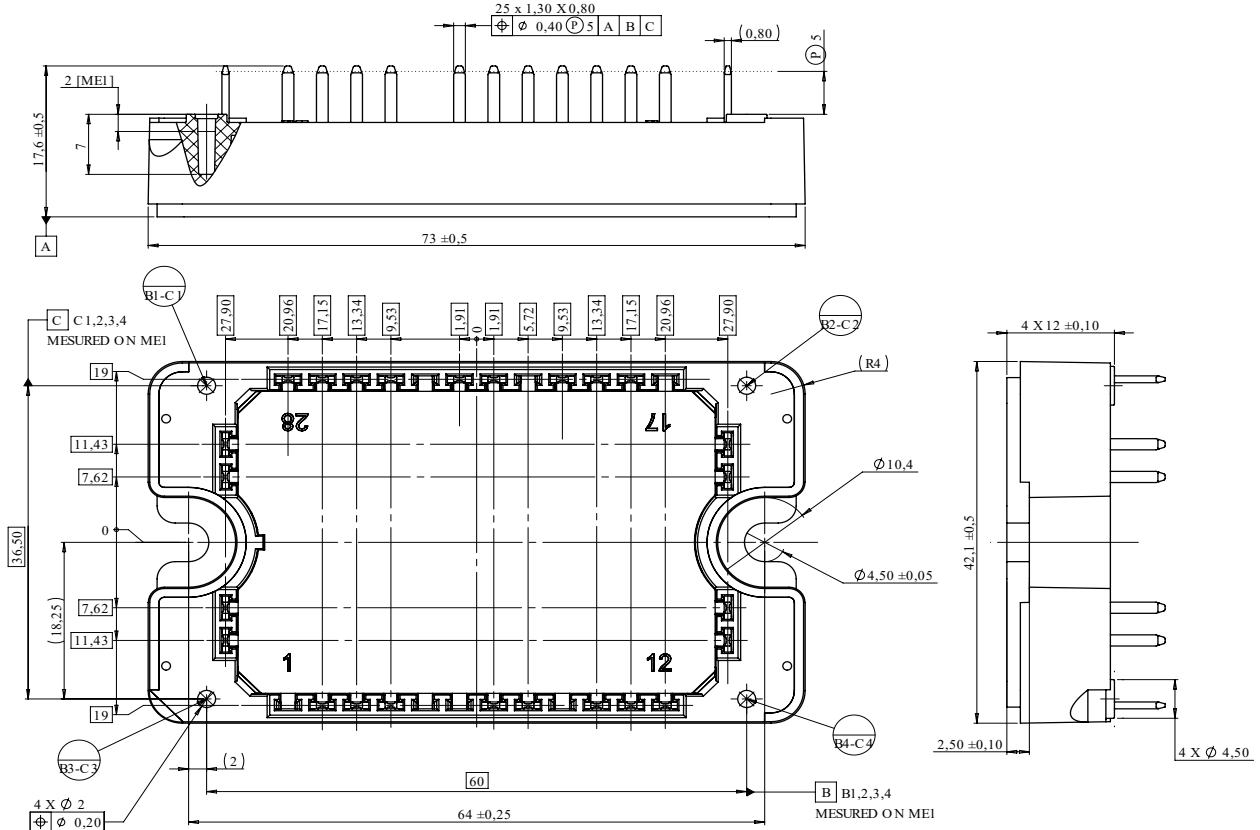
## 2. Package Specifications

The following section shows the package specification of the MSCSM70DUM07T3AG device.

### 2.1 Package Outline

The following figure shows the package outline drawing of the MSCSM70DUM07T3AG device. The dimensions in the following figure are in millimeters.

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



**Note:** See application note [AN3500A—Mounting Instructions for SP1F and SP3F Power Modules](#) for more information.

### 3. Revision History

Revision	Date	Description
A	12/2021	Initial Revision.

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