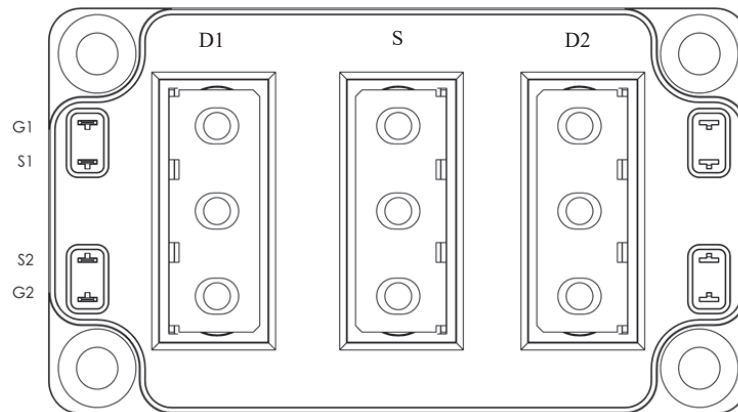
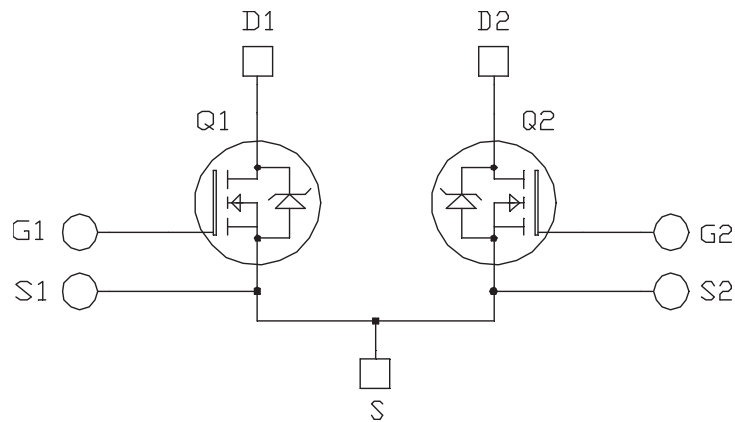


Dual Common Source SiC MOSFET Power Module

Product Overview

The MSCSM120DUM042AG device is a 1200V/495A 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

The following are the key features of MSCSM120DUM042AG device:

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

Benefits

The following are the benefits of MSCSM120DUM042AG device:

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

Application

The following are the applications of MSCSM120DUM042AG device:

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

1. Electrical Specifications

This section provides the electrical specifications of the MSCSM120DUM042AG device.

1.1 SiC MOSFET Characteristics (Per SiC MOSFET)

The following table lists the absolute maximum ratings of MSCSM120DUM042AG device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter	Maximum Ratings	Unit	
V_{DSS}	Drain-Source voltage	1200	V	
I_D	Continuous drain current	$T_C = 25\text{ }^\circ\text{C}$	495	A
		$T_C = 80\text{ }^\circ\text{C}$	395	
I_{DM}	Pulsed drain current	990		
V_{GS}	Gate-Source voltage	-10/25	V	
$R_{DS(on)}$	Drain-Source ON resistance	5.2	m Ω	
P_D	Power dissipation	$T_C = 25\text{ }^\circ\text{C}$	2031	W

The following table lists the electrical characteristics of MSCSM120DUM042AG device.

Table 1-2. Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{V}$ $V_{DS} = 1200\text{V}$	—	60	600	μA	
$R_{DS(on)}$	Drain-Source on resistance	$V_{GS} = 20\text{V}$ $I_D = 240\text{A}$	$T_J = 25\text{ }^\circ\text{C}$	—	4.2	5.2	m Ω
			$T_J = 175\text{ }^\circ\text{C}$	—	6.7	—	
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}$ $I_D = 6\text{ mA}$	1.8	2.8	—	V	
I_{GSS}	Gate-Source leakage current	$V_{GS} = 20\text{V}$ $V_{DS} = 0\text{V}$	—	—	600	nA	

MSCSM120DUM042AG

Electrical Specifications

The following table lists the dynamic characteristics of MSCSM120DUM042AG device.

Table 1-3. Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{GS} = 0V	—	18.1	—	nF
C _{oss}	Output capacitance	V _{DS} = 1000V	—	1.6	—	
C _{rss}	Reverse transfer capacitance	f = 1 MHz	—	0.15	—	
Q _g	Total gate charge	V _{GS} = -5V/20V	—	1392	—	nC
Q _{gs}	Gate-Source charge	V _{Bus} = 800V	—	246	—	
Q _{gd}	Gate-Drain charge	I _D = 240A	—	300	—	
T _{d(on)}	Turn-on delay time	V _{GS} = -5V/20V	—	56	—	ns
T _r	Rise time	V _{Bus} = 600V				
T _{d(off)}	Turn-off delay time	I _D = 300A				
T _f	Fall time	R _{Gon} = 1.3Ω R _{Goff} = 0.8Ω				
E _{on}	Turn-on energy	V _{GS} = -5V/20V	—	7.3	—	mJ
E _{off}	Turn-off energy	V _{Bus} = 600V I _D = 300A R _{Gon} = 1.3Ω R _{Goff} = 0.8Ω				
R _{Gint}	Internal gate resistance		—	1	—	Ω
R _{thJC}	Junction-to-case thermal resistance		—	—	0.074	°C/W

The following table lists the body diode ratings and characteristics of MSCSM120DUM042AG 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} = 240A	—	4	—	V
		V _{GS} = -5V I _{SD} = 240A	—	4.2	—	
t _{rr}	Reverse recovery time	I _{SD} = 240A	—	90	—	ns
Q _{rr}	Reverse recovery charge	V _{GS} = -5V	—	3300	—	nC
I _{rr}	Reverse recovery current	V _R = 800V di _F /dt = 6000A/μs	—	81	—	A

1.2 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM120DUM042AG device.

Table 1-5. Thermal and Package Characteristics

Symbol	Characteristic		Min.	Max.	Unit	
V _{ISOL}	RMS isolation voltage, any terminal to case t = 1 min, 50 Hz/60 Hz		4000	—	V	
T _J	Operating junction temperature range		−40	175	°C	
T _{JOP}	Recommended junction temperature under switching conditions		−40	T _{Jmax} −25		
T _{STG}	Storage case temperature		−40	125		
T _C	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 MSCSM120DUM042AG device.

Figure 1-1. Maximum Thermal Impedance

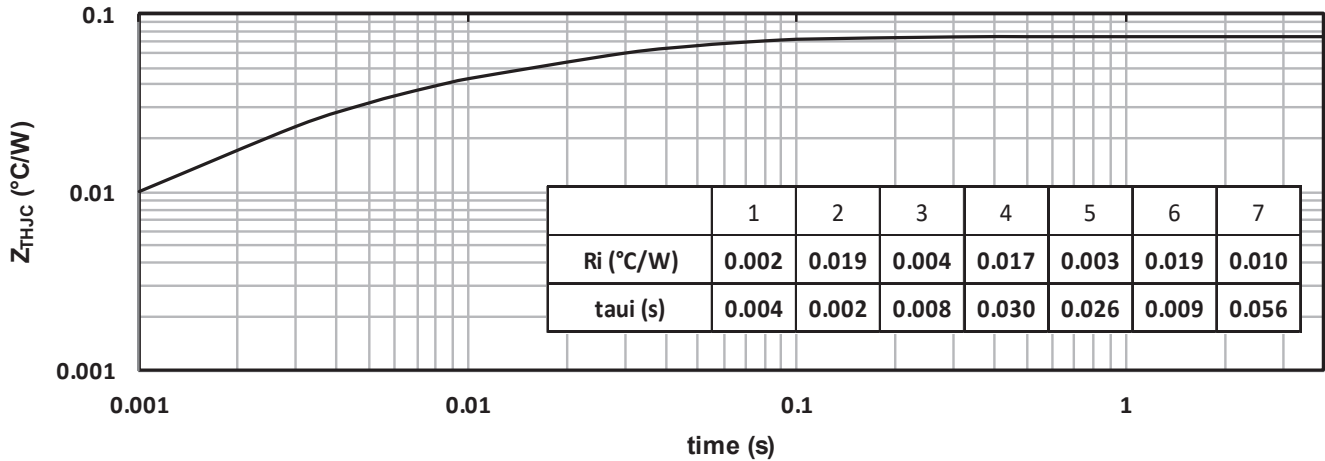


Figure 1-2. Output Characteristics, T_J = 25 °C

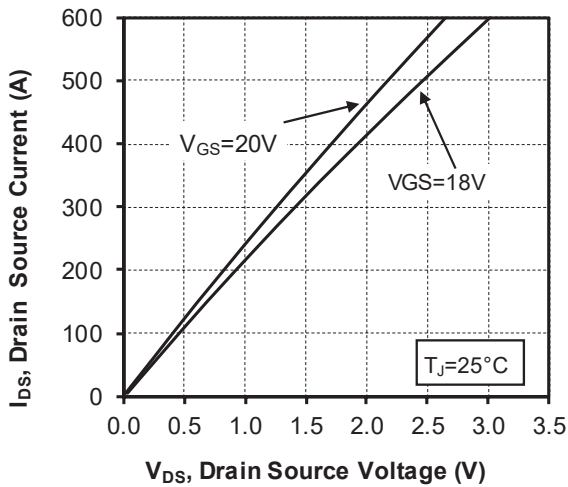


Figure 1-3. Output Characteristics, T_J = 175 °C

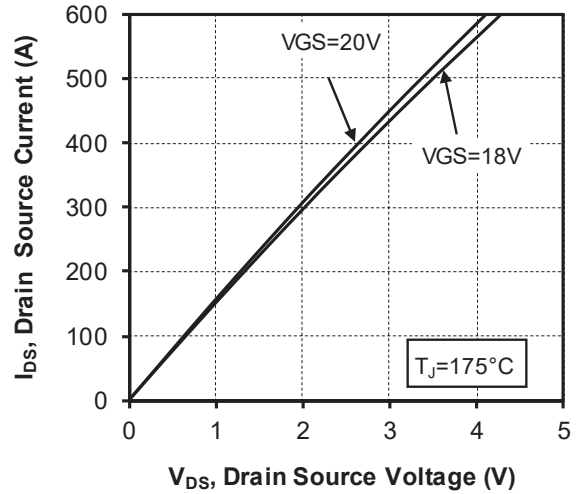


Figure 1-4. Normalized $R_{DS(on)}$ vs. Temperature

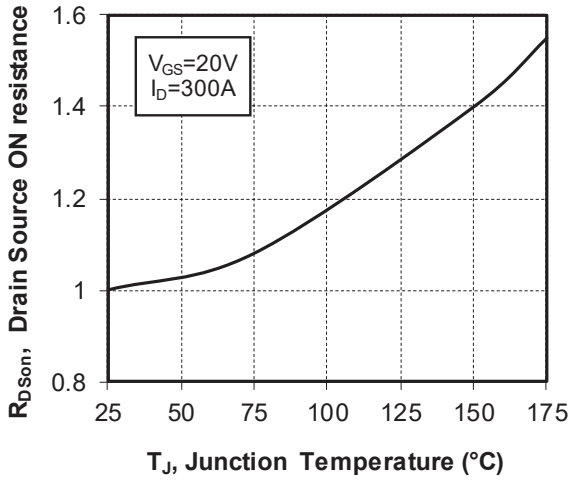


Figure 1-5. Transfer Characteristics

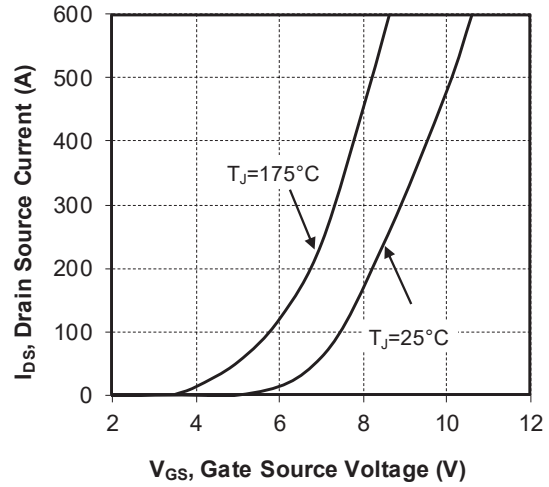


Figure 1-6. Switching Energy vs. R_g

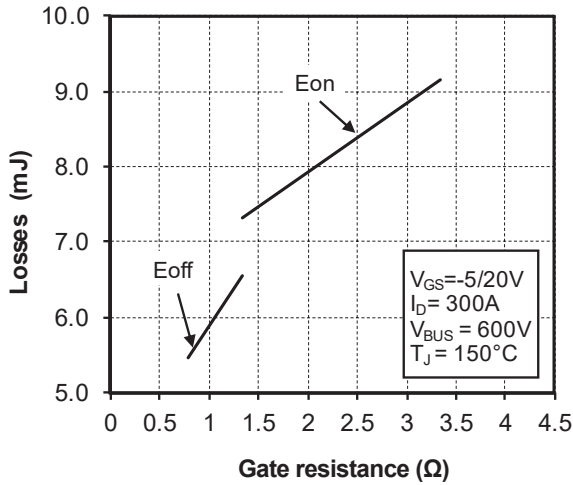


Figure 1-7. Switching Energy vs. Current

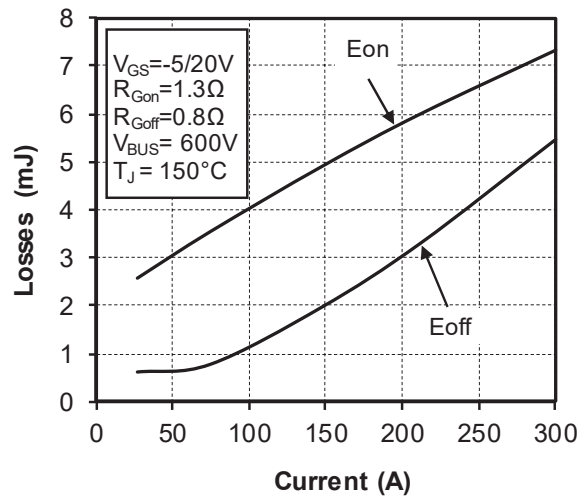


Figure 1-8. Capacitance vs. Drain Source Voltage

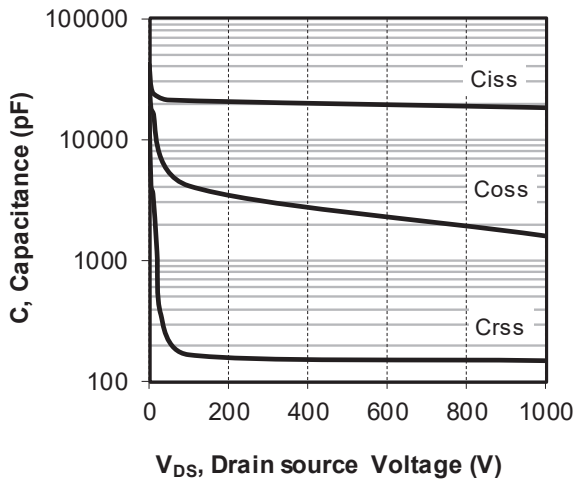


Figure 1-9. Gate Charge vs. Gate Source Voltage

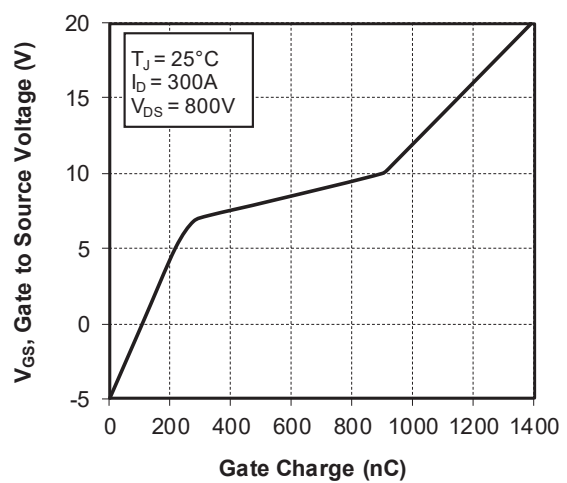


Figure 1-10. Body Diode Characteristics, $T_J = 25^\circ\text{C}$

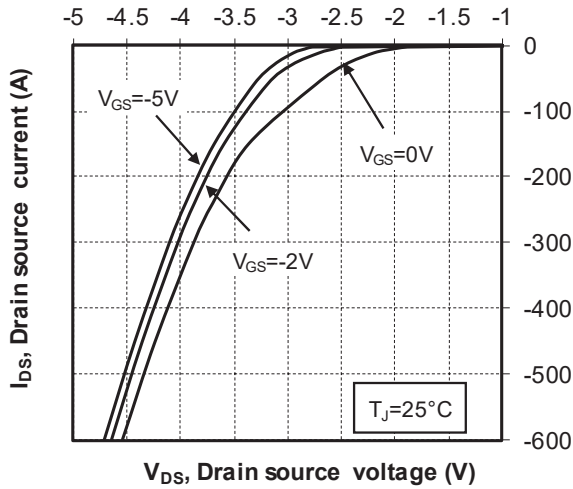


Figure 1-11. 3rd Quadrant Characteristics, $T_J = 25^\circ\text{C}$

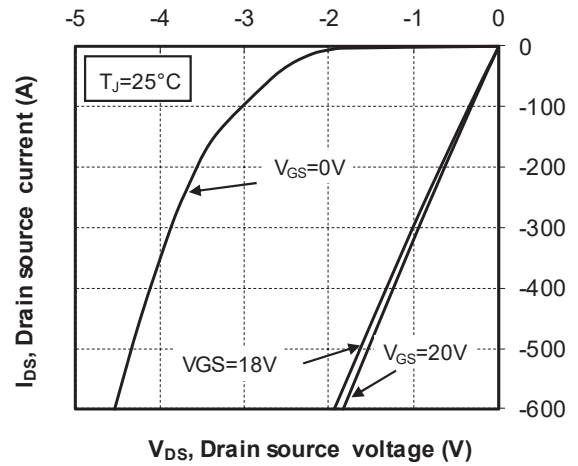


Figure 1-12. Body Diode Characteristics, $T_J = 175^\circ\text{C}$

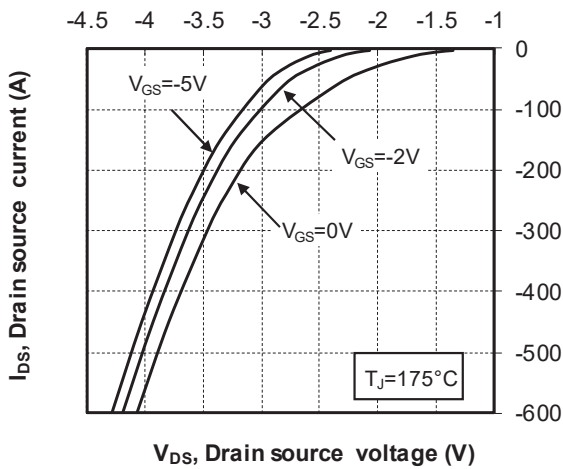


Figure 1-13. 3rd Quadrant Characteristics, $T_J = 175^\circ\text{C}$

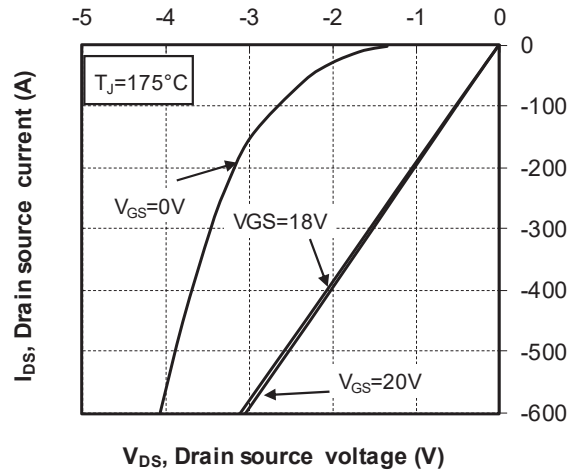
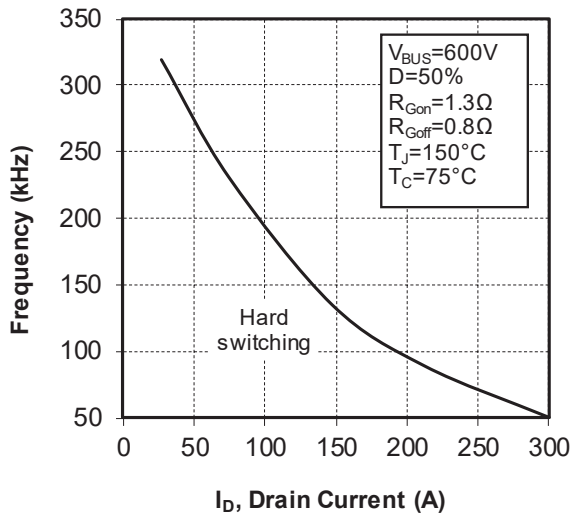


Figure 1-14. Operating Frequency vs. Drain Current



3. Revision History

Revision	Date	Description
A	12/2021	Initial Revision

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ISBN: 978-1-5224-9509-3

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