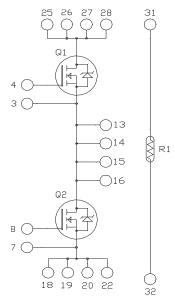
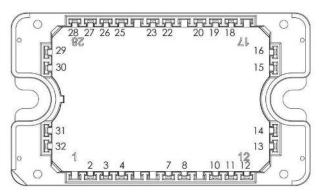
MSCSM120AM11T3AG

Phase Leg SiC MOSFET Power Module

Product Overview

The MSCSM120AM11T3AG device is a phase leg 1200V, 254A silicon carbide (SiC) MOSFET power module.





Notes:

- Pins 25 to 28 must be shorted together
 - Pins 13 to 16 must be shorted together
 - Pins 18/19/20/22 must be shorted together
- All ratings at T_J = 25 °C, unless otherwise specified.

⚠ CAUTION

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

Features

The following are key features of the MSCSM120AM11T3AG device:

- · SiC Power MOSFET
 - High speed switching
 - Low R_{DS(on)}
 - Ultra low loss
- · Low stray inductance
- · Kelvin source for easy drive
- · Internal thermistor for temperature monitoring
- · Aluminum Nitride (AIN) substrate for improved thermal performance

Benefits

The following are the benefits of MSCSM120AM11T3AG device:

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

Application

The MSCSM120AM11T3AG device is designed for the following applications:

- · Induction heating and welding
- Solar inverter
- · EV motor and traction drive

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1. Electrical Specifications

This section provides the electrical specifications of the MSCSM120AM11T3AG device.

1.1 SiC MOSFET Characteristics (Per SiC MOSFET)

The following table lists the absolute maximum ratings per SiC MOSFET of the MSCSM120AM11T3AG device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter		Maximum Ratings	Unit	
V _{DSS}	Drain-Source voltage		1200	V	
I _D			254 ¹	Α	
			2021		
I _{DM}	Pulsed drain current		500		
V _{GS}	Gate-Source voltage		-10/23	V	
R _{DS(on)}	Drain-Source ON resistance		10.4	mΩ	
P _D	Power dissipation	T _C = 25 °C	1067	W	

Note:

 SiC MOSFET device specification, but the output current must be limited due to the size of the power connectors.

The following table lists the electrical characteristics per SiC MOSFET of the MSCSM120AM11T3AG device.

Table 1-2. Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min.	Тур.	Max.	Unit
I _{DSS}	Zero gate voltage drain current	$V_{GS} = 0V$ $V_{DS} = 1200V$		_	30	300	μΑ
R _{DS(on)}	Drain-Source on	V _{GS} = 20V	T _J = 25 °C	_	8.4	10.4	mΩ
	resistance	I _D = 120A	T _J = 175 °C	_	13.4	_	
V _{GS(th)}	Gate threshold voltage	$V_{GS} = V_{DS}$ $I_D = 9 \text{ mA}$		1.8	2.8	_	V
I _{GSS}	Gate–Source leakage current	$V_{GS} = 20V; V_{DS} = 0V$		_	_	300	nA

The following table lists the dynamic characteristics per SiC MOSFET of the MSCSM120AM11T3AG device.

Table 1-3. Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min.	Тур.	Max.	Unit
C _{iss}	Input capacitance	V _{GS} = 0V		_	9060	_	pF
C _{oss}	Output capacitance	V _{DS} = 1000V		_	810	_	
C _{rss}	Reverse transfer capacitance	f = 1 MHz		_	75	_	
Qg	Total gate charge	V _{GS} = -5V/20V		_	696	_	nC
Q _{gs}	Gate-Source charge	V _{Bus} = 800V		_	123	_	
Q _{gd}	Gate-Drain charge	I _D = 120A		_	150	_	
T _{d(on)}	Turn-on delay time	V _{GS} = -5V/20V		_	30	_	ns
T _r	Rise time	V _{Bus} = 600V		_	30	_	
T _{d(off)}	Turn-off delay time	I _D = 150A		_	50	_	
T _f	Fall time	$R_{G(on)} = 2.7\Omega$ $R_{G(off)} = 1.6\Omega$			25	_	
E _{on}	Turn-on energy	V _{GS} = -5V/20V	T _J = 150 °C	_	3.6	_	mJ
E _{off}	Turn-off energy	$V_{Bus} = 600V$ $I_{D} = 150A$ $R_{G(on)} = 2.7\Omega$ $R_{G(off)} = 1.6\Omega$		_	2		
R _{Gint}	Internal gate resistance			_	2	_	Ω
R _{thJC}	Junction-to-case therm	nal resistance			_	0.141	°C/W

The following table lists the body diode ratings and characteristics per SiC MOSFET of the MSCSM120AM11T3AG device.

Table 1-4. Body Diode Ratings and Characteristics

Symbol	Characteristic	Test Conditions	Min.	Тур.	Max.	Unit
V _{SD}	Diode forward voltage	V _{GS} = 0V; I _{SD} = 120A	_	4	_	V
		$V_{GS} = -5V; I_{SD} = 120A$	_	4.2	_	
t _{rr}	Reverse recovery time	I _{SD} = 120A; V _{GS} = -5V	_	90	_	ns
Q _{rr}	Reverse recovery charge	$V_R = 800V$; $di_F/dt = 3000 A/\mu s$	_	1650	_	nC
Irr	Reverse recovery current		_	40.5	_	Α

1.2 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM120AM11T3AG device.

Table 1-5. Thermal and Package Characteristics

Symbol	Characteristics			Min.	Max.	Unit
V _{ISOL}	RMS isolation voltage, any terminal to case t =1 min, 50 Hz/60 Hz				_	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 temperature range				125	
T _C	Operating case temperature			-40	125	
Torque	Mounting torque To heatsink M4				3	N.m
Wt	Package weight			_	110	g

The following table lists the temperature sensor NTC of the MSCSM120AM11T3AG device.

Table 1-6. Temperature Sensor NTC

Symbol	Characteristic		Min.	Тур.	Max.	Unit
R ₂₅	Resistance at 25 °C		_	50	_	kΩ
$\Delta R_{25}/R_{25}$	_	_	_	5	_	%
B _{25/85}	T ₂₅ = 298.15K	_	_	3952	_	K
ΔΒ/Β	_	T _C = 100 °C	_	4	_	%

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

This section shows the typical SiC MOSFET performance curves of the MSCSM120AM11T3AG device.

Figure 1-1. Maximum Thermal Impedance

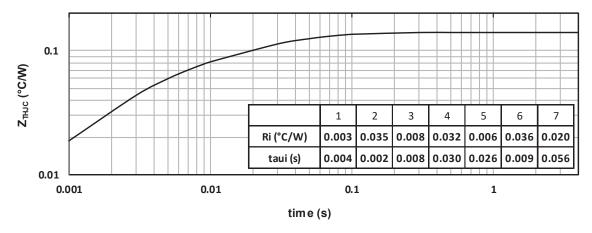


Figure 1-2. Output Characteristics, $T_J = 25$ °C

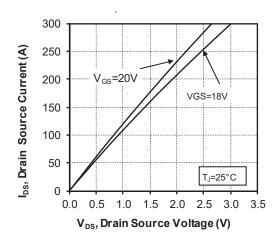


Figure 1-3. Output Characteristics, T_J = 175 °C

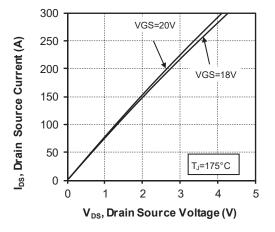


Figure 1-4. Normalized R_{DS(on)} vs. Temperature

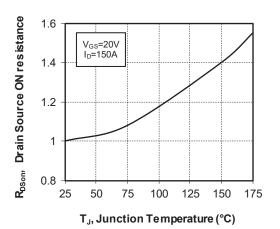


Figure 1-5. Transfer Characteristics

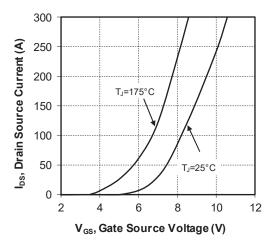


Figure 1-6. Switching Energy vs. Current

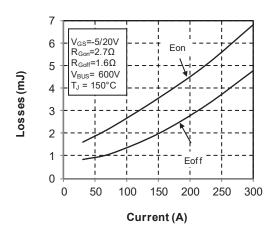


Figure 1-7. Switching Energy vs. Rg

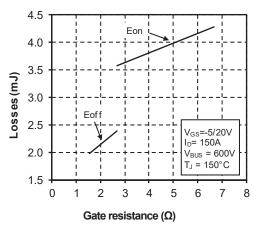


Figure 1-8. Capacitance vs. Drain Source Voltage

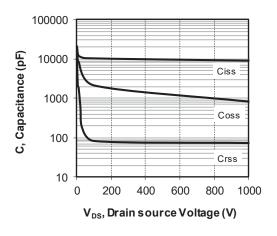


Figure 1-9. Gate Charge vs. Gate Source Voltage

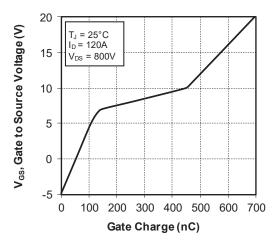
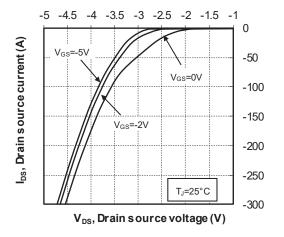


Figure 1-10. Body Diode Characteristics, T_J = 25 °C Figure 1-11. 3rd Quadrant Characteristics, T_J = 25 °C



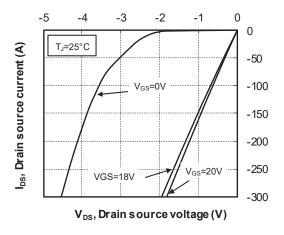
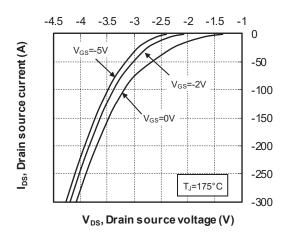


Figure 1-12. Body Diode Characteristics, T_J = 175 °C Figure 1-13. 3rd Quadrant Characteristics, T_J = 175 °C



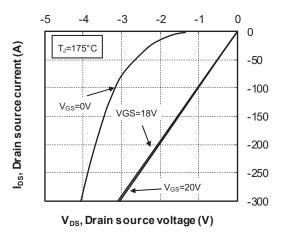
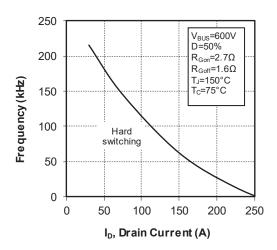


Figure 1-14. Operating Frequency vs Drain Current



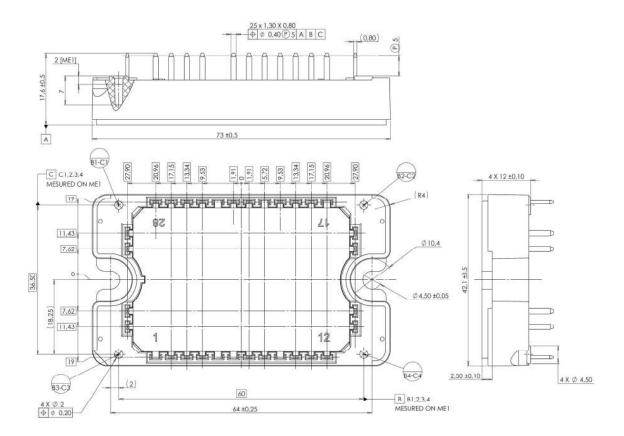
2. Package Specifications

The following section shows the package specification of the MSCSM120AM11T3AG device.

2.1 Package Outline

The following figure shows the package outline drawing of the MSCSM120AM11T3AG device. The dimensions in the following figure are in millimeters.

Figure 2-1. Package Outline Drawing



Note: See AN3500A - Mounting instructions for SP1F and SP3F Power Modules for more information.

MSCSM120AM11T3AG

Revision History

3. Revision History

Revision	Date	Description
Α	06/2022	Initial Revision

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