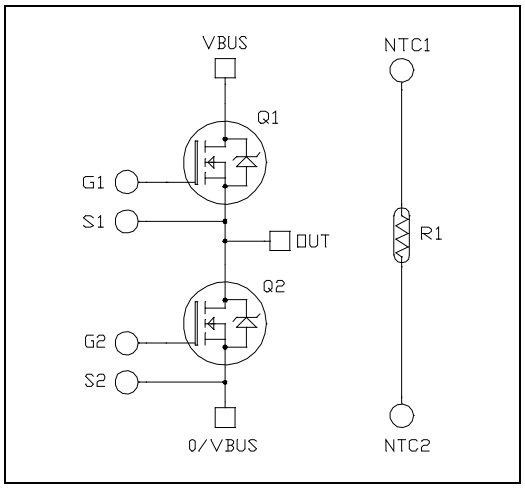
MSCSM120AM03T6LIAG
Preliminary data

Very low stray inductance
Phase leg SiC MOSFET Power Module

V_{DSS} = 1200V
R_{DSon} = 3.1mΩ max @ Tj = 25°C
I_D = 805*A @ Tc = 25°C

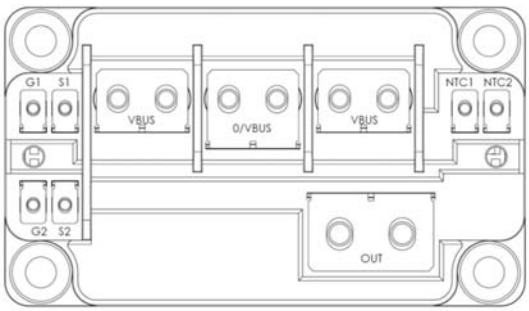


Application

- Motor control

Features

- ***SiC Power MOSFET***
  - Low $R_{DS(on)}$
  - High temperature performance
- Very low stray inductance
- Internal thermistor for temperature monitoring
- M4 & M5 power connectors
- M2.5 signals connectors
- AlN substrate for improved thermal performance



Benefits

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

All ratings @ T_j = 25°C unless otherwise specified

1. SiC MOSFET characteristics (Per MOSFET)

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Voltage		1200	V
I_D	Continuous Drain Current	T_c = 25°C	805*	A
		T_c = 80°C	642*	
I_{DM}	Pulsed Drain current		1200	
V_{GS}	Gate - Source Voltage		-10/+25	V
R_{DSon}	Drain - Source ON Resistance		3.1	mΩ
P_D	Power Dissipation	T_c = 25°C	3215	W

* Specification of SiC MOSFET device but output current must be limited due to size of power connectors.

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V , V_{DS} = 1200V			150	1000	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS}=20V ; I_D=400A	T_j = 25°C		2.5	3.1	mΩ
			T_j = 175°C		3.4		
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 10mA		1.8	2.8		V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0V				1	µA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 1000V f = 1MHz		30.2		nF
C_{oss}	Output Capacitance			2.7		
C_{rss}	Reverse Transfer Capacitance			0.25		
Q_g	Total gate Charge	V_{GS} = -5/+20V V_{Bus} = 800V I_D = 400A		2320		nC
Q_{gs}	Gate – Source Charge			410		
Q_{gd}	Gate – Drain Charge			500		
$T_{d(on)}$	Turn-on Delay Time	V_{GS} = -5/+20V ; T_J=150°C V_{Bus} = 600V I_D = 500A R_G = 0.3Ω		63		ns
T_r	Rise Time			63		
$T_{d(off)}$	Turn-off Delay Time			150		
T_f	Fall Time			50		
E_{on}	Turn on Energy	Inductive Switching ; T_J=150°C V_{GS} = -5/+20V ; V_{Bus} = 600V I_D = 500A ; R_G = 0.3Ω		11		mJ
E_{off}	Turn off Energy			8.3		
R_{Gint}	Internal gate resistance			0.7		Ω
R_{thJC}	Junction to Case Thermal Resistance				0.047	°C/W

Body diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	V_{GS} = 0V ; I_{SD} = 400A		4		V
		V_{GS} = -5V ; I_{SD} = 400A		4.2		
t_{rr}	Reverse Recovery Time	I_{SD} = 400A ; V_{GS} = -5V V_R = 800V ; di_F/dt = 10000A/µs		90		ns
Q_{rr}	Reverse Recovery Charge			5.5		µC
I_{rr}	Reverse Recovery Current			135		A

2. Thermal and package characteristics

Package characteristics

Symbol	Characteristic			Min	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000		V
T_J	Operating junction temperature range			-40	175	°C
T_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	
T_{STG}	Storage Temperature Range			-40	125	
T_C	Operating Case Temperature			-40	125	
Torque	Mounting torque	For terminals	M2.5	0.4	0.6	N.m
			M4	2	3	
			M5	2	3.5	
		To heatsink	M6	3	5	
L_{DC}	Module stray inductance between VBUS & 0/VBUS				3	nH
Wt	Package Weight				320	g

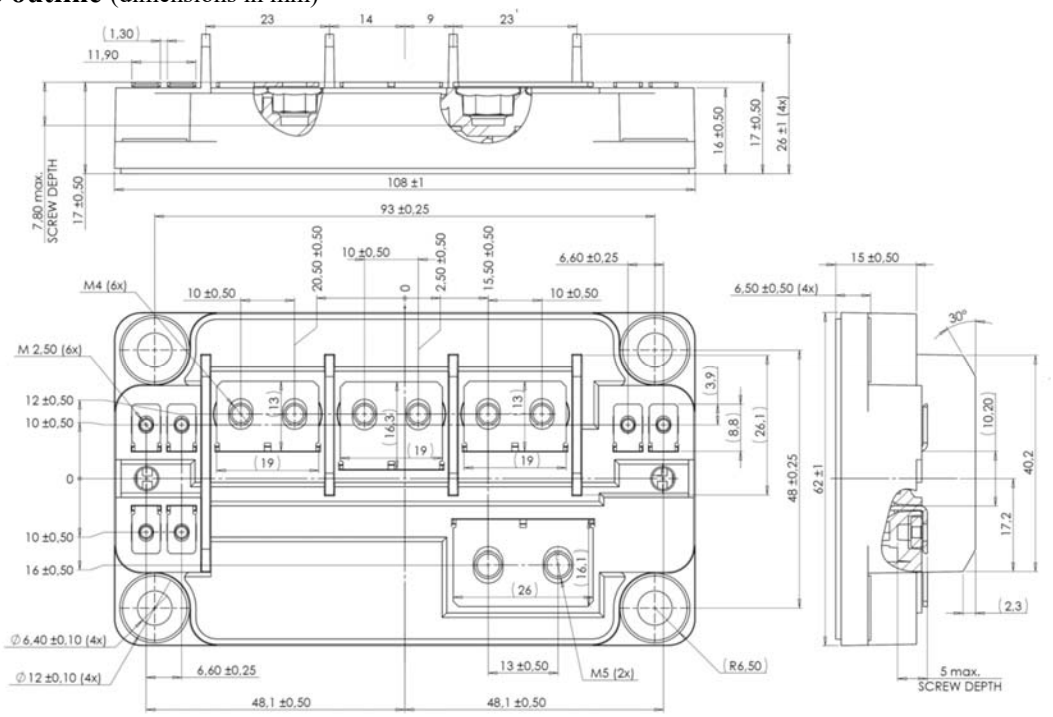
Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
$\Delta B/B$		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

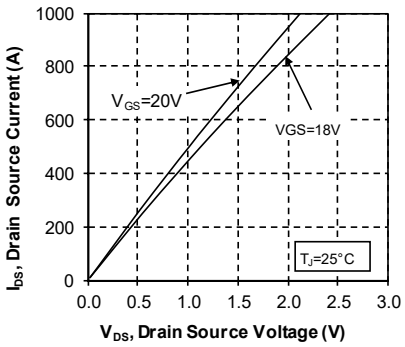
Package outline (dimensions in mm)



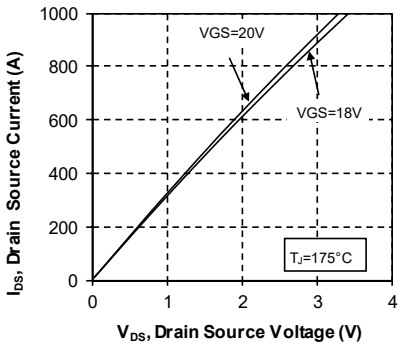
See application note AN1911 - Mounting instructions for SP6 Low inductance Power Module on www.microsemi.com

Typical Performance Curve

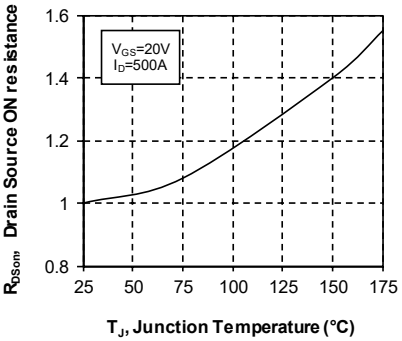
Output Characteristics



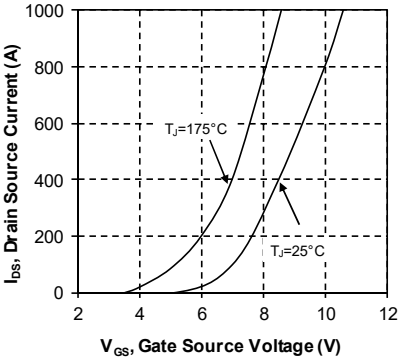
Output Characteristics



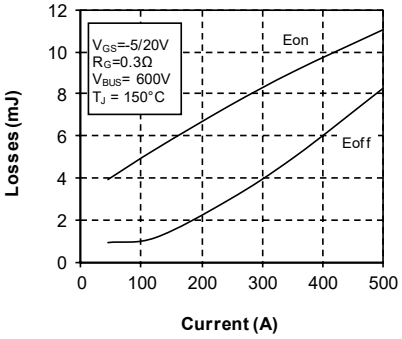
Normalized $R_{DS(on)}$ vs. Temperature



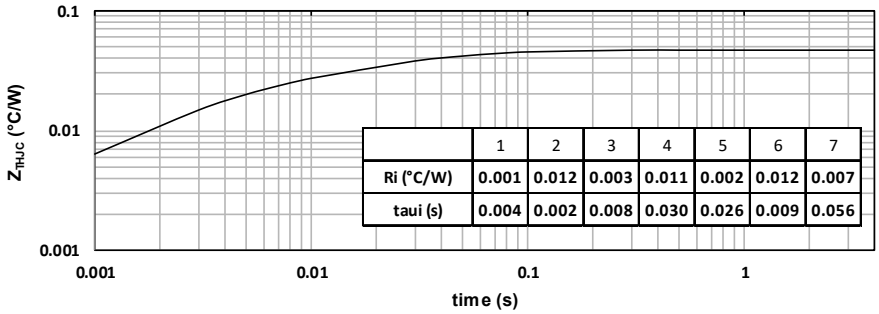
Transfert Characteristics



switching energy vs current

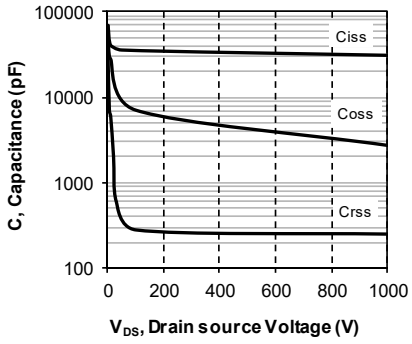


Maximum thermal impedance

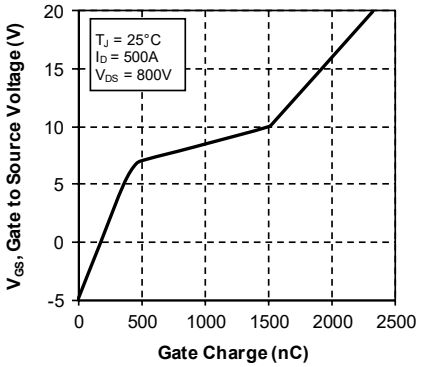


	1	2	3	4	5	6	7
Ri (°C/W)	0.001	0.012	0.003	0.011	0.002	0.012	0.007
taui (s)	0.004	0.002	0.008	0.030	0.026	0.009	0.056

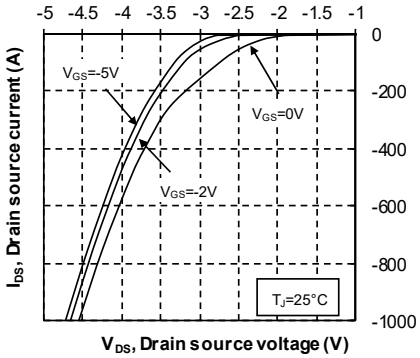
Capacitance vs Drain Source Voltage



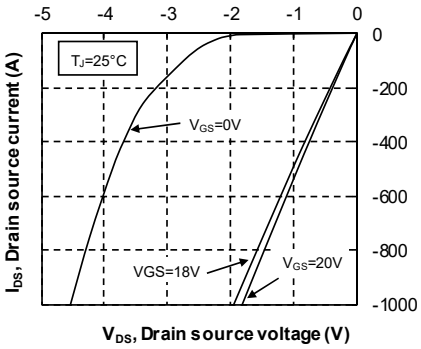
Gate Charge vs Gate Source Voltage



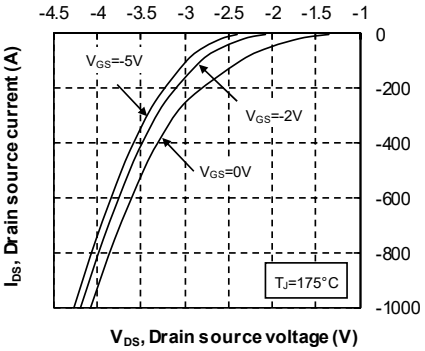
Body diode Characteristics



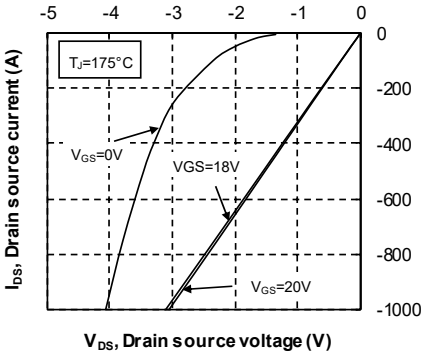
3rd Quadrant Characteristics



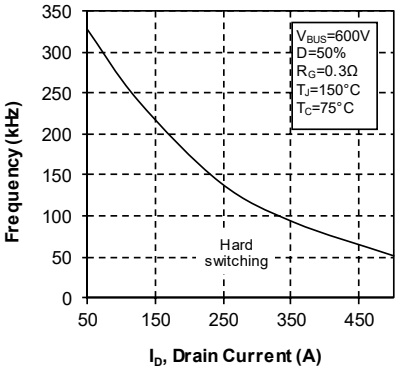
Body diode Characteristics



3rd Quadrant Characteristics



Operating Frequency vs Drain Current



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