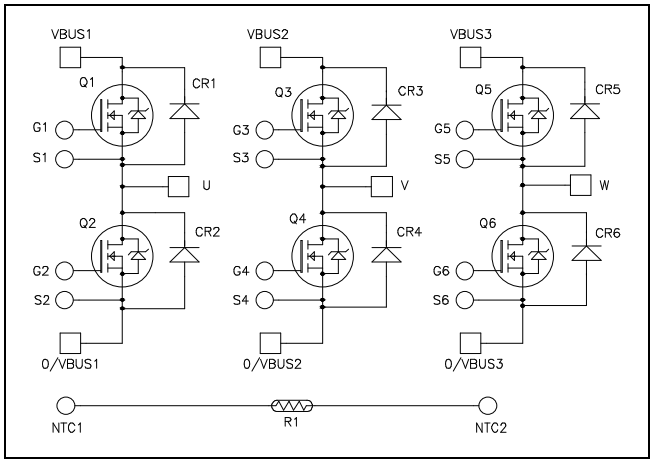
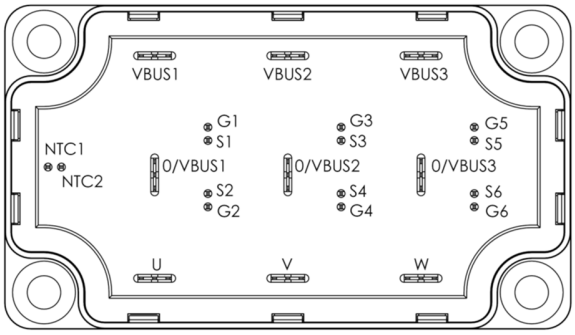
MSCSM170TAM23CTPAG
Preliminary data

Triple phase leg SiC MOSFET Power Module

V_{DSS} = 1700V
R_{DSon} = 17.5mΩ typ @ Tj = 25°C
I_D = 122A @ Tc = 25°C





Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- EV motor and traction drive

Features

- ***SiC Power MOSFET***
  - Low $R_{DS(on)}$
  - High temperature performance
- ***SiC Schottky Diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Very low stray inductance
- Internal thermistor for temperature monitoring
- AlN substrate for improved thermal performance

Benefits

- High power & efficiency converters and inverters
- 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

All ratings @ T_j = 25°C unless otherwise specified

Absolute maximum ratings (Per SiC MOSFET)

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Voltage		1700	V
I_D	Continuous Drain Current	T_c = 25°C	122	A
		T_c = 80°C	97	
I_{DM}	Pulsed Drain current		240	
V_{GS}	Gate - Source Voltage		-10/23	V
R_{DSon}	Drain - Source ON Resistance		22.5	mΩ
P_D	Power Dissipation	T_c = 25°C	588	W

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

Electrical Characteristics (Per SiC MOSFET)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V ; V_{DS} = 1700V			20	200	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 20V I_D = 60A	T_j = 25°C		17.5	22.5	mΩ
			T_j = 175°C		31		
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 5mA		1.8	3.2		V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0V				200	nA

Dynamic Characteristics (Per SiC MOSFET)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 1000V f = 1MHz			6600		pF
C_{oss}	Output Capacitance				300		
C_{rss}	Reverse Transfer Capacitance				20		
Q_g	Total gate Charge	V_{GS}= -5/20V V_{Bus} = 850V I_D = 60A			356		nC
Q_{gs}	Gate – Source Charge				98		
Q_{gd}	Gate – Drain Charge				54		
$T_{d(on)}$	Turn-on Delay Time	V_{GS} = -5/+20V ;T_j = 150°C V_{Bus} = 900V I_D = 100A R_{Gon} = 2.4Ω ; R_{Goff} = 1.4Ω			24		ns
T_r	Rise Time				17		
$T_{d(off)}$	Turn-off Delay Time				35		
T_f	Fall Time				19		
E_{on}	Turn on Energy	V_{GS} = -5/+20V V_{Bus} = 900V I_D = 100A R_{Gon} = 2.4Ω R_{Goff} = 1.4Ω	T_j = 150°C		2.2		mJ
E_{off}	Turn off Energy		T_j = 150°C		0.33		mJ
R_{Gint}	Internal gate resistance				2.93		Ω
R_{thJC}	Junction to Case Thermal Resistance					0.255	°C/W

Body diode ratings and characteristics (Per SiC MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	V_{GS} = 0V ; I_{SD} = 60A		3.7		V
		V_{GS} = -5V ; I_{SD} = 60A		3.9		
t_{rr}	Reverse Recovery Time	I_{SD} = 60A ; V_{GS} = -5V V_R = 900V ; di_F/dt = 2000A/µs		27		ns
Q_{rr}	Reverse Recovery Charge			1300		nC
I_{rr}	Reverse Recovery Current			92		A

SiC schottky diode ratings and characteristics (per SiC diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Peak Repetitive Reverse Voltage					1700	V
I_{RRM}	Reverse Leakage Current	V_R=1700V	T_j = 25°C		10	200	µA
			T_j = 175°C		150		
I_F	Forward Current		Tc = 125°C		30		A
V_F	Diode Forward Voltage	I_F = 30A	T_j = 25°C		1.5	1.8	V
			T_j = 175°C		2.3		
Q_C	Total Capacitive Charge	V_R = 900V			230		nC
C	Total Capacitance	f = 1MHz, V_R = 600V			167		pF
		f = 1MHz, V_R = 900V			138		
R_{thJC}	Junction to Case Thermal Resistance					0.532	°C/W

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	To heatsink	M6	3	5	N.m
Wt	Package Weight				250	g

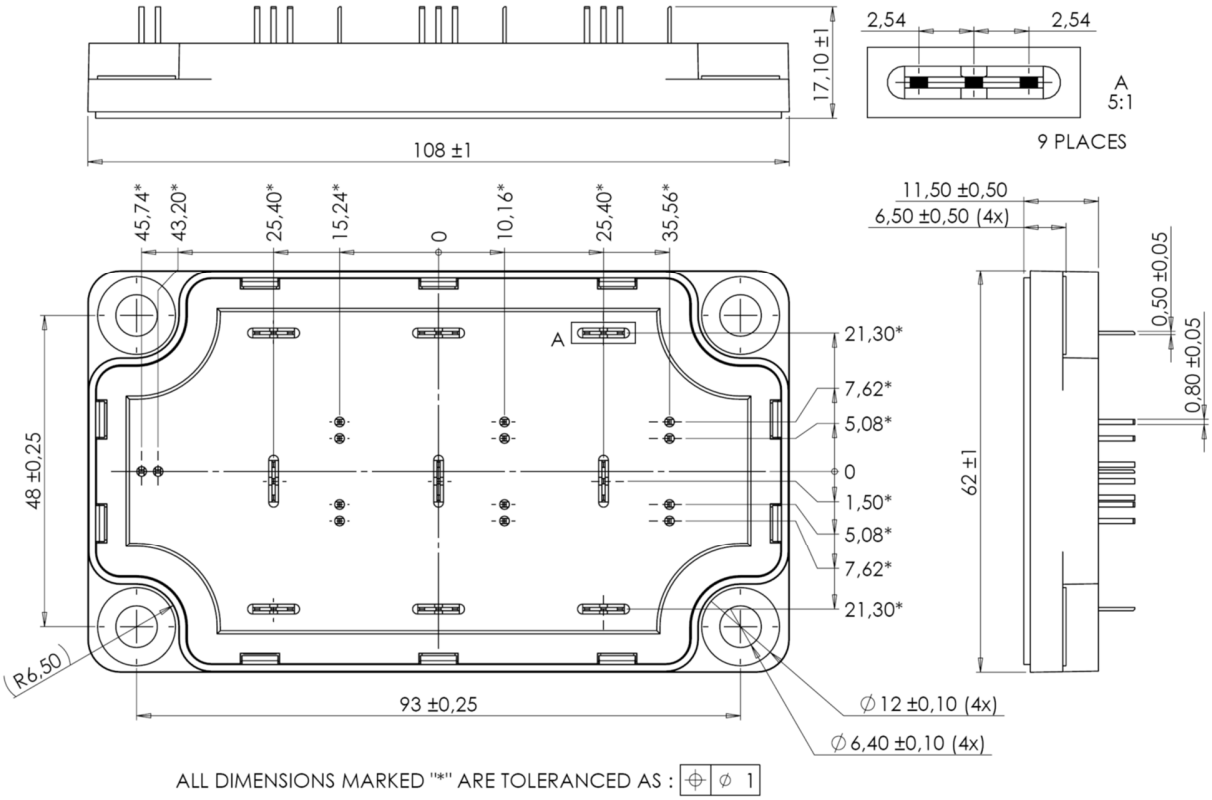
Temperature sensor NTC (see application note APT0406)

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
ΔB/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

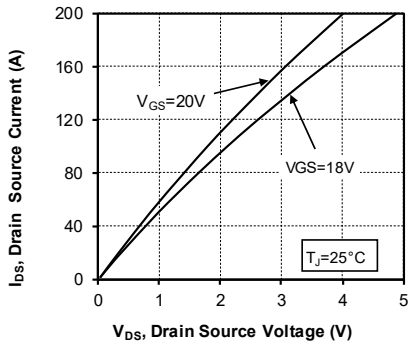
Package outline (dimensions in mm)



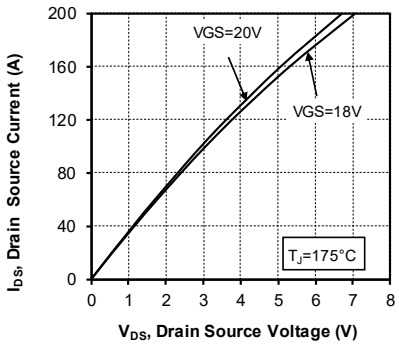
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules

Typical SiC MOSFET Performance Curve

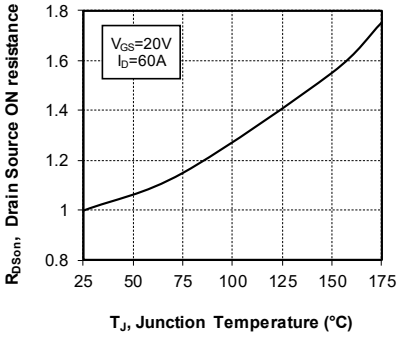
Output Characteristics



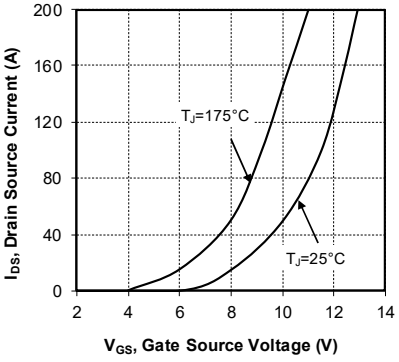
Output Characteristics



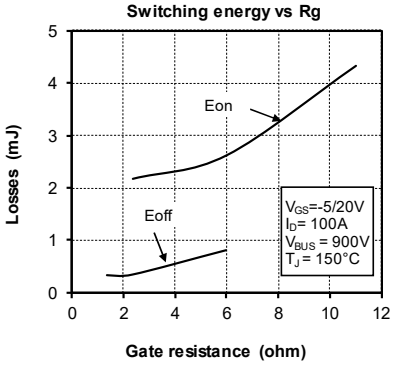
Normalized $R_{DS(on)}$ vs. Temperature



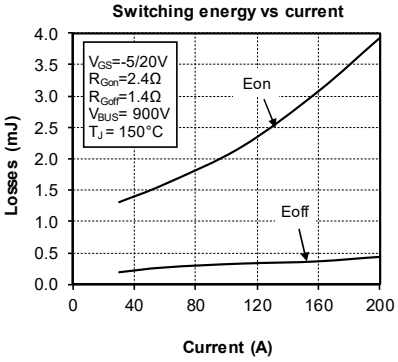
Transfert Characteristics



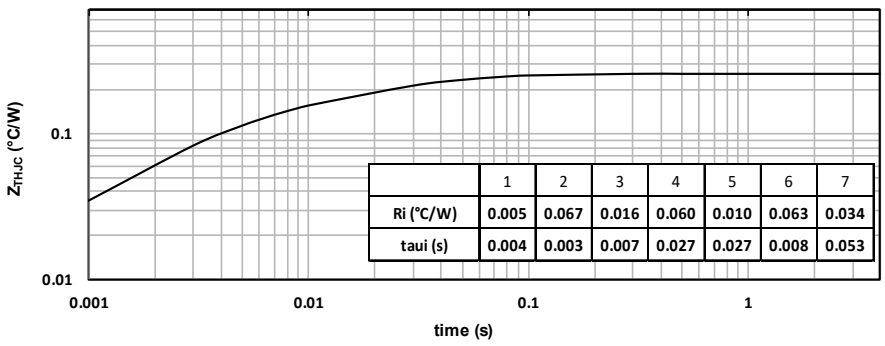
Switching energy vs Rg



Switching energy vs current

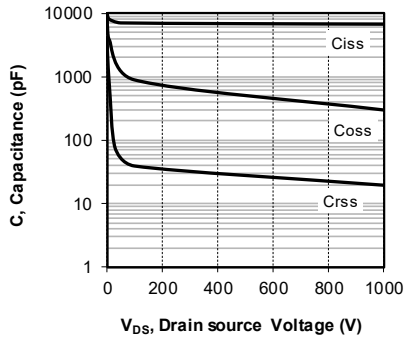


Maximum thermal impedance

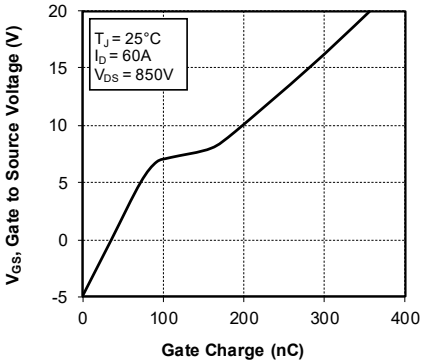


	1	2	3	4	5	6	7
Ri (°C/W)	0.005	0.067	0.016	0.060	0.010	0.063	0.034
taui (s)	0.004	0.003	0.007	0.027	0.027	0.008	0.053

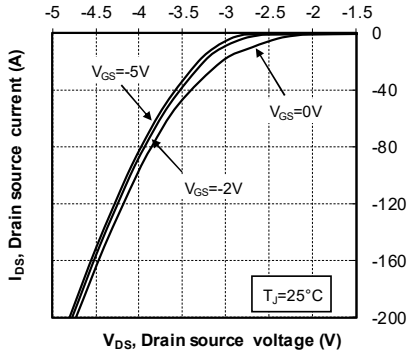
Capacitance vs Drain Source Voltage



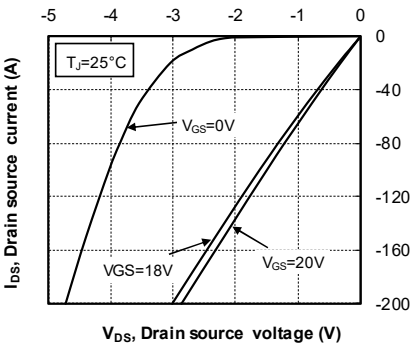
Gate Charge vs Gate Source Voltage



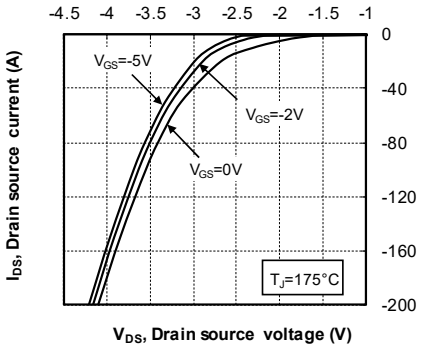
Body diode Characteristics



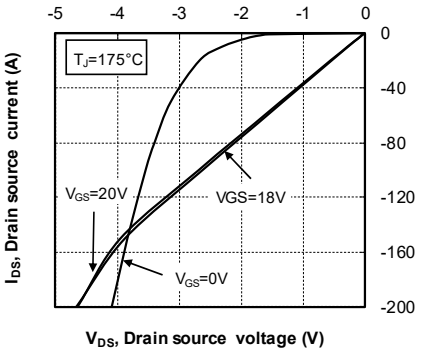
3rd Quadrant Characteristics



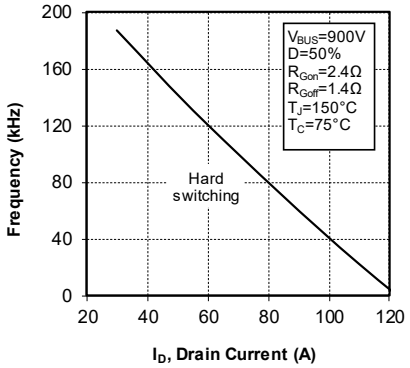
Body diode Characteristics



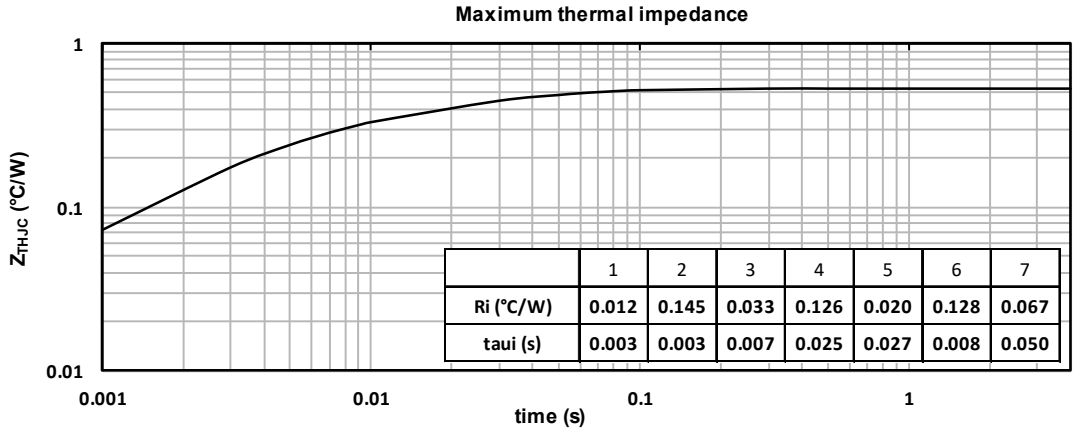
3rd Quadrant Characteristics



Operating Frequency vs Drain Current



Typical SiC diode Performance Curve



	1	2	3	4	5	6	7
Ri (°C/W)	0.012	0.145	0.033	0.126	0.020	0.128	0.067
taui (s)	0.003	0.003	0.007	0.025	0.027	0.008	0.050