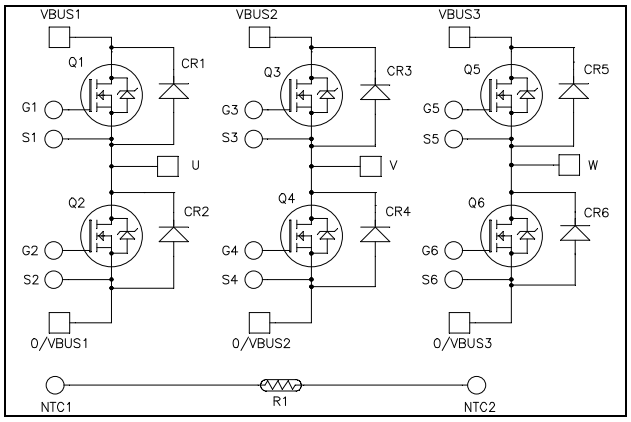
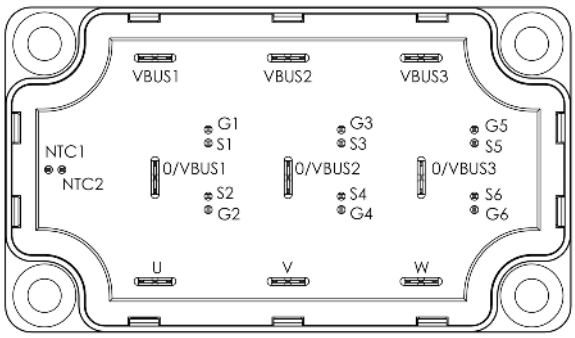
APTMC120TAM12CTPAG

Triple phase leg SiC MOSFET Power Module

V_{DSS} = 1200V
R_{DSon} = 12mΩ max @ Tj = 25°C
I_D = 220A @ Tc = 25°C





Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

Features

- ***SiC Power MOSFET***
  - High speed switching
  - Low $R_{DS(on)}$
  - Ultra low loss
- ***SiC Schottky Diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Very low stray inductance
- Kelvin source for easy drive
- Internal thermistor for temperature monitoring
- High level of integration
- 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
- 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		1200	V
I_D	Continuous Drain Current	T_c = 25°C	220	A
		T_c = 80°C	165	
I_{DM}	Pulsed Drain current		440	
V_{GS}	Gate - Source Voltage		-10/25V	V
R_{DSon}	Drain - Source ON Resistance		12	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	925	W

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} = 1200V				300	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 20V, I_D = 150A	T_j = 25°C		8	12	mΩ
			T_j = 150°C		14	21	
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 30mA		2.1	2.4		V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0V				1.8	µA

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			8.4		nF
C_{oss}	Output Capacitance				0.66		
C_{rss}	Reverse Transfer Capacitance				0.045		
Q_g	Total gate Charge	V_{GS} = -5/+20V V_{Bus} = 800V I_D = 150A			483		nC
Q_{gs}	Gate – Source Charge				138		
Q_{gd}	Gate – Drain Charge				150		
$T_{d(on)}$	Turn-on Delay Time	V_{GS} = -5/+20V V_{Bus} = 800V I_D =150A , T_J =150°C R_L = 5.3Ω ; R_{Gext} = 6.7Ω			35		ns
T_r	Rise Time				40		
$T_{d(off)}$	Turn-off Delay Time				150		
T_f	Fall Time				70		
E_{on}	Turn on Energy	Inductive Switching V_{GS} = -5/+20V V_{Bus} = 600V I_D = 150A R_{Gext} = 6.7Ω	T_j = 150°C		3.3		mJ
E_{off}	Turn off Energy		T_j = 150°C		1.8		
R_{Gint}	Internal gate resistance				2		Ω
R_{thJC}	Junction to Case Thermal Resistance					0.135	°C/W

Source - Drain diode ratings and characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	V_{GS} = -5V, I_{SD} = 75A		3.3		V
		V_{GS} = -2V, I_{SD} = 75A		3.1		
t_{rr}	Reverse Recovery Time	I_{SD} = 150A ; V_{GS} = -5V V_R = 800V ; di_F/dt = 3000A/µs		45		ns
Q_{rr}	Reverse Recovery Charge			1.2		µC
I_{rr}	Reverse Recovery Current			40		A

SiC schottky diode ratings and characteristics (per SiC diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Peak Repetitive Reverse Voltage					1200	V
I_{RRM}	Reverse Leakage Current	V_R=1200V	T_j = 25°C		100	515	µA
			T_j = 175°C		483	1920	
I_F	DC Forward Current		Tc = 125°C		50		A
V_F	Diode Forward Voltage	I_F = 50A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.3	2.7	
Q_C	Total Capacitive Charge	I_F = 50A, V_R = 1200V di/dt =500A/µs			170		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			320		pF
		f = 1MHz, V_R = 400V			230		
R_{thJC}	Junction to Case Thermal Resistance					0.45	°C/W

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
ΔB/B		T_C=100°C		4		%

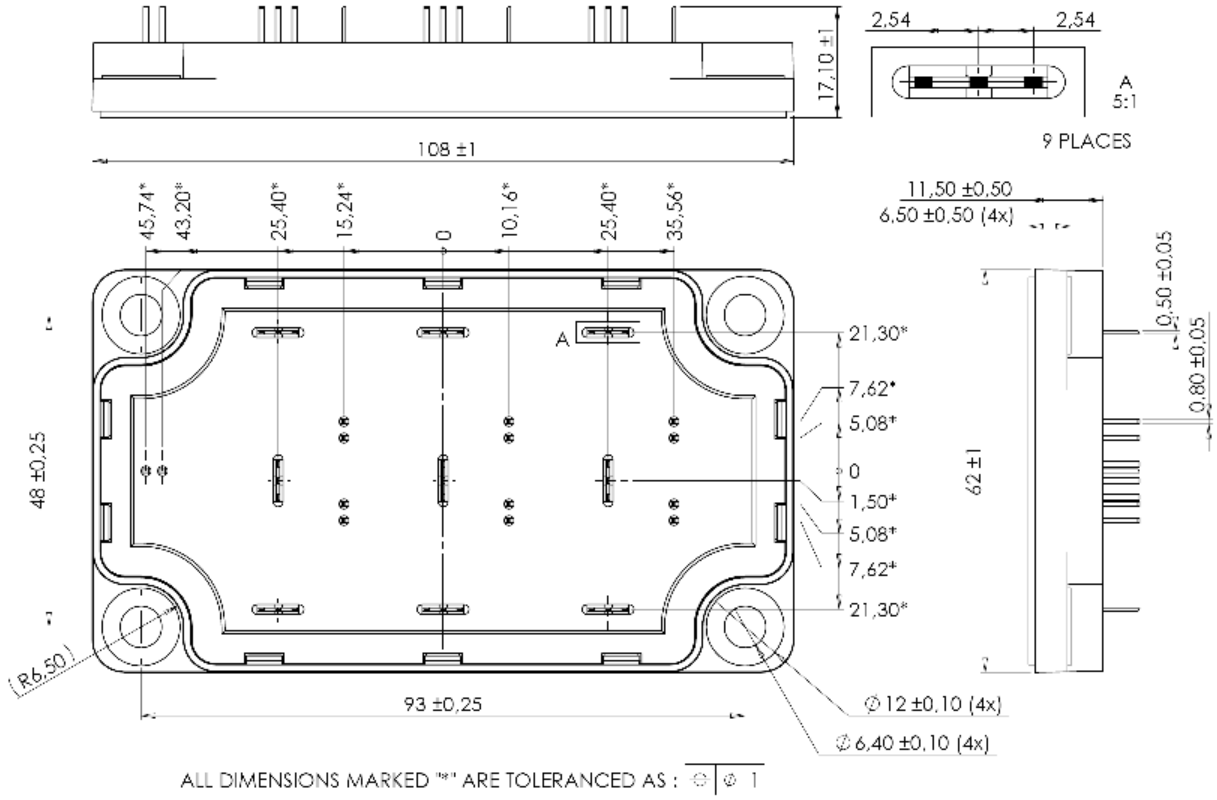
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and 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	SiC MOSFET		-40	150	°C
		SiC diode		-40	175	
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	100	
Torque	Mounting torque	To heatsink	M6	3	5	N.m
Wt	Package Weight				250	g

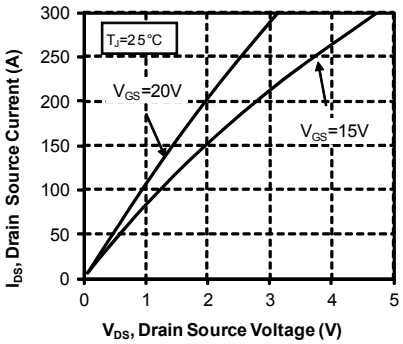
Package outline (dimensions in mm)



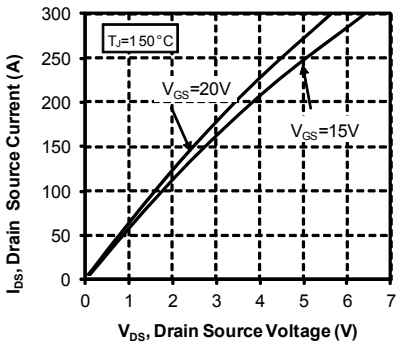
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

Typical SiC MOSFET Performance Curve

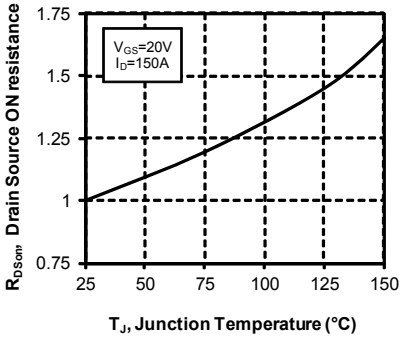
Output Characteristics



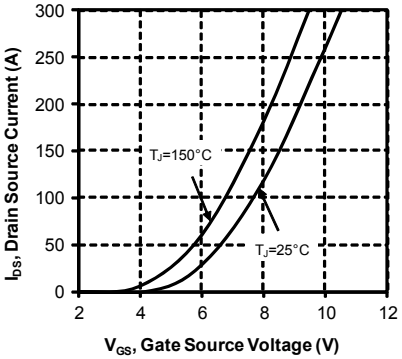
Output Characteristics



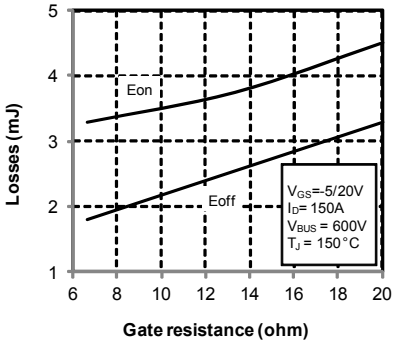
Normalized $R_{DS(on)}$ vs. Temperature



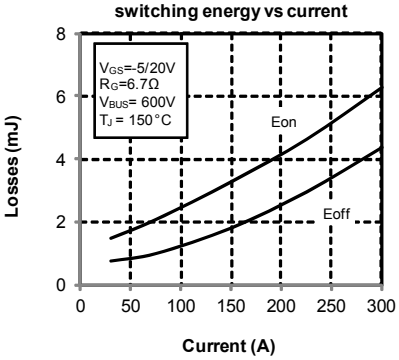
Transfert Characteristics



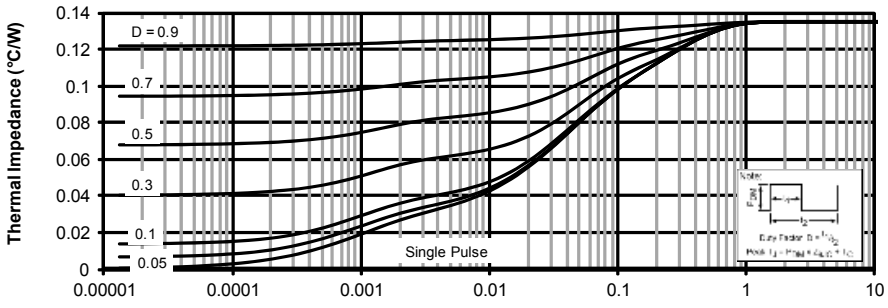
Switching energy vs Rg



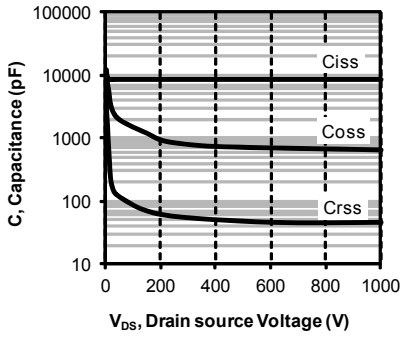
switching energy vs current



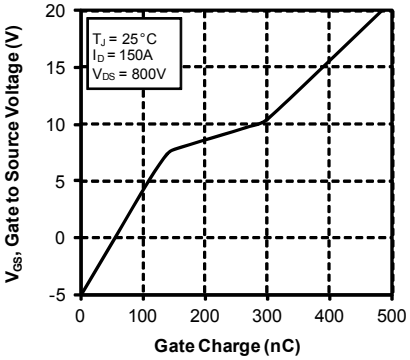
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



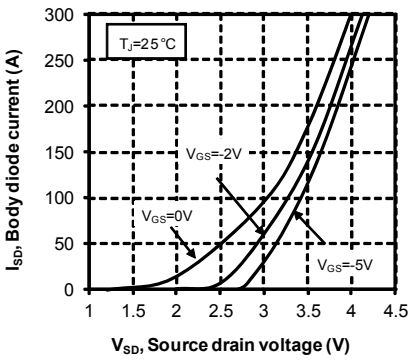
Capacitance vs Drain Source Voltage



Gate Charge vs Gate Source Voltage



Body diode Characteristics



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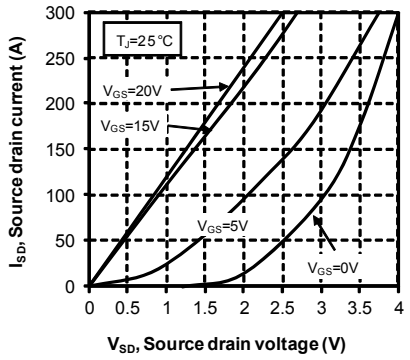

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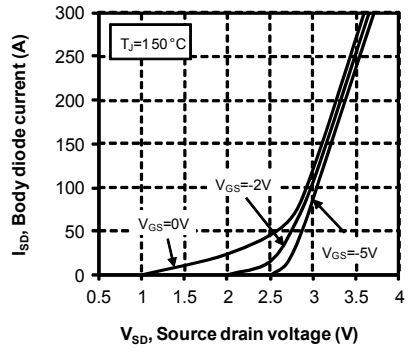

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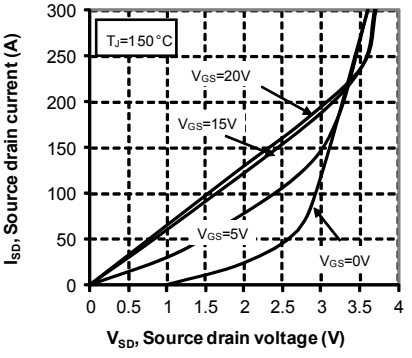
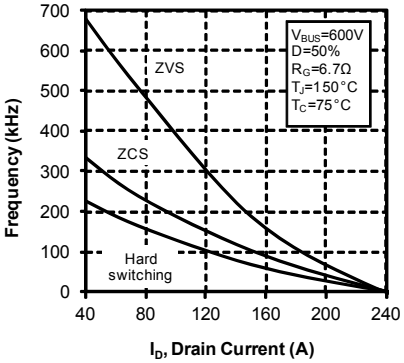
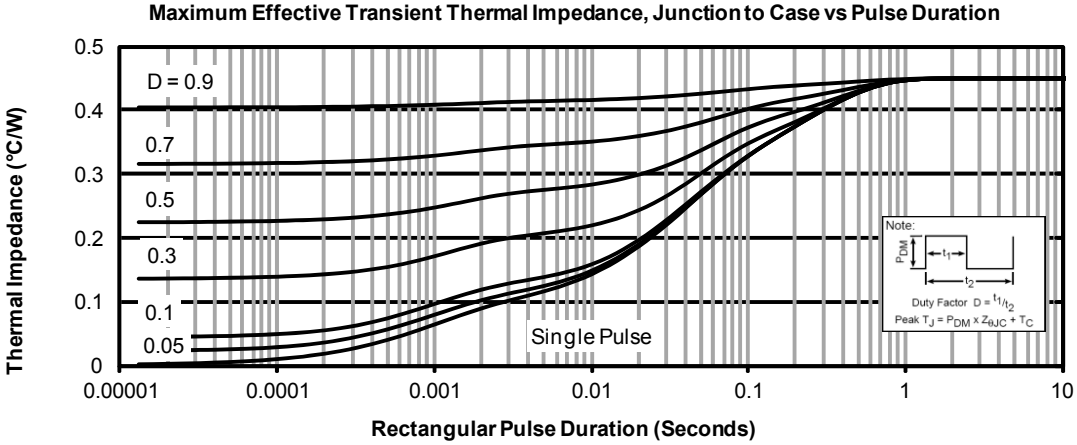
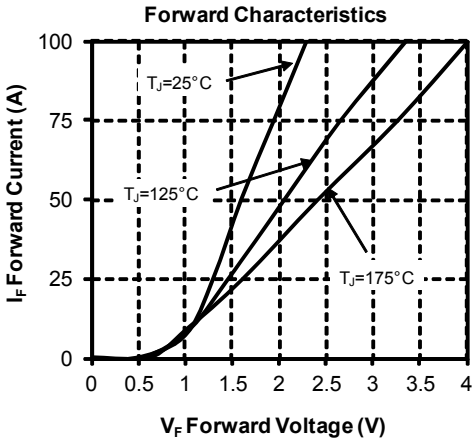


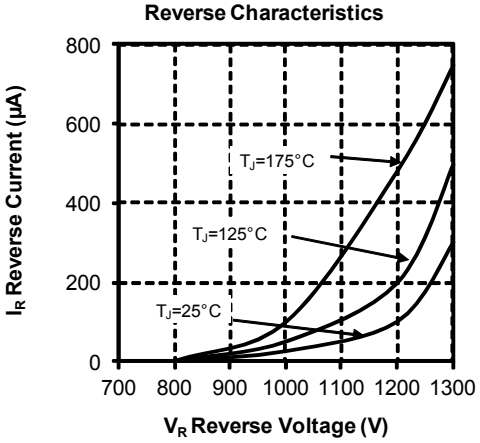
Operating Frequency vs Drain Current

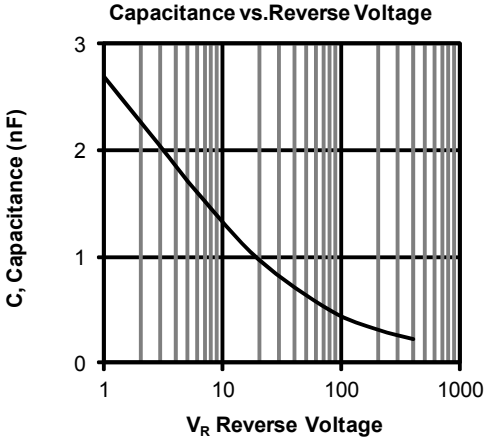


Typical SiC diode Performance Curve









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