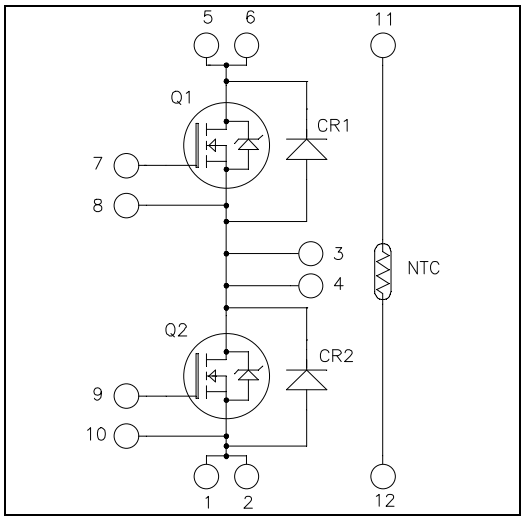
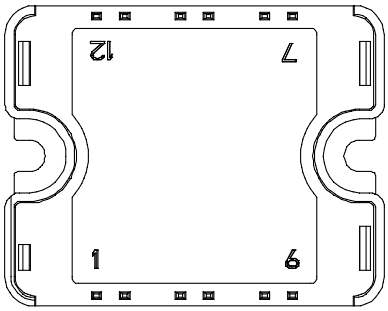
APTMC120AM20CT1AG

Phase leg SiC MOSFET Power Module

V_{DSS} = 1200V
R_{DSon} = 17mΩ max @ Tj = 25°C
I_D = 143A @ Tc = 25°C





Pins 1/2 ; 3/4 ; 5/6 must be shorted together

Application

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

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
- 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

1. SiC MOSFET characteristics (Per MOSFET)

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		1200	V
I_D	Continuous Drain Current	T_c = 25°C	143	A
		T_c = 80°C	108	
I_{DM}	Pulsed Drain current		280	
V_{GS}	Gate - Source Voltage		-10/+25	V
R_{DSon}	Drain - Source ON Resistance		17	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	600	W

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.
See application note APT0502 on www.microsemi.com

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V , V_{DS} = 1200V			20	200	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 20V I_D = 100A	T_j = 25°C		12.5	17	mΩ
			T_j = 150°C		22	32	
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 2mA		1.9	2.3		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			5960		pF
C_{oss}	Output Capacitance				440		
C_{rss}	Reverse Transfer Capacitance				46		
Q_g	Total gate Charge	V_{GS} = -2/+20V V_{Bus} = 800V I_D =100A			360		nC
Q_{gs}	Gate – Source Charge				64		
Q_{gd}	Gate – Drain Charge				126		
$T_{d(on)}$	Turn-on Delay Time	V_{GS} = -2/+20V V_{Bus} = 800V I_D = 100A R_L = 8Ω ; R_G = 10Ω			21		ns
T_r	Rise Time				19		
$T_{d(off)}$	Turn-off Delay Time				50		
T_f	Fall Time				30		
E_{on}	Turn on Energy	Inductive Switching V_{GS} = -5/+20V V_{Bus} = 600V I_D = 100A R_G = 10Ω	T_j = 150°C		2.2		mJ
E_{off}	Turn off Energy		T_j = 150°C		1.2		
R_{thJC}	Junction to Case Thermal Resistance					0.21	°C/W

2. SiC diode characteristics (Per SiC diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1200			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1200V	T_j = 25°C		70	400	µA
			T_j = 175°C		130	800	
I_F	DC Forward Current		Tc = 125°C		40		A
V_F	Diode Forward Voltage	I_F = 40A	T_j = 25°C		1.5	1.8	V
			T_j = 175°C		2.2	3	
Q_C	Total Capacitive Charge	I_F = 40A, V_R = 1200V di/dt = 1000A/µs			260		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			186		pF
		f = 1MHz, V_R = 400V			134		
R_{thJC}	Junction to Case Thermal Resistance					0.7	°C/W

3. Thermal and package characteristics

Package characteristics

Symbol	*Characteristic*			*Min*	*Typ*	*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		125	
Torque	Mounting torque	To heatsink	M4	2		3	N.m
Wt	Package Weight					80	g

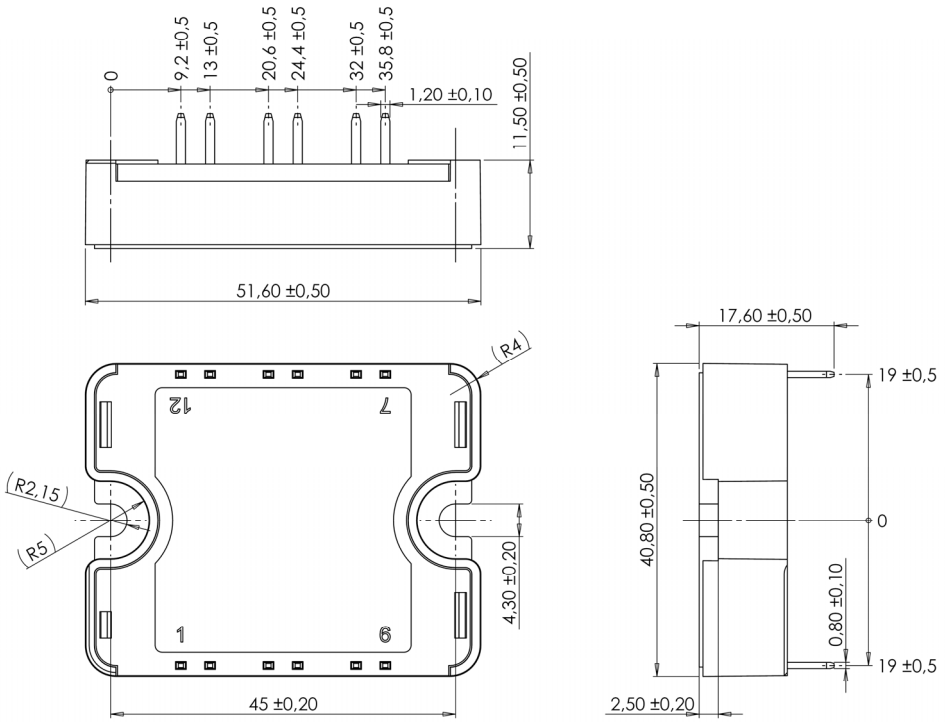
Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

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
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

SP1 Package outline (dimensions in mm)

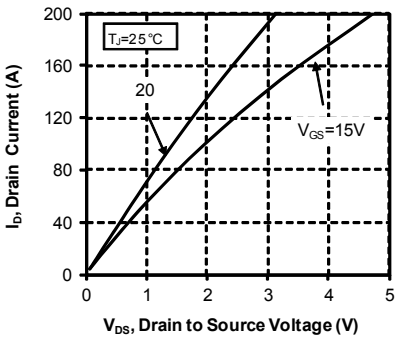


See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

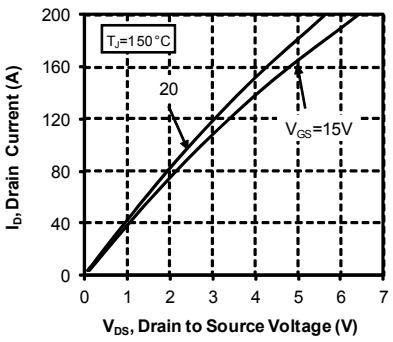
4. Typical Performance Curves

SiC MOSFET

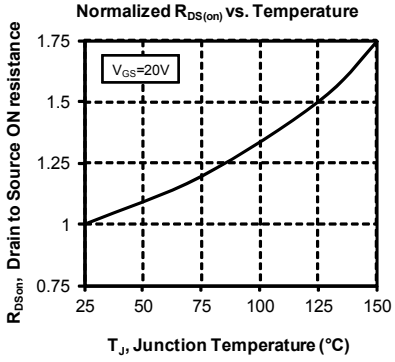
Output Characteristics



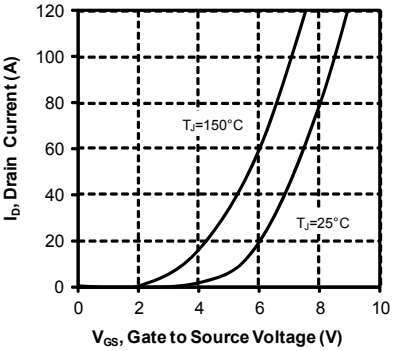
Output Characteristics



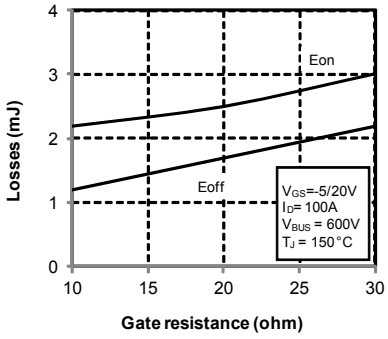
Normalized $R_{DS(on)}$ vs. Temperature



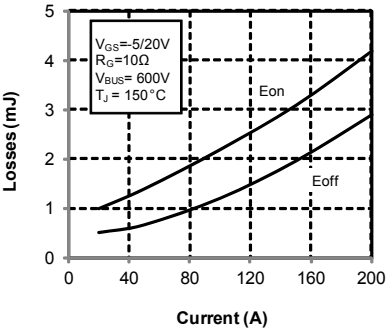
Transfert Characteristics



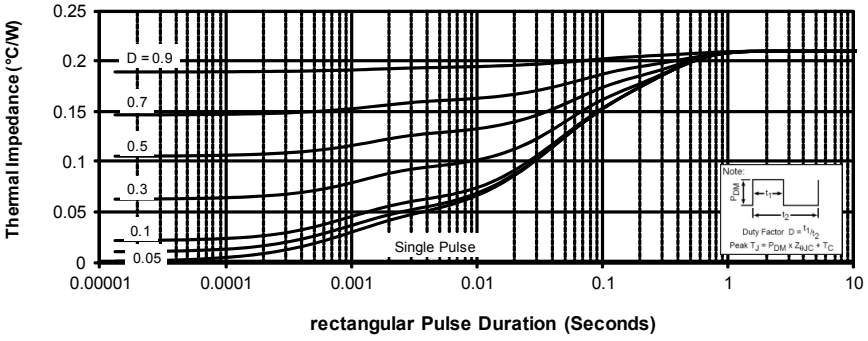
Switching energy vs Rg

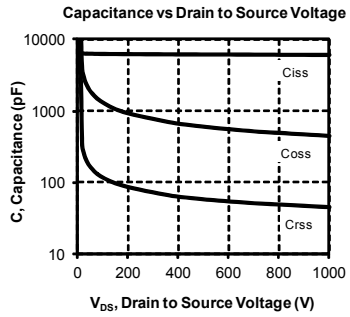


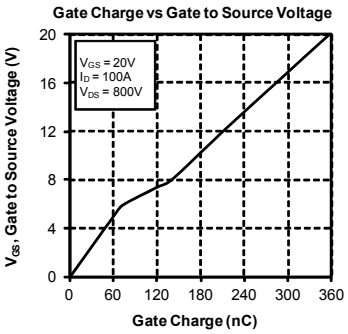
switching energy vs current

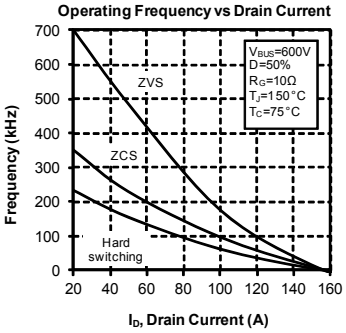


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

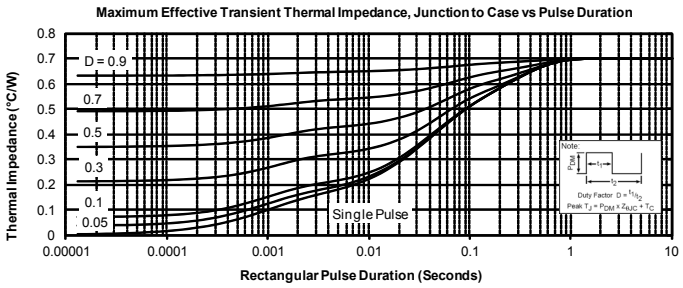


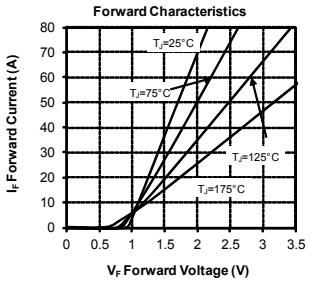


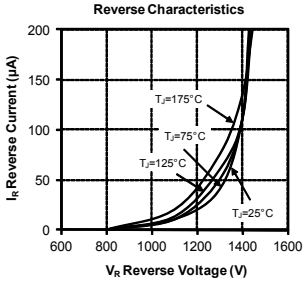


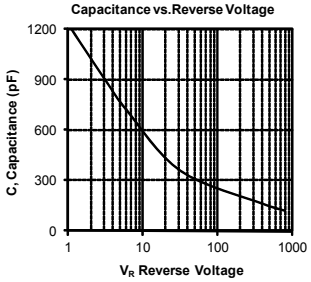


SiC diode









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