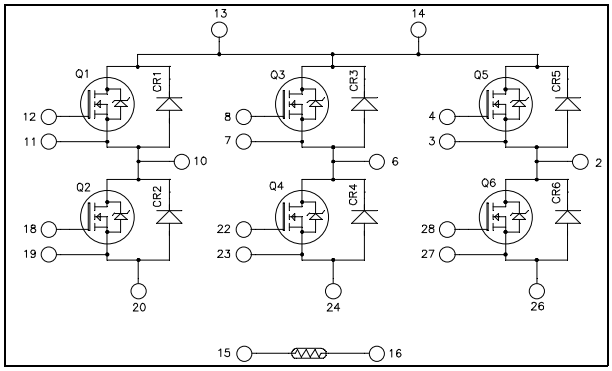
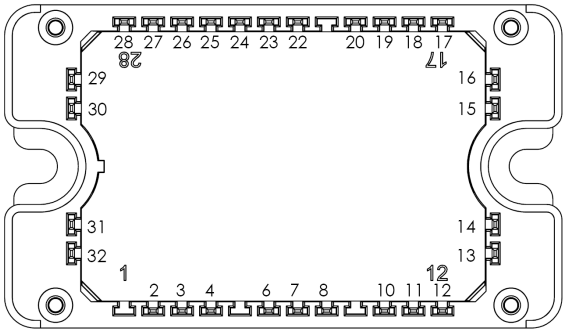
APTSM120TA10CT3AG

3 phase bridge
SiC MOSFET Power Module

V_{DSS} = 1200V
R_{DSon} = 100mΩ max @ Tj = 25°C
I_D = 38A @ Tc = 25°C





Pins 20, 24 & 26 must be shorted together to perform a 3 phase bridge.

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
- 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	38	A
		T_c = 80°C	30	
I_{DM}	Pulsed Drain current		76	
V_{GS}	Gate - Source Voltage		-10/+25	V
R_{DSon}	Drain - Source ON Resistance		100	mΩ
P_D	Power Dissipation	T_c = 25°C	240	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} = 1200V			10	100	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 20V I_D = 20A	T_j = 25°C		80	100	mΩ
			T_j = 175°C		140		
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 1mA		1.7	3		V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0V				100	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			2560		pF
C_{oss}	Output Capacitance				120		
C_{rss}	Reverse Transfer Capacitance				20		
Q_g	Total gate Charge	V_{GS} = -5/20V V_{Bus} = 600V I_D = 20A			136		nC
Q_{gs}	Gate – Source Charge				40		
Q_{gd}	Gate – Drain Charge				40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching V_{GS} = -5/20V ; V_{Bus} = 800V I_D = 20A ; T_J =150°C R_G = 5Ω			10		ns
T_r	Rise Time				10		
$T_{d(off)}$	Turn-off Delay Time				45		
T_f	Fall Time				30		
E_{on}	Turn on Energy	Inductive Switching V_{GS} = -5/+20V V_{Bus} = 600V I_D = 20A R_G = 5Ω	T_j = 150°C		0.43		mJ
E_{off}	Turn off Energy		T_j = 150°C		0.24		
R_{Gint}	Internal gate resistance				1.3		Ω
R_{thJC}	Junction to Case Thermal Resistance					0.63	°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} = 20A		3.9		V
t_{rr}	Reverse Recovery Time	I_{SD} = 20A ; V_{GS} = -2V V_R = 800V ; di_F/dt = 100A/µs		140		ns
Q_{rr}	Reverse Recovery Charge			115		nC
I_{rr}	Reverse Recovery Current			2		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		10	200	µA
			T_j = 175°C		500		
I_F	DC Forward Current		Tc = 125°C		10		A
V_F	Diode Forward Voltage	I_F = 10A	T_j = 25°C		1.5	1.8	V
			T_j = 175°C		2.3		
Q_C	Total Capacitive Charge	I_F = 10A, V_R = 600V di/dt =500A/µs			120		nC
C	Total Capacitance	f = 1MHz, V_R = 400V			115		pF
		f = 1MHz, V_R = 800V			85		
R_{thJC}	Junction to Case Thermal Resistance					1.1	°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		%

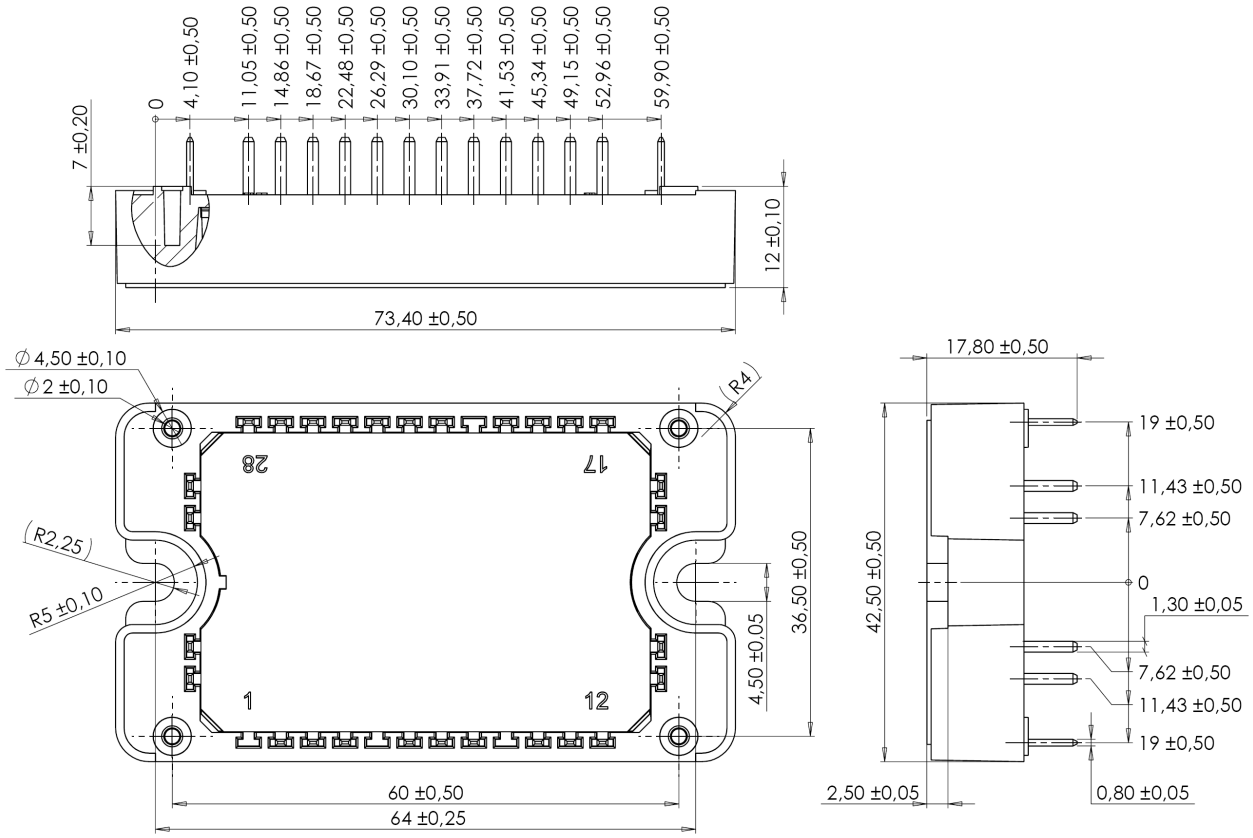
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

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			-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	M4	2	3	N.m
Wt	Package Weight				110	g

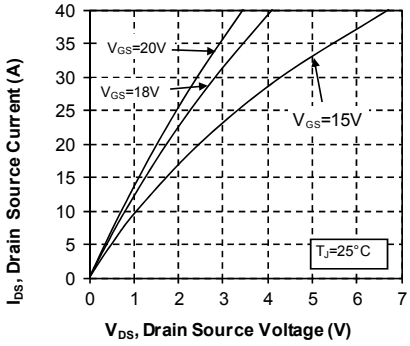
Package outline (dimensions in mm)



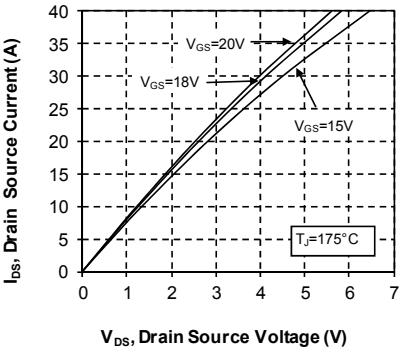
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

Typical SiC MOSFET Performance Curve

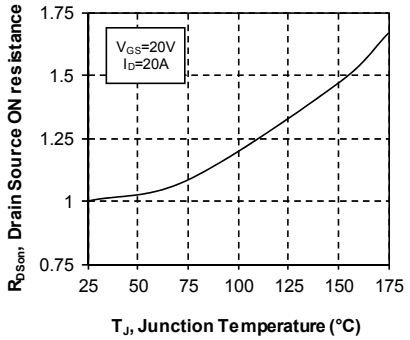
Output Characteristics



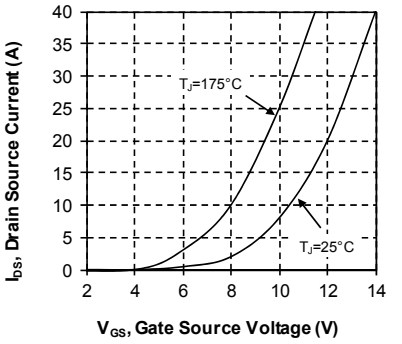
Output Characteristics



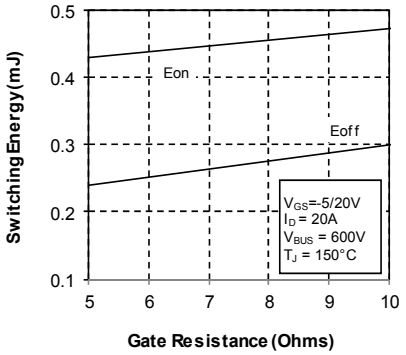
Normalized $R_{DS(on)}$ vs. Temperature



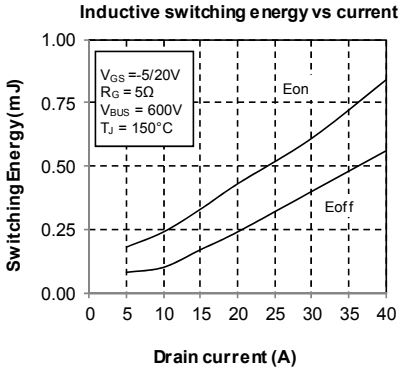
Transfert Characteristics



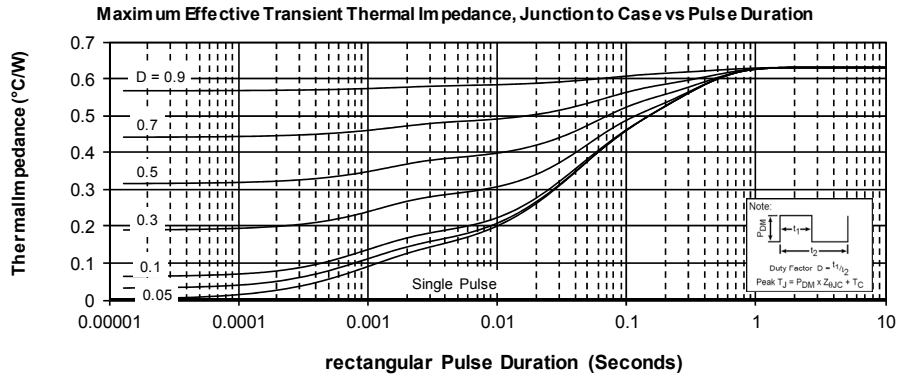
inductive switching energy vs RG



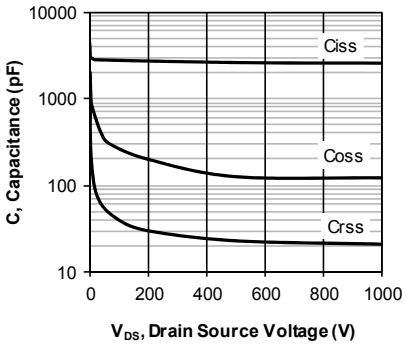
Inductive switching energy vs current



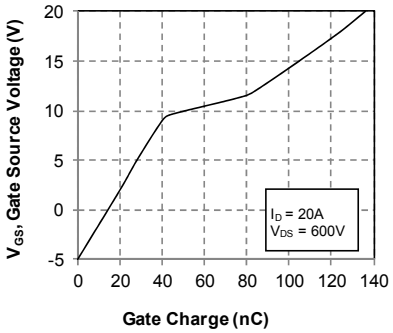
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



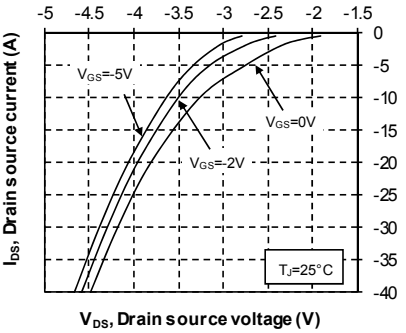
Capacitance vs Drain Source Voltage



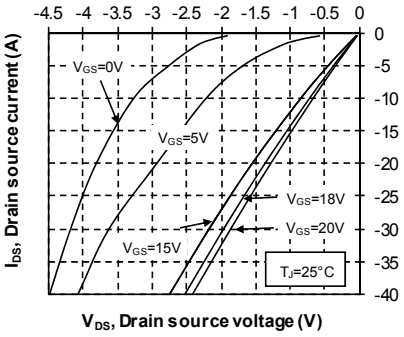
Gate Charge vs Gate Source Voltage



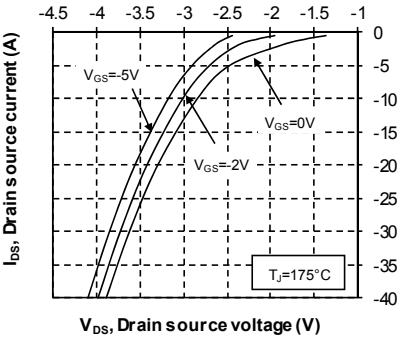
Body diode Characteristics



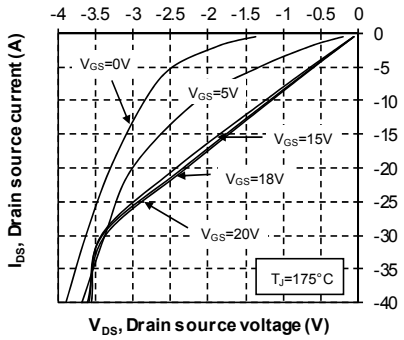
3rd quadrant Characteristics



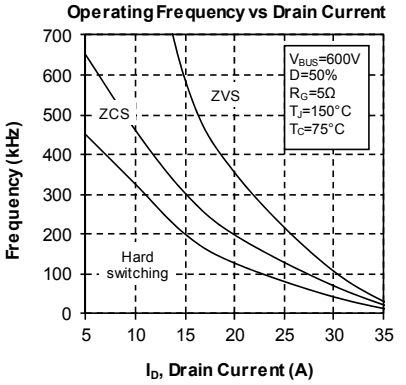
Body diode Characteristics



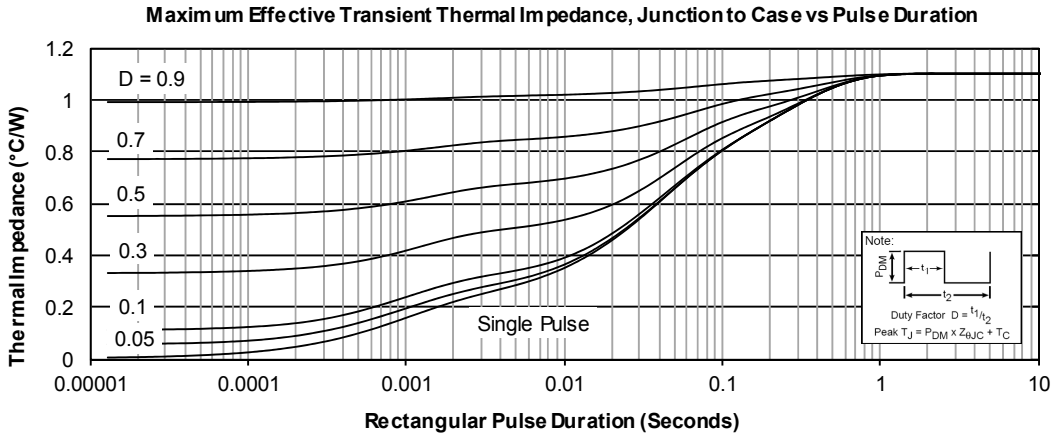
3rd quadrant Characteristics

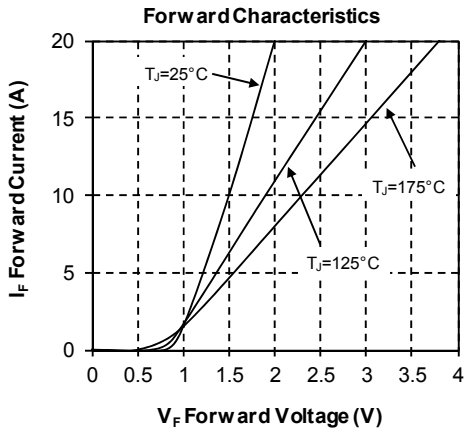


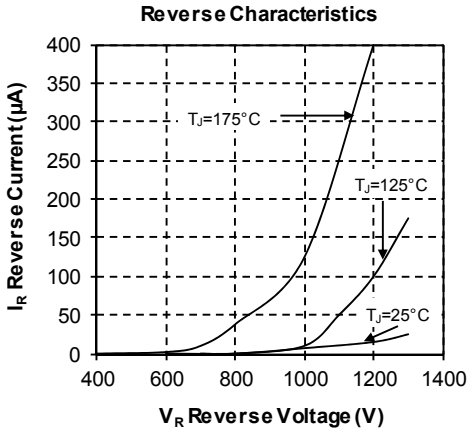
Operating Frequency vs Drain Current

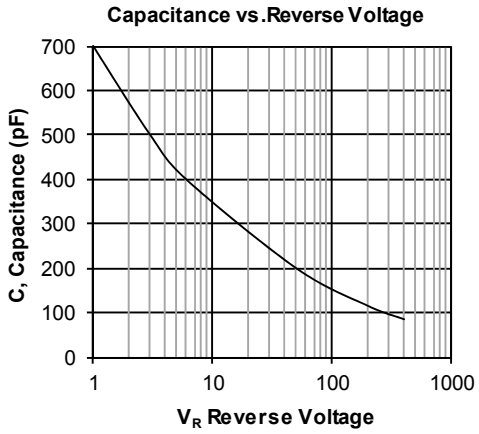


Typical SiC diode Performance Curve









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