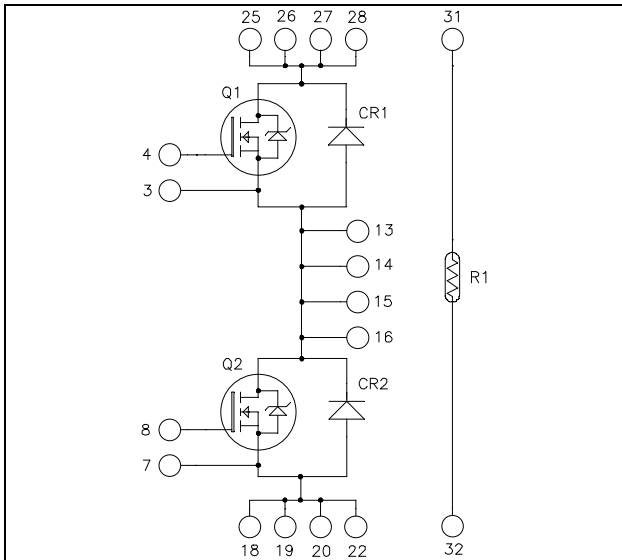


**Phase leg
SiC MOSFET Power Module**

$V_{DSS} = 1200V$
 $R_{DS(on)} = 25m\Omega \text{ max @ } T_j = 25^\circ C$
 $I_D = 148A \text{ @ } T_c = 25^\circ C$

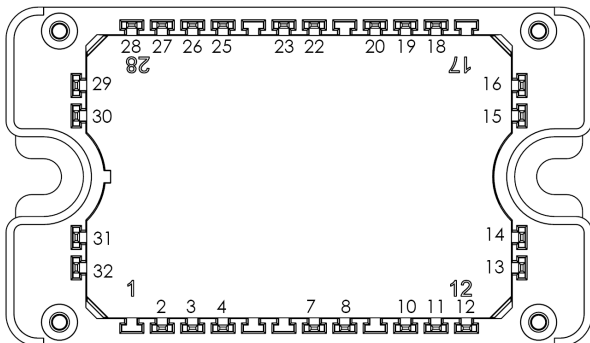


Application

- 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
- 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

Pins 25 to 28 must be shorted together
Pins 13 to 16 must be shorted together
Pins 18/19/20/22 must be shorted together

All ratings @ $T_j = 25^\circ C$ unless otherwise specified

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

Absolute maximum ratings (per SiC MOSFET)

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>
V _{DSS}	Drain - Source Voltage	1200	V
I _D	Continuous Drain Current	T _c = 25°C	148
		T _c = 80°C	118
I _{DM}	Pulsed Drain current	300	A
V _{GS}	Gate - Source Voltage	-10/25V	V
R _{DS(on)}	Drain - Source ON Resistance	25	mΩ
P _D	Power Dissipation	T _c = 25°C	937
			W

Electrical Characteristics (per SiC MOSFET)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
I _{DSS}	Zero Gate Voltage Drain Current	V _{GS} = 0V, V _{DS} = 1200V		40	400	μA
R _{DS(on)}	Drain - Source on Resistance	V _{GS} = 20V I _D = 80A	T _j = 25°C	20	25	mΩ
			T _j = 175°C	34		
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 4mA	1.7	3		V
I _{GSS}	Gate - Source Leakage Current	V _{GS} = 20V, V _{DS} = 0V			400	nA

Dynamic Characteristics (per SiC MOSFET)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
C _{iss}	Input Capacitance	V _{GS} = 0V V _{DS} = 1000V f = 1MHz		10.2		nF
C _{oss}	Output Capacitance			0.48		
C _{rss}	Reverse Transfer Capacitance			0.08		
Q _g	Total gate Charge	V _{GS} = -5/+20V		544		nC
Q _{gs}	Gate - Source Charge	V _{Bus} = 600V		160		
Q _{gd}	Gate - Drain Charge	I _D = 80A		160		
T _{d(on)}	Turn-on Delay Time	V _{GS} = -5/+20V V _{Bus} = 800V I _D = 80A ; T _j = 150°C R _L = 10Ω ; R _{Gext} = 1.25Ω		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 = 80A R _{Gext} = 1.25Ω	T _j = 150°C	1.75		mJ
E _{off}	Turn off Energy			T _j = 150°C	1	
R _{Gint}	Internal gate resistance			0.82		Ω
R _{thJC}	Junction to Case Thermal Resistance				0.16	°C/W

Body diode ratings and characteristics (per SiC MOSFET)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V _{SD}	Diode Forward Voltage	V _{GS} = 0V, I _{SD} = 80A		3.9		V
t _{rr}	Reverse Recovery Time	I _{SD} = 80A ; V _{GS} = -2V V _R = 800V ; di _F /dt = 400A/μs		140		ns
Q _{rr}	Reverse Recovery Charge				460	nC
I _{rr}	Reverse Recovery Current				8	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	40	800	μA
			T _j = 175°C	2000		
I _F	DC Forward Current		T _c = 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	2.3		
Q _C	Total Capacitive Charge	I _F = 40A, V _R = 600V di/dt = 2000A/μs		480		nC
C	Total Capacitance	f = 1MHz, V _R = 200V		460		pF
		f = 1MHz, V _R = 400V		340		
R _{thJC}	Junction to Case Thermal Resistance				0.28	°C/W

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

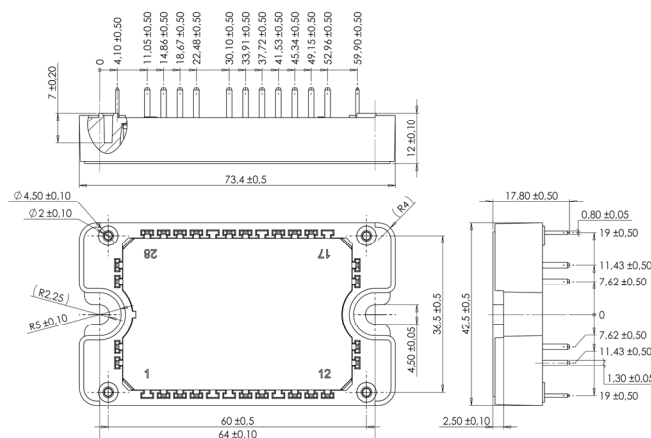
Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
ΔR ₂₅ /R ₂₅			5		%
B _{25/85}	T ₂₅ = 298.15 K		3952		K
ΔB/B		T _C =100°C	4		%

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

T: Thermistor temperature
R_T: Thermistor value at T

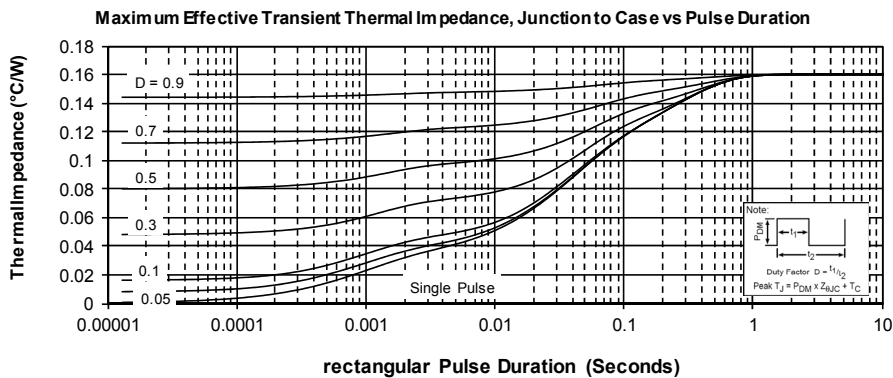
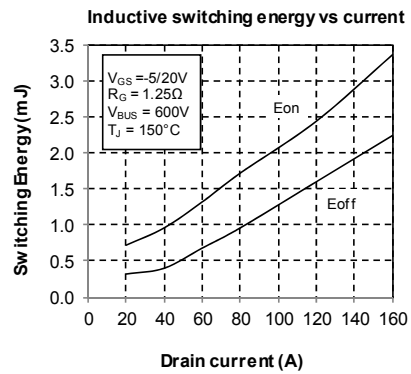
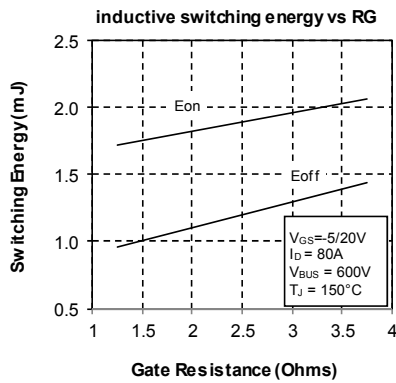
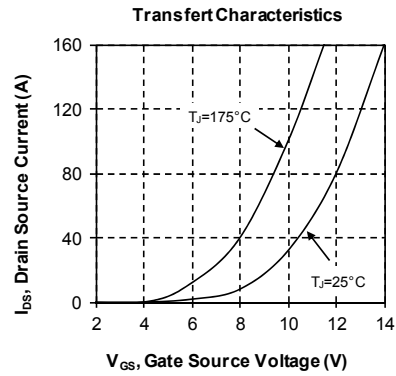
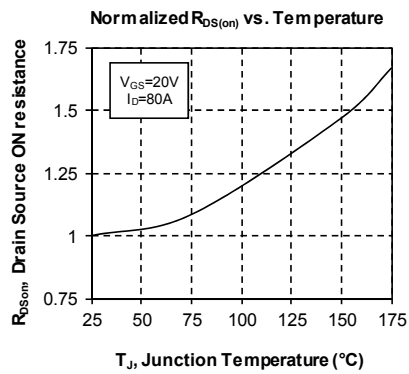
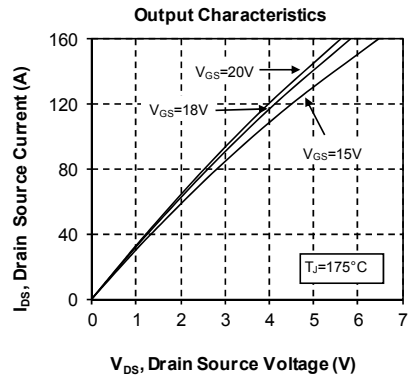
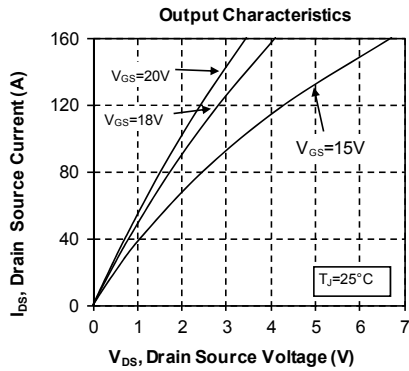
Thermal and package characteristics

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 _{Jmax} -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

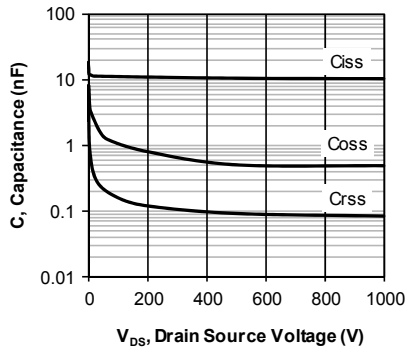
Package outline (dimensions in mm)


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

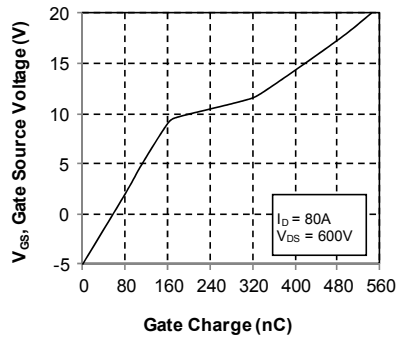
Typical SiC MOSFET Performance Curve



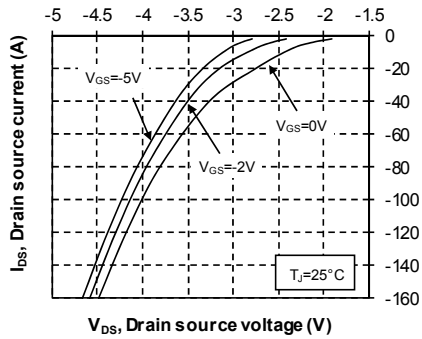
Capacitance vs Drain Source Voltage



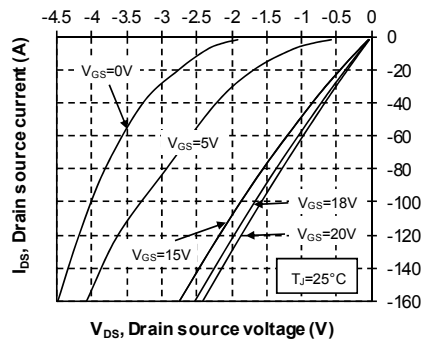
Gate Charge vs Gate Source Voltage



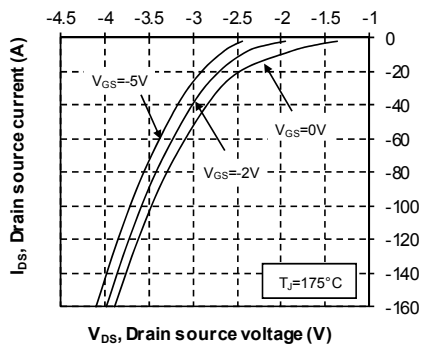
Body diode Characteristics



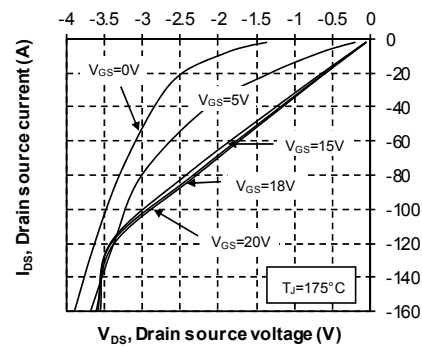
3rd quadrant Characteristics



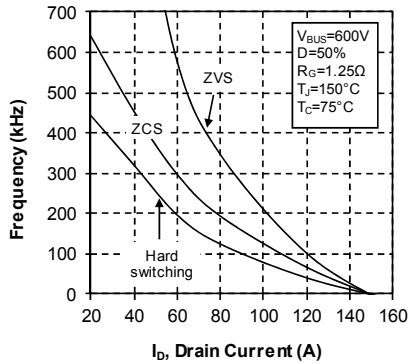
Body diode Characteristics



3rd quadrant Characteristics

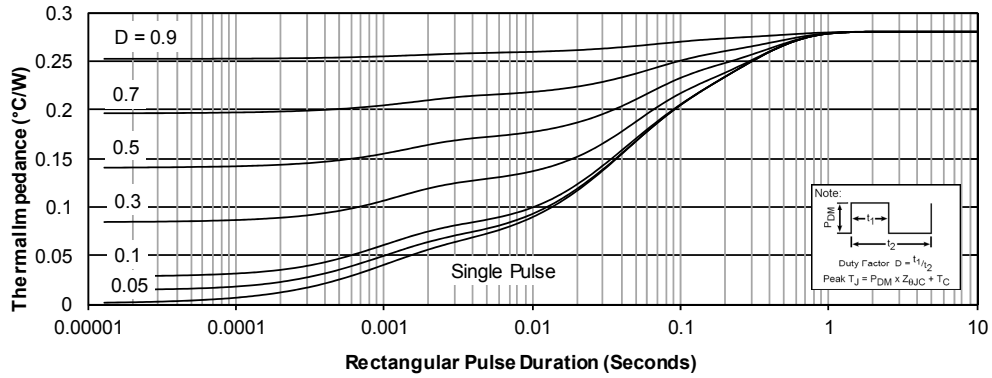


Operating Frequency vs Drain Current

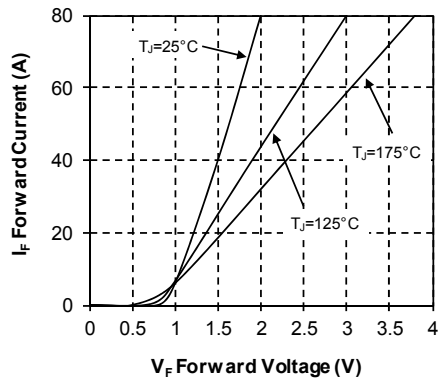


Typical SiC diode Performance Curve

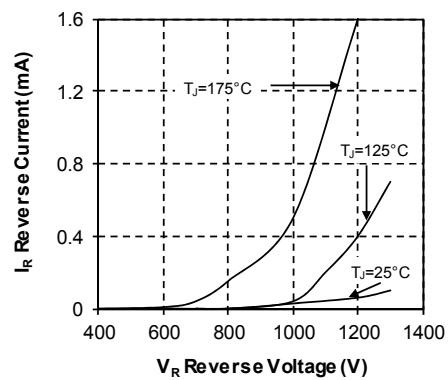
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



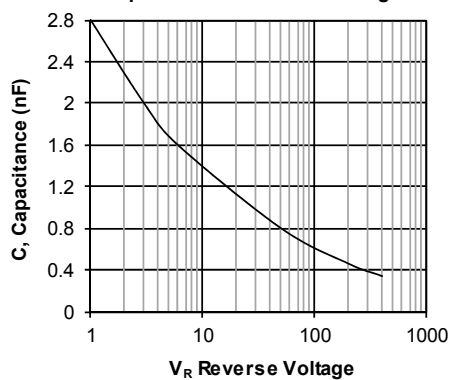
Forward Characteristics



Reverse Characteristics



Capacitance vs. Reverse Voltage



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