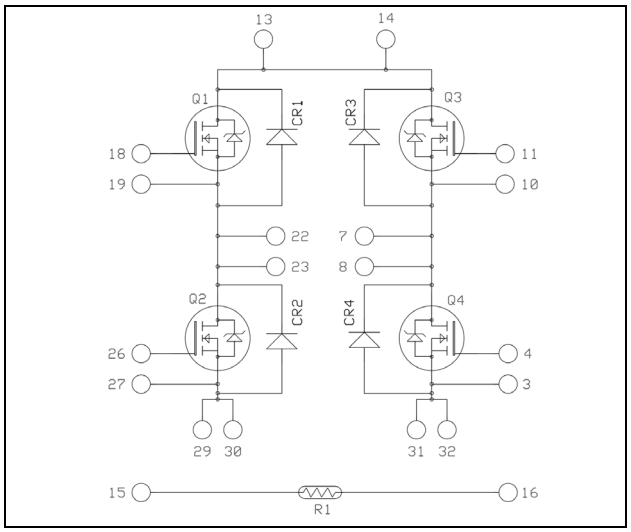
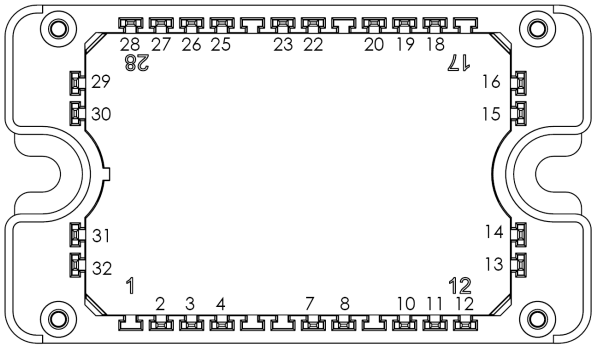
Full bridge SiC MOSFET Power Module

V_{DSS} = 1200V
R_{DSon} = 17mΩ max @ Tj = 25°C
I_D = 147A @ Tc = 25°C





All multiple inputs & outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

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
- Kelvin source for easy drive
- Very low stray inductance
- 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
- Each leg can be easily paralleled to achieve a phase leg of twice the current capability
- RoHS compliant

All ratings @ T_j = 25°C unless otherwise specified

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

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	147	A
		T_c = 80°C	116	
I_{DM}	Pulsed Drain current		300	
V_{GS}	Gate - Source Voltage		-10/25V	V
R_{DSon}	Drain - Source ON Resistance		17	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	750	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			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 = 175°C		26		
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 30mA		2	2.6	4	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0V				1.2	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			5576		pF
C_{oss}	Output Capacitance				440		
C_{rss}	Reverse Transfer Capacitance				30		
Q_g	Total gate Charge	V_{GS} = -5/+20V V_{Bus} = 800V I_D =100A			332		nC
Q_{gs}	Gate – Source Charge				92		
Q_{gd}	Gate – Drain Charge				100		
$T_{d(on)}$	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_{Gint}	Internal gate resistance				3.05		Ω
R_{thJC}	Junction to Case Thermal Resistance					0.2	°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} = -5V I_{SD} = 50A	T_j = 25°C		4		V
			T_j = 175°C		3.5		
t_{rr}	Reverse Recovery Time	I_{SD} = 100A ; V_{GS} = -5V V_R = 800V ; di_F/dt = 2000A/µs			45		ns
Q_{rr}	Reverse Recovery Charge				812		nC
I_{rr}	Reverse Recovery Current				27		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		70	400	µA
			T_j = 175°C		130	800	
I_F	DC Forward Current		Tc = 100°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			198		nC
C	Total Capacitance	f = 1MHz, V_R = 400V			186		pF
		f = 1MHz, V_R = 800V			134		
R_{thJC}	Junction to Case Thermal Resistance					0.55	°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		%

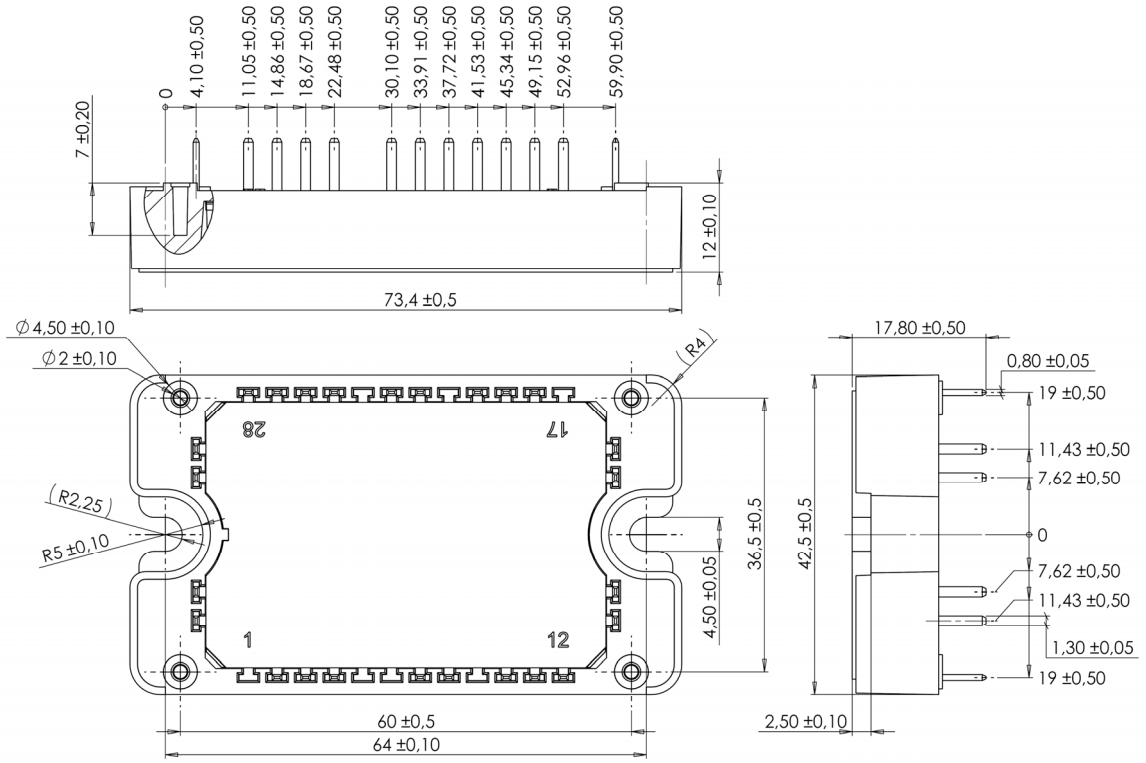
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

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

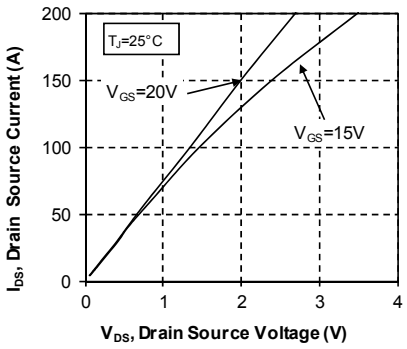
Package outline (dimensions in mm)



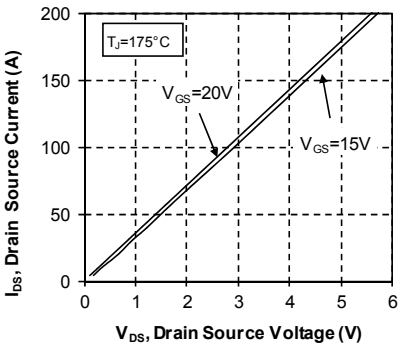
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

Typical SiC MOSFET Performance Curve

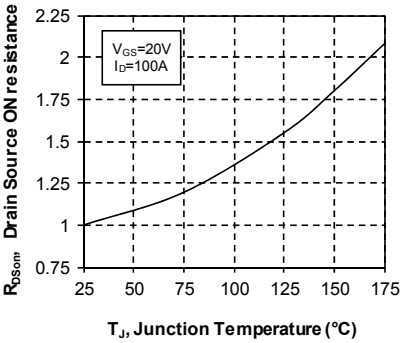
Output Characteristics



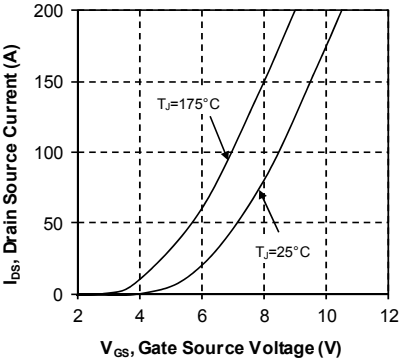
Output Characteristics



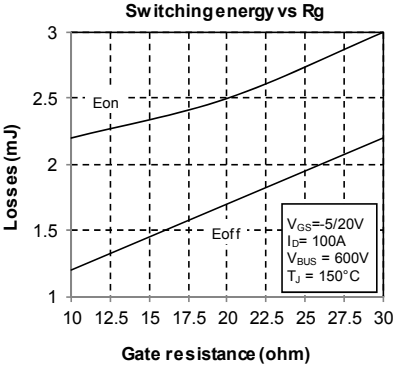
Normalized $R_{DS(on)}$ vs. Temperature



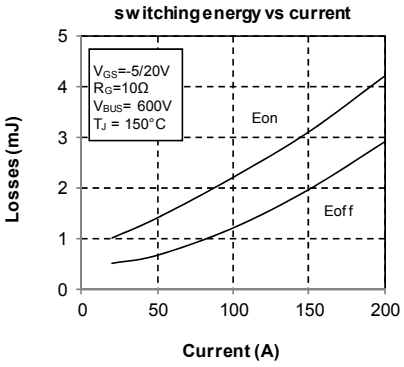
Transfert Characteristics



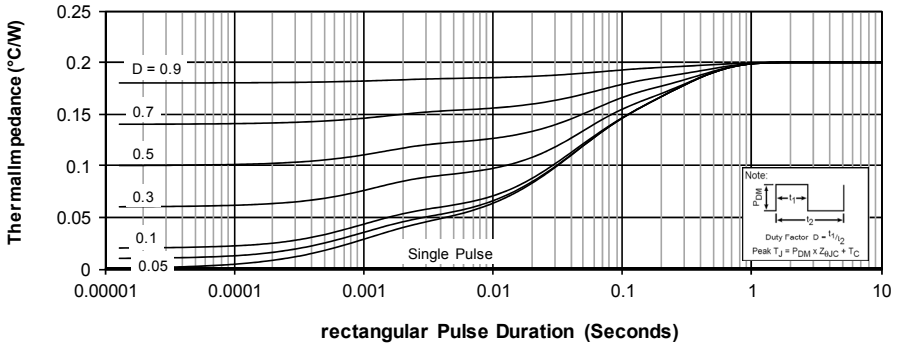
Switching energy vs Rg



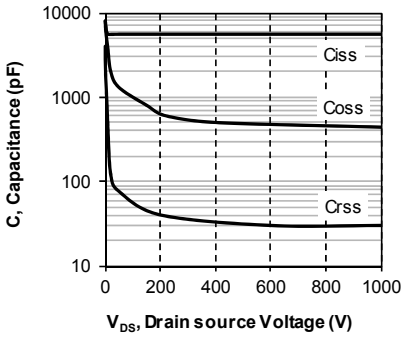
switching energy vs current



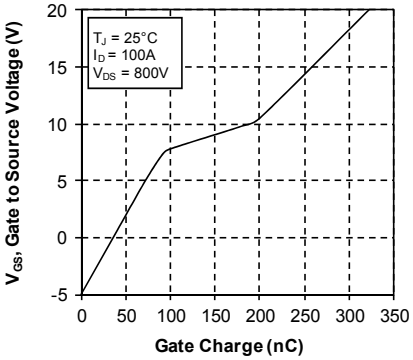
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



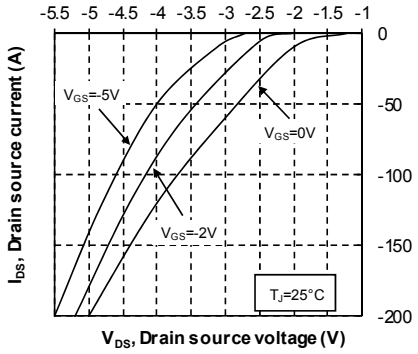
Capacitance vs Drain Source Voltage



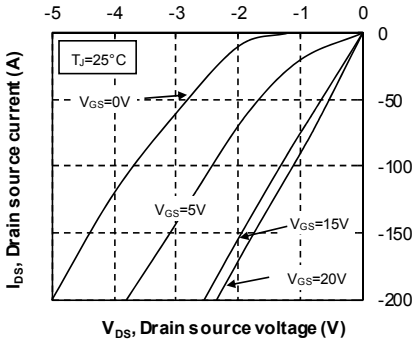
Gate Charge vs Gate Source Voltage



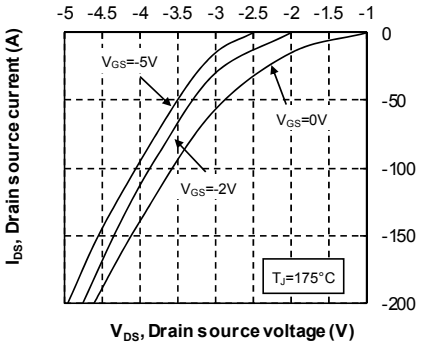
Body diode Characteristics



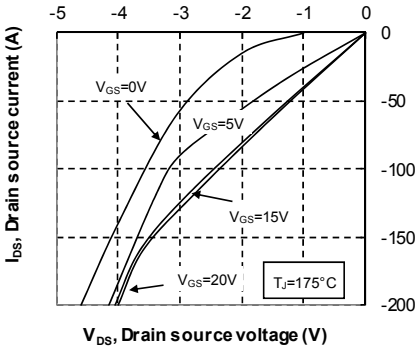
3rd Quadrant Characteristics



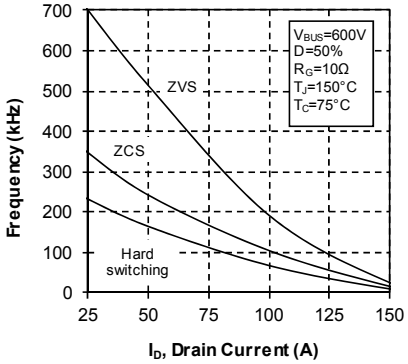
Body diode Characteristics



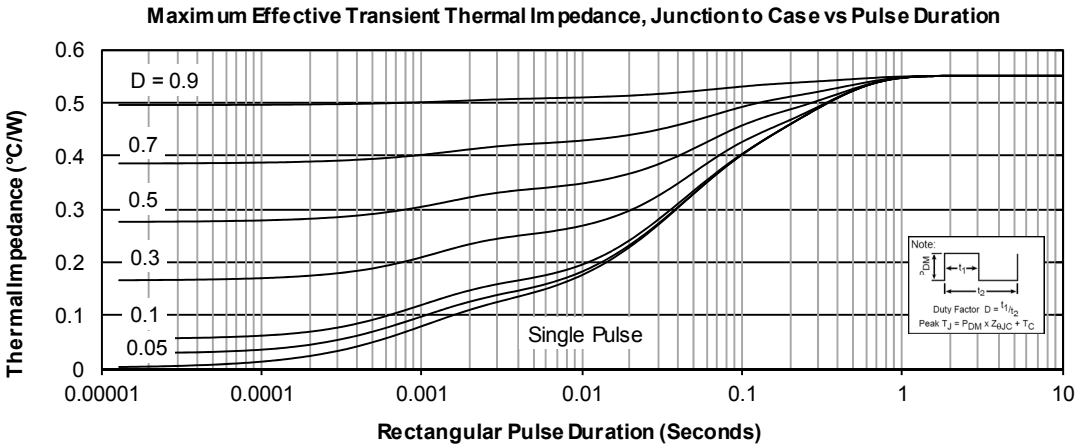
3rd Quadrant Characteristics

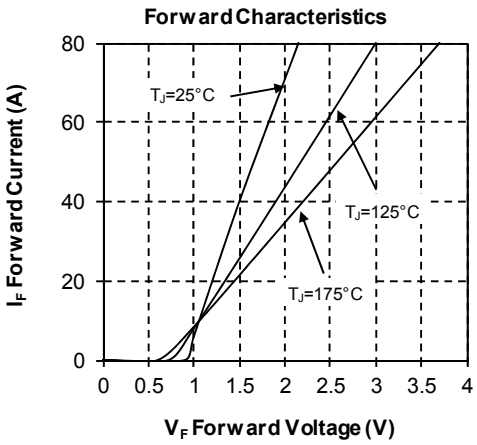


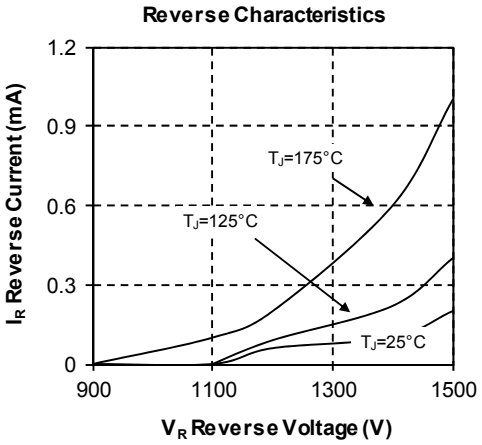
Operating Frequency vs Drain Current

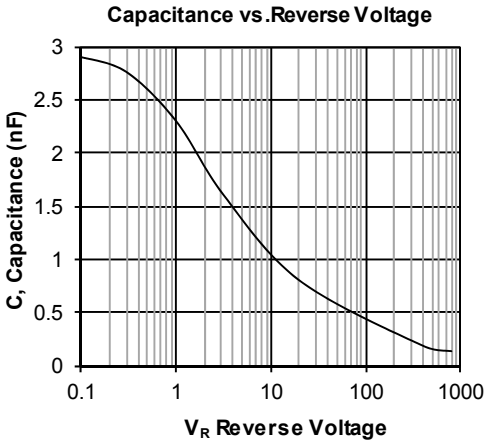


Typical SiC diode Performance Curve









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