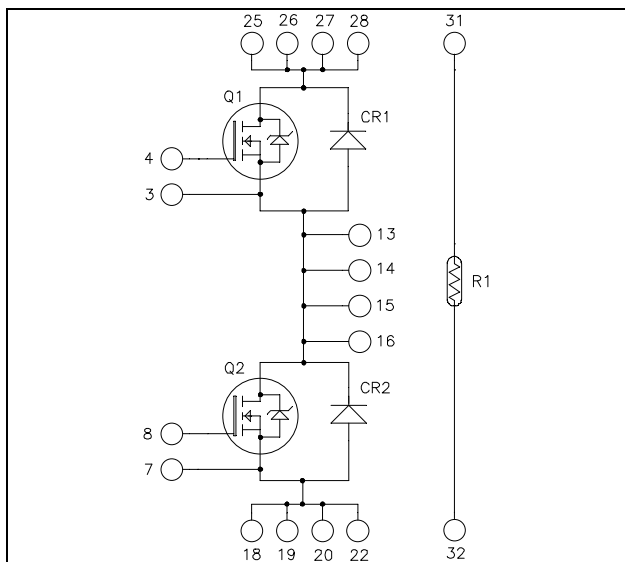


Phase leg SiC MOSFET Power Module

$$V_{DSS} = 1200V$$

$$R_{DS(on)} = 12m\Omega \text{ max @ } T_j = 25^\circ C$$

$$I_D = 220A^* \text{ @ } T_c = 25^\circ C$$



Application

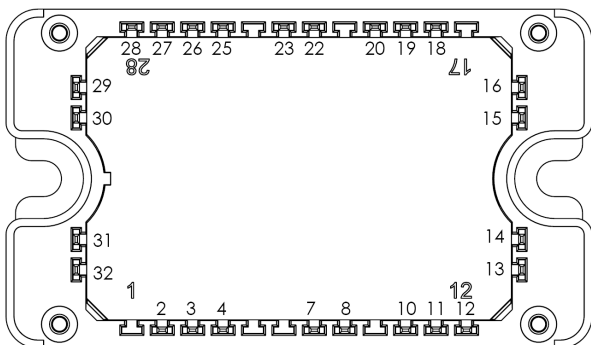
- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

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
- 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



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)

Symbol	Parameter	Max ratings	Unit
V_{DS}	Drain - Source Voltage	1200	V
I_D	Continuous Drain Current	$T_c = 25^\circ\text{C}$	A
		$T_c = 80^\circ\text{C}$	
I_{DM}	Pulsed Drain current	440	
V_{GS}	Gate - Source Voltage	-10/25V	V
$R_{DS(on)}$	Drain - Source ON Resistance	12	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ\text{C}$	W

* Specification of device but current must be limited due to size of pins.

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	$V_{GS} = 20V$		8	12	m Ω
		$I_D = 150A$				
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 30mA$	2.1	2.4		V
I_{GSS}	Gate - Source Leakage Current	$V_{GS} = 20V, V_{DS} = 0V$			1.8	μA

Dynamic Characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V$		8.4		nF
C_{oss}	Output Capacitance	$V_{DS} = 1000V$		0.66		
C_{rss}	Reverse Transfer Capacitance	$f = 1MHz$		0.045		
Q_g	Total gate Charge	$V_{GS} = -5/+20V$		483		nC
Q_{gs}	Gate - Source Charge	$V_{Bus} = 800V$		138		
Q_{gd}	Gate - Drain Charge	$I_D = 150A$		150		
$T_{d(on)}$	Turn-on Delay Time	$V_{GS} = -5/+20V$		35		ns
T_r	Rise Time	$V_{Bus} = 800V$		40		
$T_{d(off)}$	Turn-off Delay Time	$I_D = 150A, T_j = 150^\circ\text{C}$		150		
T_f	Fall Time	$R_L = 5.3\Omega; R_{Gext} = 6.7\Omega$		70		
E_{on}	Turn on Energy	Inductive Switching $V_{GS} = -5/+20V$ $V_{Bus} = 600V$		3.3		mJ
E_{off}	Turn off Energy	$I_D = 150A$ $R_{Gext} = 6.7\Omega$		1.8		
R_{Gint}	Internal gate resistance			2		Ω
R_{thJC}	Junction to Case Thermal Resistance				0.135	$^\circ\text{C/W}$

Body diode ratings and characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	$V_{GS} = -5V, I_{SD} = 75A$		3.3		V
		$V_{GS} = -2V, I_{SD} = 75A$		3.1		
t_{rr}	Reverse Recovery Time	$I_{SD} = 150A; V_{GS} = -5V$ $V_R = 800V; di_F/dt = 3000A/\mu\text{s}$		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		105	600	μA
		T _j = 175°C		195	1200	
I _F	DC Forward Current	T _C = 125°C		60		A
V _F	Diode Forward Voltage	I _F = 60A				
		T _j = 25°C		1.5	1.8	V
		T _j = 175°C		2.2	3	
Q _C	Total Capacitive Charge	I _F = 60A, V _R = 1200V di/dt = 1500A/μs		390		nC
C	Total Capacitance	f = 1MHz, V _R = 400V		279		pF
		f = 1MHz, V _R = 800V		201		
R _{thJC}	Junction to Case Thermal Resistance				0.37	°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			4		%

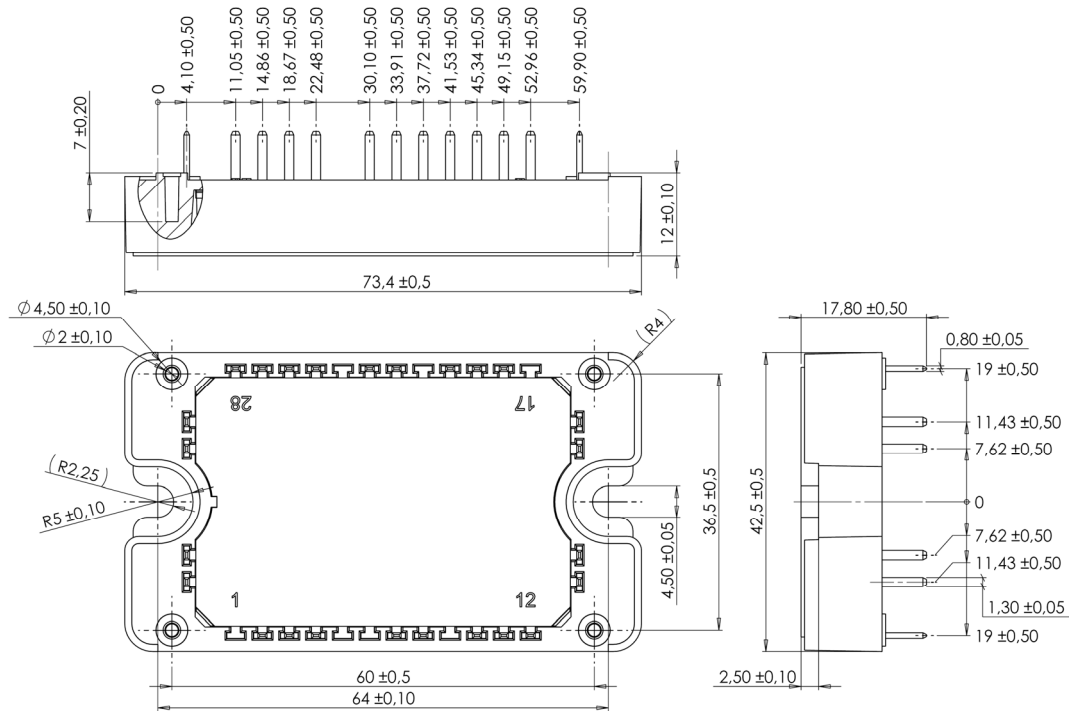
$$R_T = \frac{R_{25}}{\exp \left[B_{25/85} \left(\frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

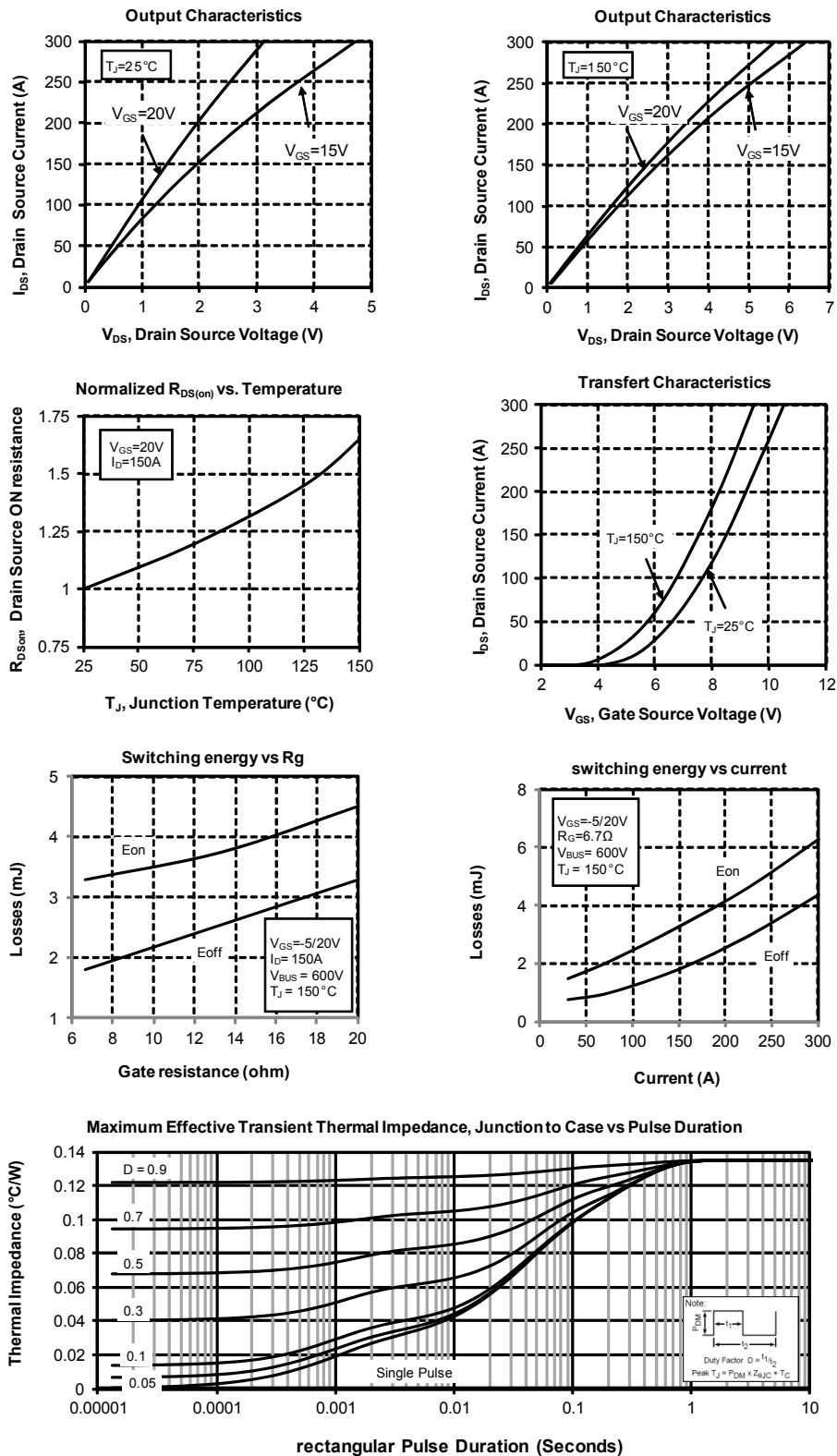
Symbol	Characteristic	Min	Max	Unit
V _{ISOL}	RMS Isolation Voltage, any terminal to case t = 1 min, 50/60Hz	4000		V
T _J	Operating junction temperature range			
	SiC MOSFET	-40	150	
	SiC diode	-40	175	
T _{JOP}	Recommended junction temperature under switching conditions	-40	T _{Jmax} -25	°C
T _{STG}	Storage Temperature Range	-40	125	
T _C	Operating Case Temperature	-40	100	
Torque	Mounting torque	To heatsink	M4	N.m
Wt	Package Weight		110	g

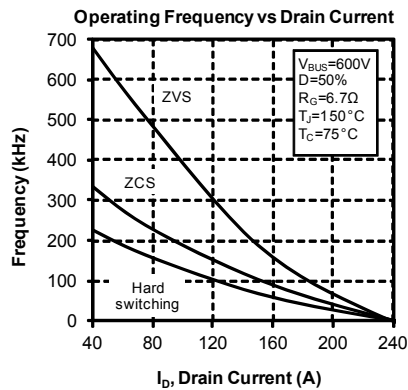
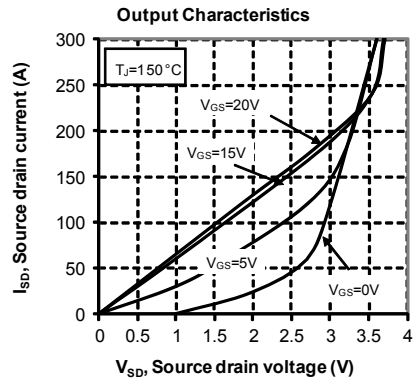
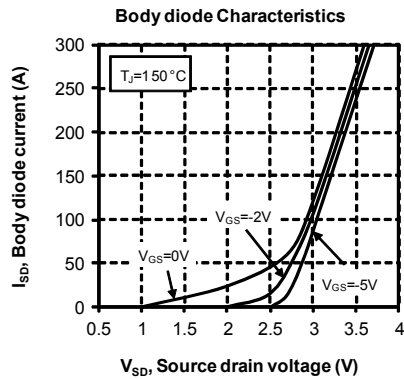
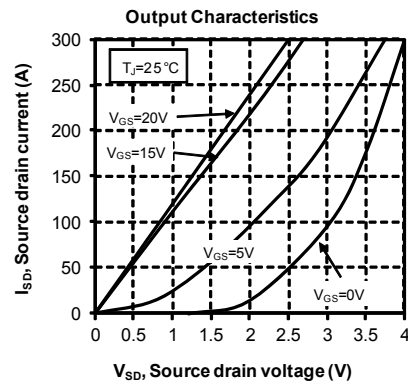
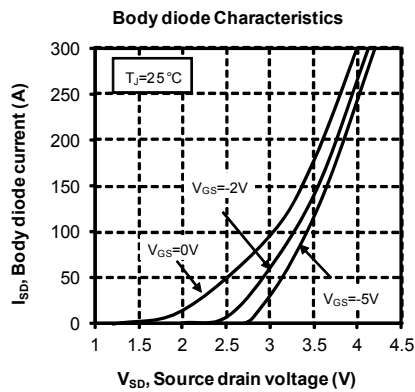
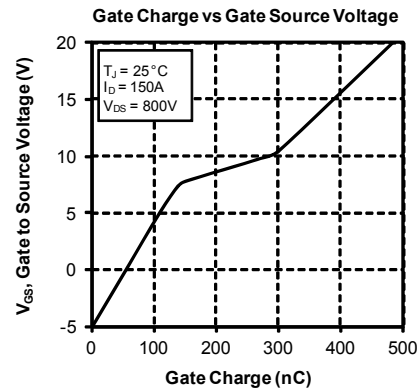
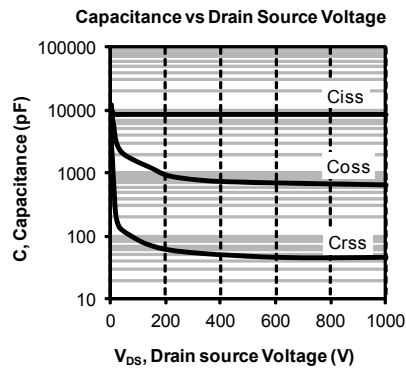
Package outline (dimensions in mm)



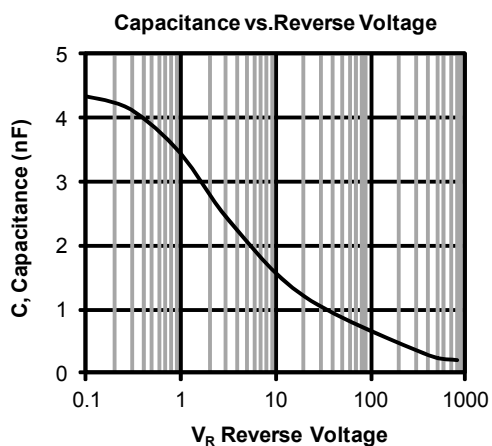
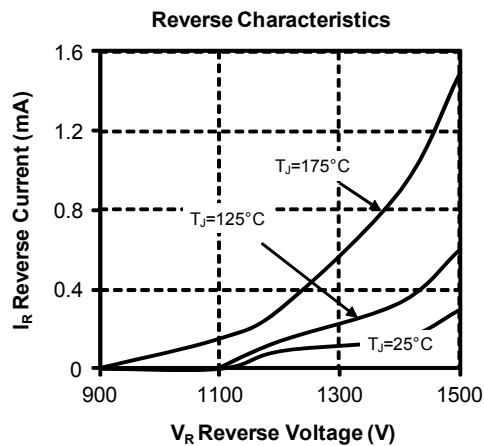
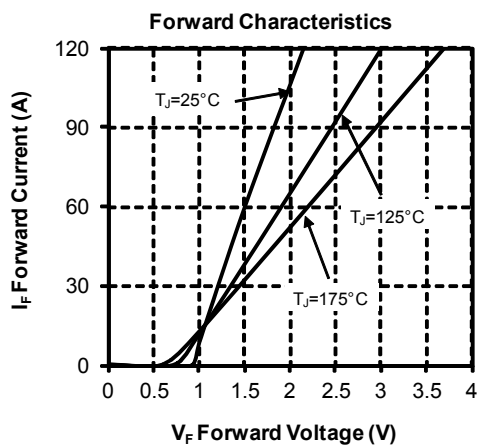
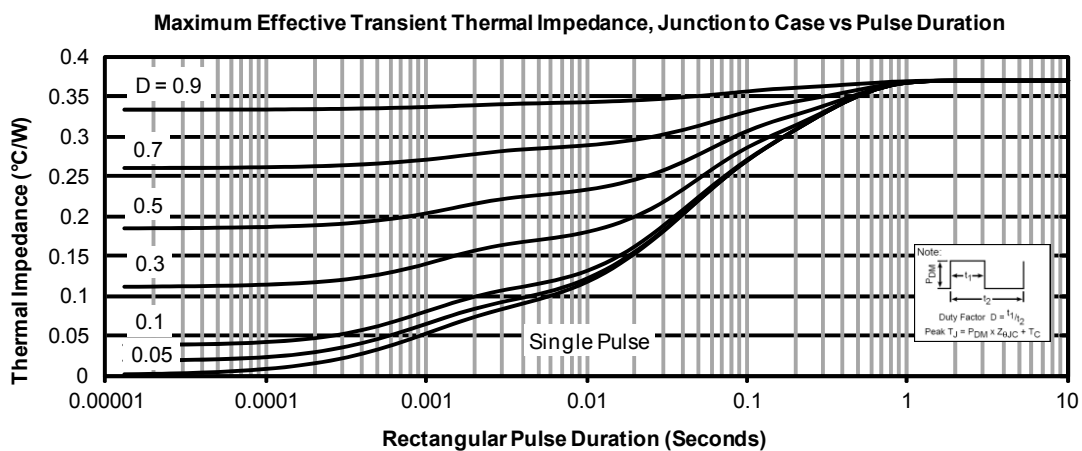
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

Typical SiC MOSFET Performance Curve





Typical SiC diode Performance Curve



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