

*Phase leg
Series & SiC parallel diodes
Super Junction
MOSFET Power Module*

$V_{DSS} = 900V$

$R_{DSon} = 60m\Omega \text{ max @ } T_j = 25^\circ C$

$I_D = 59A \text{ @ } T_c = 25^\circ C$

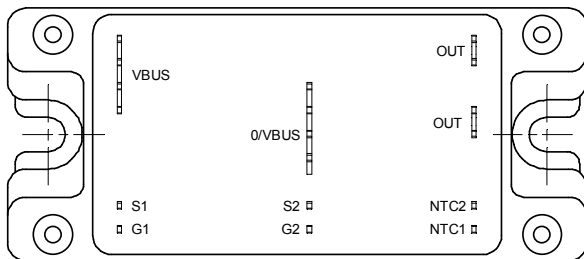
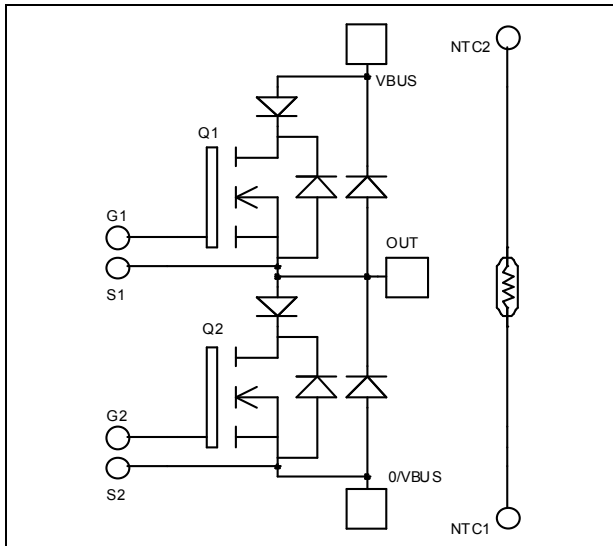
Application

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

Features



- Ultra low R_{DSon}
- Low Miller capacitance
- Ultra low gate charge
- Avalanche energy rated
- **Parallel 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
 - Symmetrical design
 - Lead frames for power connections
- Internal thermistor for temperature monitoring
- High level of integration



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

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	900	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	59
		$T_c = 80^\circ C$	44
I_{DM}	Pulsed Drain current	150	A
V_{GS}	Gate - Source Voltage	± 20	V
R_{DSon}	Drain - Source ON Resistance	60	$m\Omega$
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	462
I_{AR}	Avalanche current (repetitive and non repetitive)	8.8	A
E_{AR}	Repetitive Avalanche Energy	2.9	mJ
E_{AS}	Single Pulse Avalanche Energy	1940	

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

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

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 900V$	$T_j = 25^\circ\text{C}$			200	μA
		$V_{GS} = 0V, V_{DS} = 900V$	$T_j = 125^\circ\text{C}$		1000		
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 52A$			50	60	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 6\text{mA}$		2.5	3	3.5	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$				200	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V; V_{DS} = 100V$ $f = 1\text{MHz}$		13.6		nF
C_{oss}	Output Capacitance			0.66		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 400V$ $I_D = 52A$		540		nC
Q_{gs}	Gate – Source Charge			64		
Q_{gd}	Gate – Drain Charge			230		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C)		70		ns
T_r	Rise Time	$V_{GS} = 10V$		20		
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 600V$		400		
T_f	Fall Time	$I_D = 52A$ $R_G = 3.8\Omega$		25		
E_{on}	Turn-on Switching Energy	Inductive switching @ 25°C		1.8		mJ
E_{off}	Turn-off Switching Energy	$V_{GS} = 10V; V_{Bus} = 600V$ $I_D = 52A; R_G = 3.8\Omega$		1.5		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125°C		2.52		mJ
E_{off}	Turn-off Switching Energy	$V_{GS} = 10V; V_{Bus} = 600V$ $I_D = 52A; R_G = 3.8\Omega$		1.7		

Series diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage		200			V
I_{RM}	Maximum Reverse Leakage Current	$V_R = 200V$	$T_j = 25^\circ\text{C}$		350	μA
			$T_j = 125^\circ\text{C}$		600	
I_F	DC Forward Current	$T_c = 85^\circ\text{C}$		60		A
V_F	Diode Forward Voltage	$I_F = 60A$		1.1	1.15	V
		$I_F = 120A$		1.4		
		$I_F = 60A$	$T_j = 125^\circ\text{C}$	0.9		
t_{rr}	Reverse Recovery Time	$I_F = 60A$ $V_R = 133V$ $di/dt = 400A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	24		ns
			$T_j = 125^\circ\text{C}$	48		
Q_{rr}	Reverse Recovery Charge	$I_F = 60A$ $V_R = 133V$ $di/dt = 400A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	66		nC
			$T_j = 125^\circ\text{C}$	300		

SiC parallel diode ratings and characteristics

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		64	400	μA
			T _j = 175°C		112	2000	
I _F	DC Forward Current	T _c = 100°C			20		A
V _F	Diode Forward Voltage	I _F = 20A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2.3	3	
Q _C	Total Capacitive Charge	I _F = 20A, V _R = 600V di/dt = 1000A/μs			80		nC
C	Total Capacitance	f = 1MHz, V _R = 200V			192		pF
		f = 1MHz, V _R = 400V			138		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R _{thJC}	Junction to Case Thermal Resistance	Transistor				0.27	°C/W
		Series diode				0.65	
		SiC Parallel diode				1	
V _{ISOL}	RMS Isolation Voltage, any terminal to case t = 1 min, I _{isol} < 1mA, 50/60Hz			4000			V
T _J	Operating junction temperature range			-40		150	°C
T _{STG}	Storage Temperature Range			-40		125	
T _C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To Heatsink	M5	2.5		4.7	N.m
Wt	Package Weight					160	g

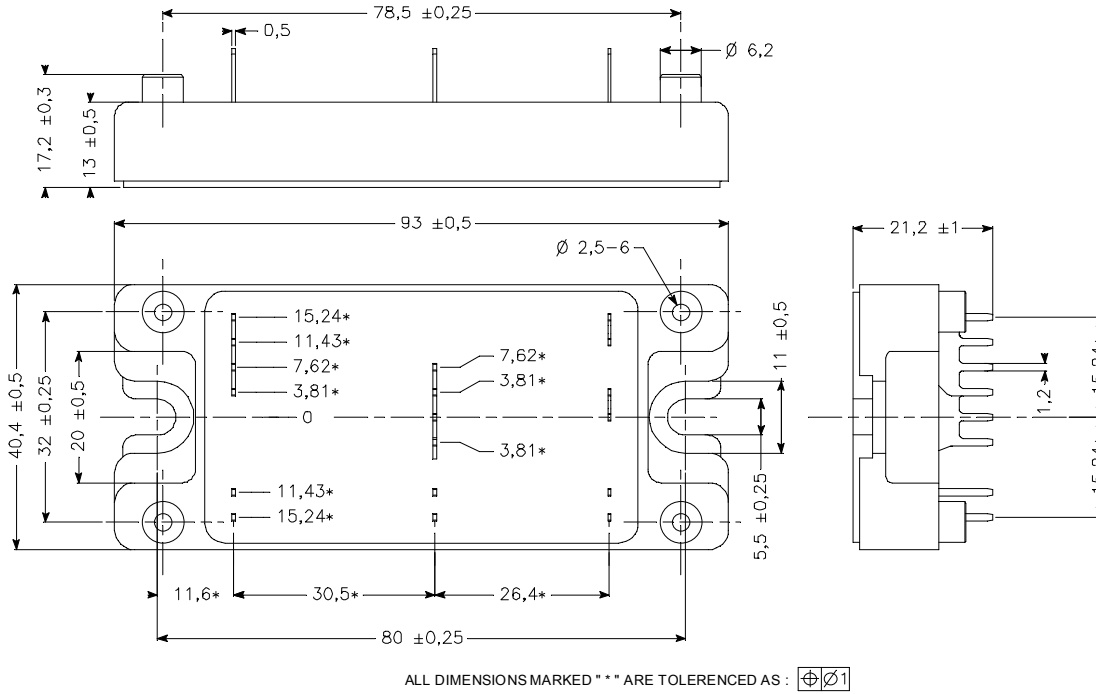
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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		%

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

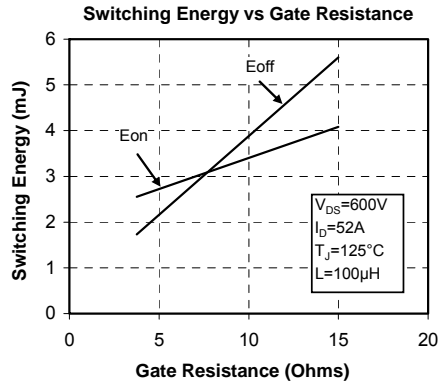
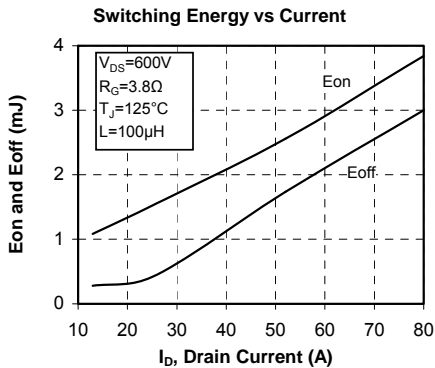
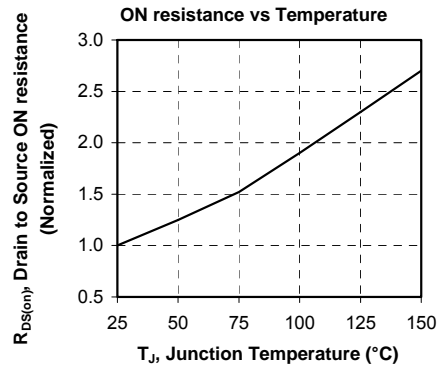
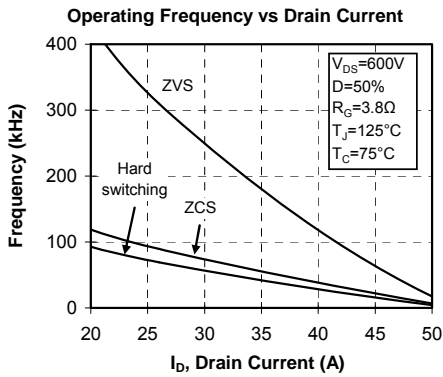
T: Thermistor temperature
 R_T: Thermistor value at T

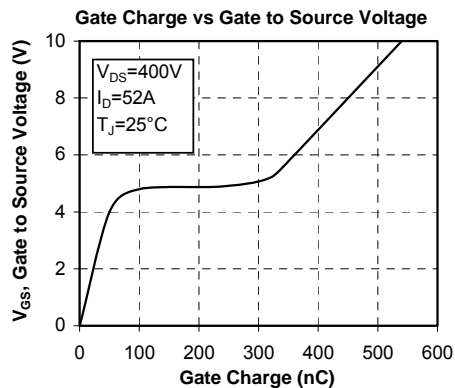
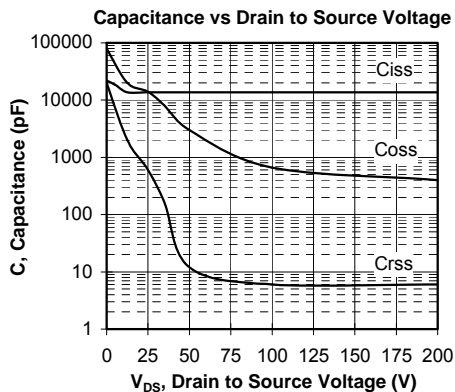
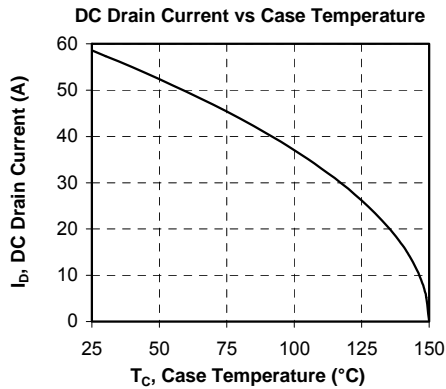
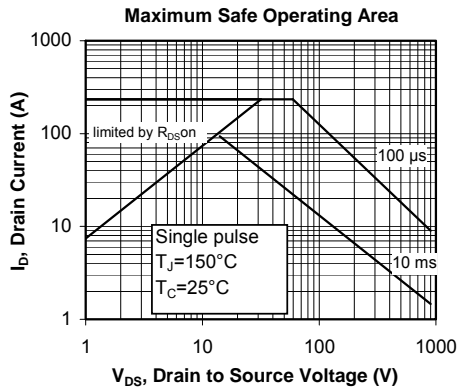
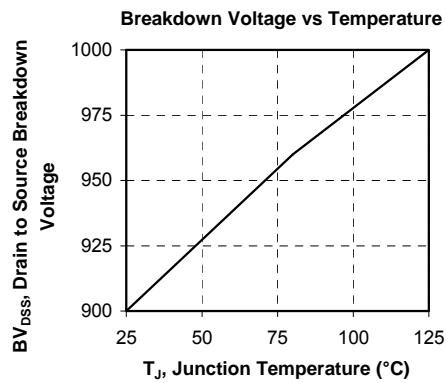
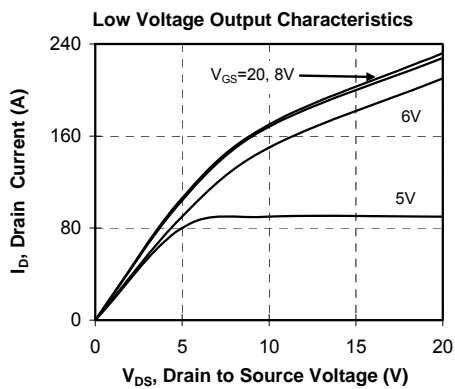
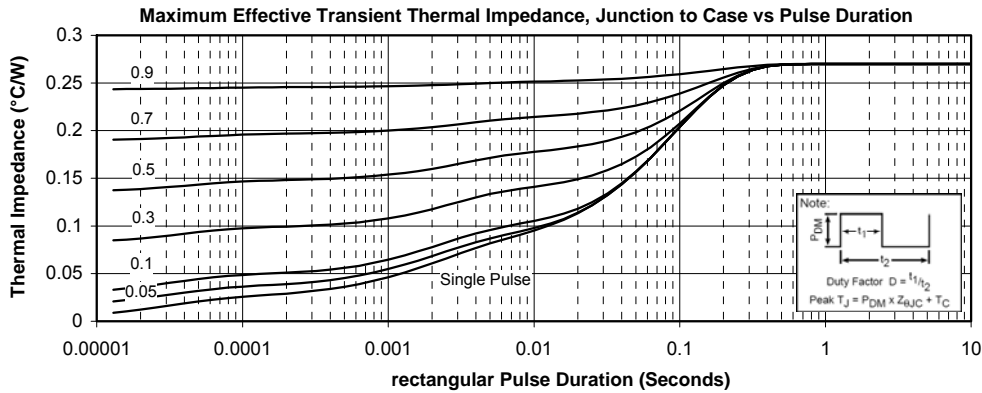
SP4 Package outline (dimensions in mm)



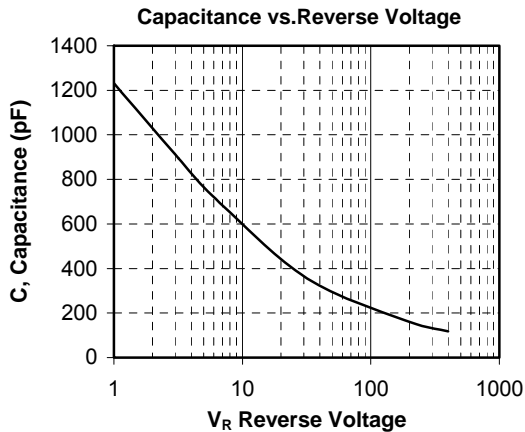
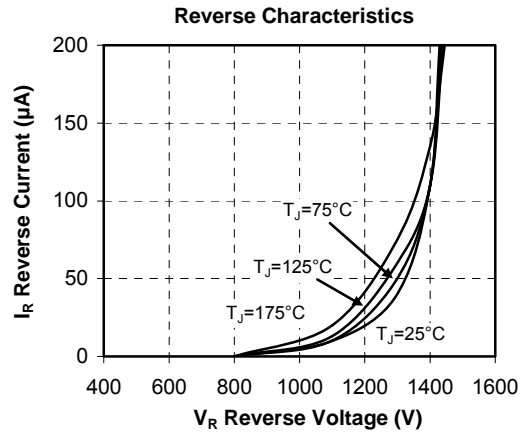
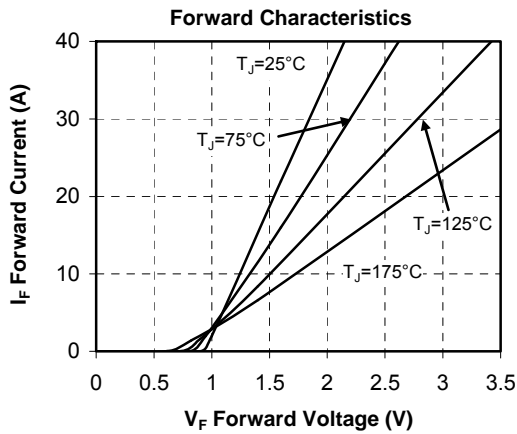
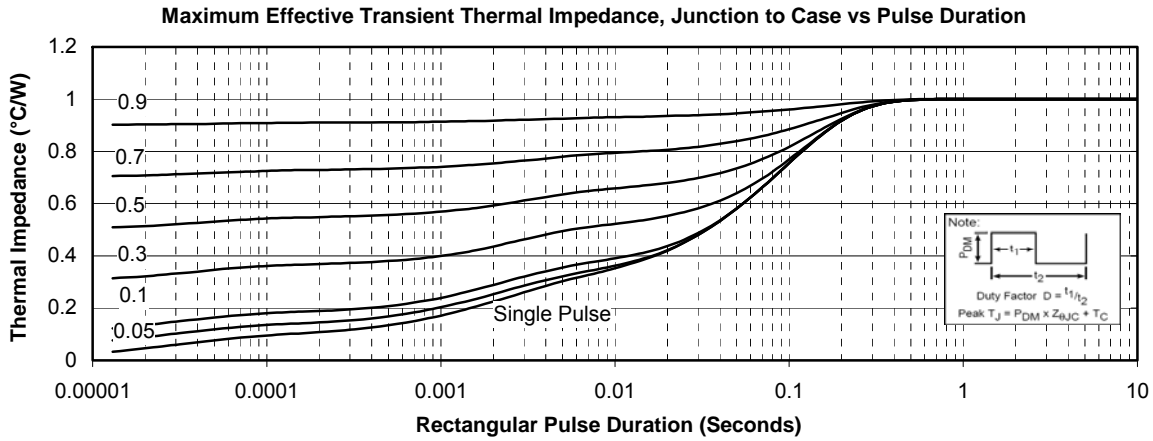
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

Typical CoolMOS Performance Curve





Typical parallel SiC Diode Performance Curve



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