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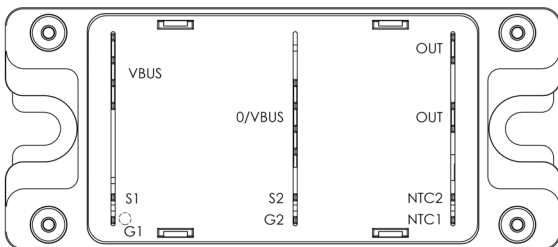
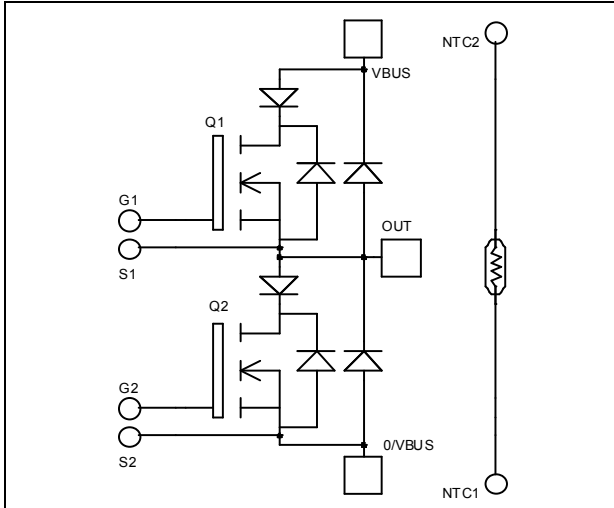
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*Phase leg Series & SiC parallel diodes
MOSFET Power Module*

$V_{DSS} = 500V$
 $R_{DSon} = 38m\Omega$ typ @ $T_j = 25^\circ C$
 $I_D = 90A$ @ $T_c = 25^\circ C$



Application

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

Features

- **Power MOS 7[®] MOSFETs**
 - Low R_{DSon}
 - Low input and Miller capacitance
 - 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

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

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	500	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	90
		$T_c = 80^\circ C$	67
I_{DM}	Pulsed Drain current	360	
V_{GS}	Gate - Source Voltage	± 30	V
R_{DSon}	Drain - Source ON Resistance	45	$m\Omega$
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	694
I_{AR}	Avalanche current (repetitive and non repetitive)	46	A
E_{AR}	Repetitive Avalanche Energy	50	mJ
E_{AS}	Single Pulse Avalanche Energy	2500	

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

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I _{DSS}	Zero Gate Voltage Drain Current	V _{GS} = 0V, V _{DS} = 500V T _j = 25°C			200	μA
		V _{GS} = 0V, V _{DS} = 400V T _j = 125°C			1000	
R _{DS(on)}	Drain – Source on Resistance	V _{GS} = 10V, I _D = 45A		38	45	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 5mA	3		5	V
I _{GSS}	Gate – Source Leakage Current	V _{GS} = ±30 V, V _{DS} = 0V			±150	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{iss}	Input Capacitance	V _{GS} = 0V		11.2		nF
C _{oss}	Output Capacitance	V _{DS} = 25V		2.36		
C _{rss}	Reverse Transfer Capacitance	f = 1MHz		0.18		
Q _g	Total gate Charge	V _{GS} = 10V V _{Bus} = 250V I _D = 90A		246		nC
Q _{gs}	Gate – Source Charge			66		
Q _{gd}	Gate – Drain Charge			130		
T _{d(on)}	Turn-on Delay Time	Inductive switching @ 125°C V _{GS} = 15V V _{Bus} = 333V I _D = 90A R _G = 2Ω		18		ns
T _r	Rise Time			35		
T _{d(off)}	Turn-off Delay Time			87		
T _f	Fall Time			77		
E _{on}	Turn-on Switching Energy	Inductive switching @ 25°C V _{GS} = 15V, V _{Bus} = 333V I _D = 90A, R _G = 2Ω		906		μJ
E _{off}	Turn-off Switching Energy			1452		
E _{on}	Turn-on Switching Energy	Inductive switching @ 125°C V _{GS} = 15V, V _{Bus} = 333V I _D = 90A, R _G = 2Ω		1490		μJ
E _{off}	Turn-off Switching Energy			1692		
R _{thJC}	Junction to Case Thermal Resistance				0.18	°C/W

Series diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{RRM}	Maximum Peak Repetitive Reverse Voltage		600			V
I _{RM}	Maximum Reverse Leakage Current	V _R = 600V			250	μA
I _F	DC Forward Current	T _c = 85°C		90		A
V _F	Diode Forward Voltage	I _F = 90A		1.6	1.8	V
		I _F = 180A		1.9		
		I _F = 90A T _j = 125°C		1.4		
t _{rr}	Reverse Recovery Time	I _F = 90A V _R = 400V di/dt = 600A/μs	T _j = 25°C	85		ns
			T _j = 125°C	160		
Q _{rr}	Reverse Recovery Charge	I _F = 90A V _R = 400V di/dt = 600A/μs	T _j = 25°C	390		nC
			T _j = 125°C	2100		
R _{thJC}	Junction to Case Thermal Resistance				0.45	°C/W

Parallel diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V _{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I _{RM}	Maximum Reverse Leakage Current	V _R =600V	T _j = 25°C		250	1000	μA
			T _j = 175°C		500	5000	
I _F	DC Forward Current	T _c = 125°C			50		A
V _F	Diode Forward Voltage	I _F = 50A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2.0	2.4	
Q _C	Total Capacitive Charge	I _F = 50A, V _R = 300V di/dt = 1400A/μs			70		nC
Q	Total Capacitance	f = 1MHz, V _R = 200V			325		pF
		f = 1MHz, V _R = 400V			250		
R _{thJC}	Junction to Case Thermal Resistance					0.5	°C/W

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	150	°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	100	
Torque	Mounting torque	To heatsink	M5	
Wt	Package Weight			g

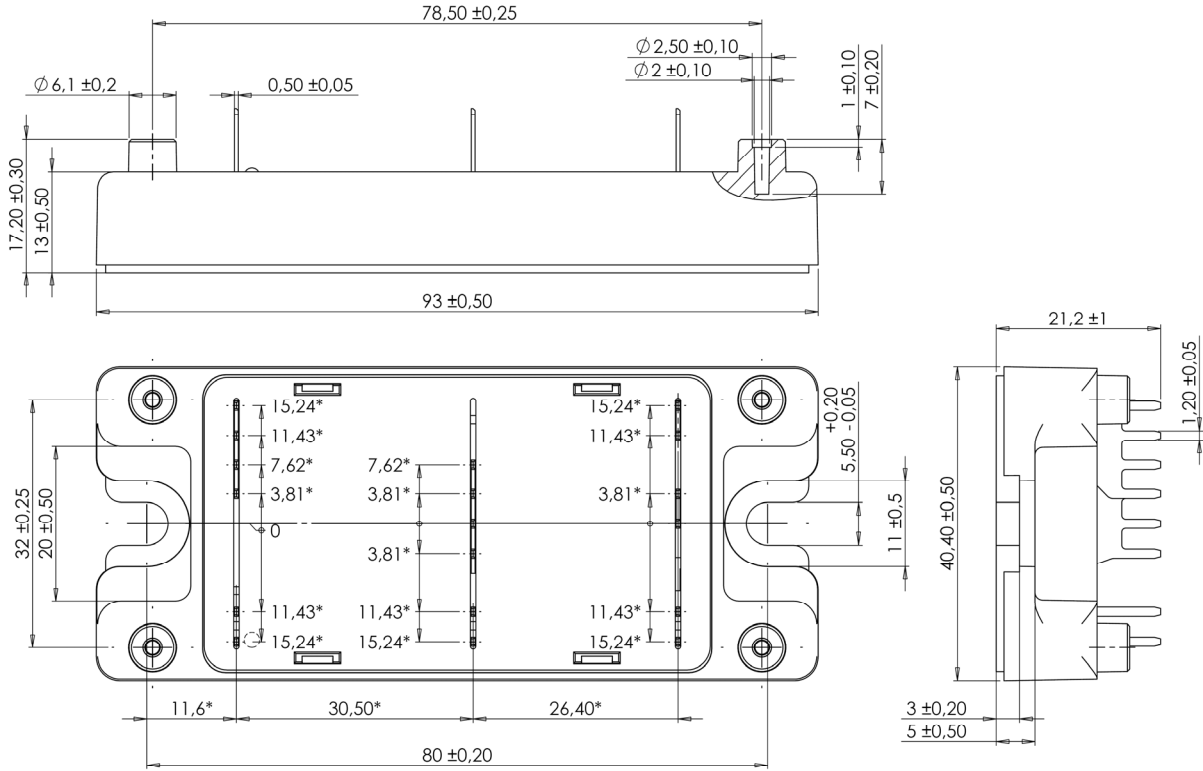
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

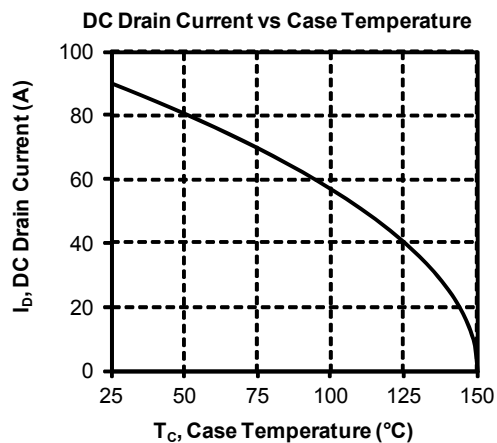
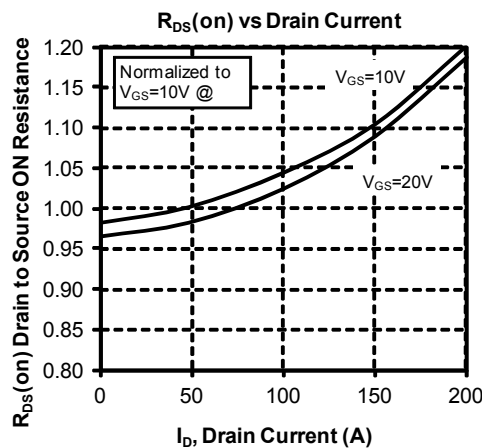
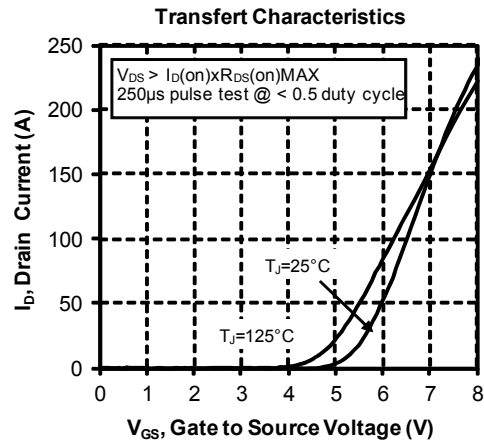
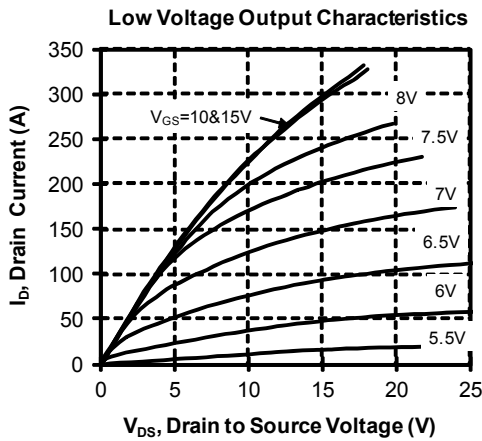
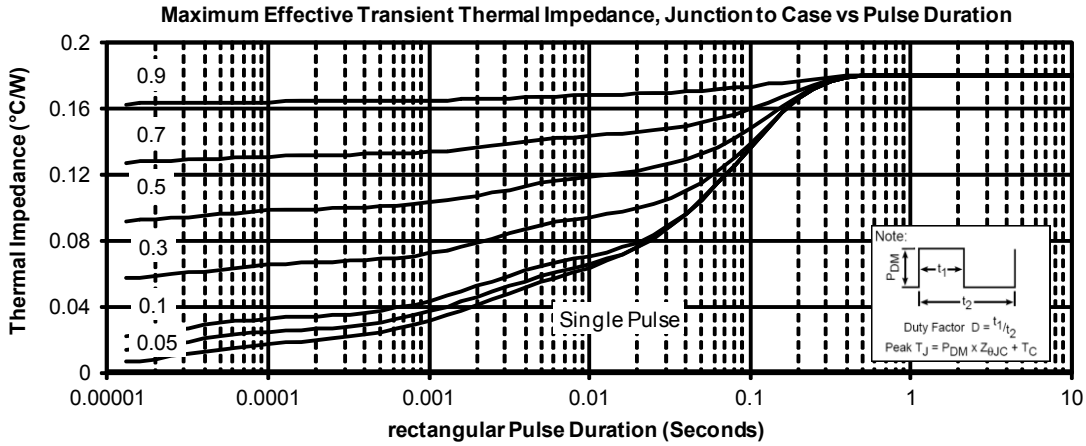
SP4 Package outline (dimensions in mm)

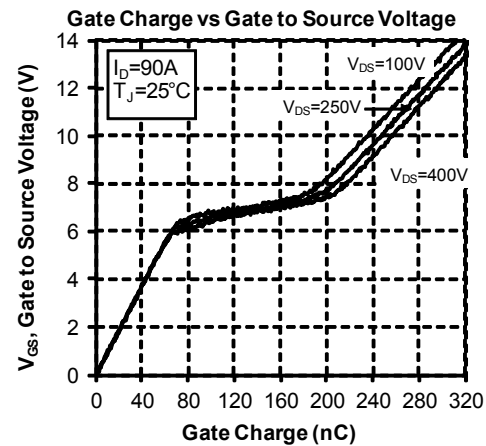
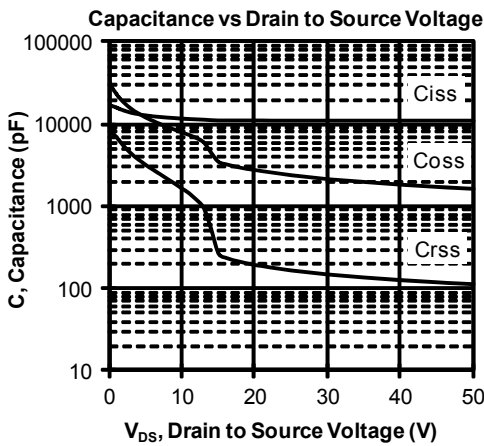
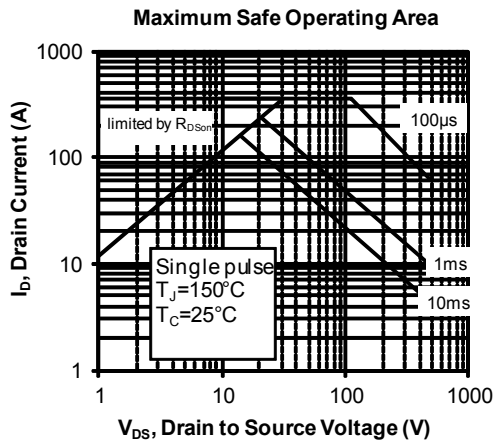
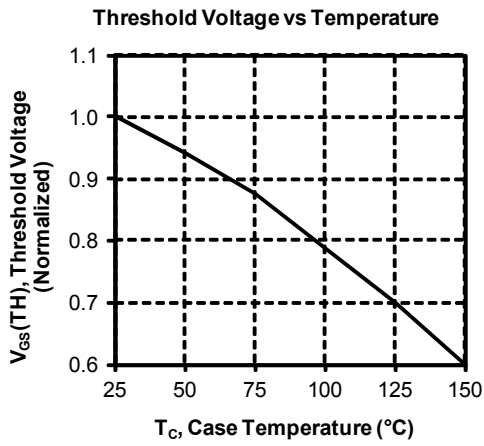
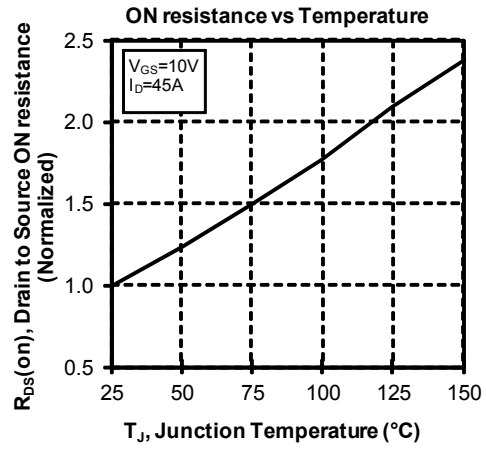
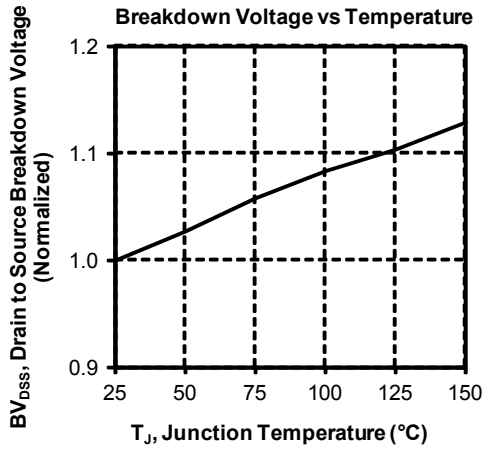


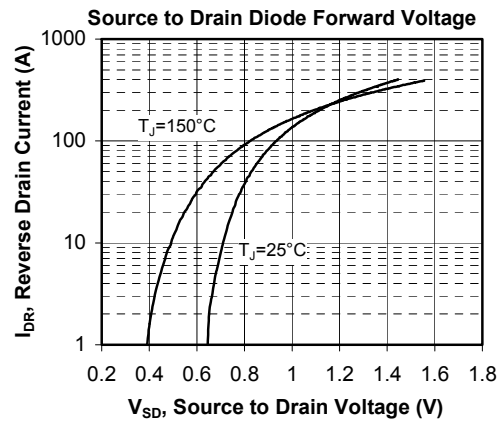
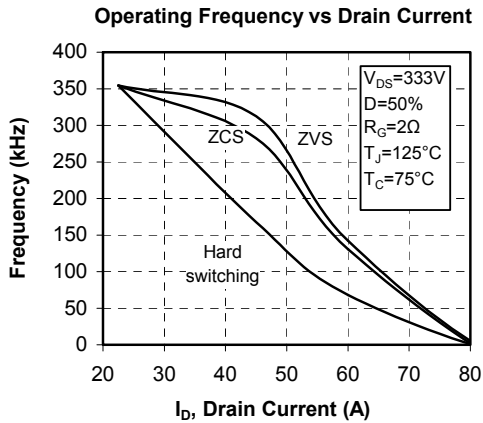
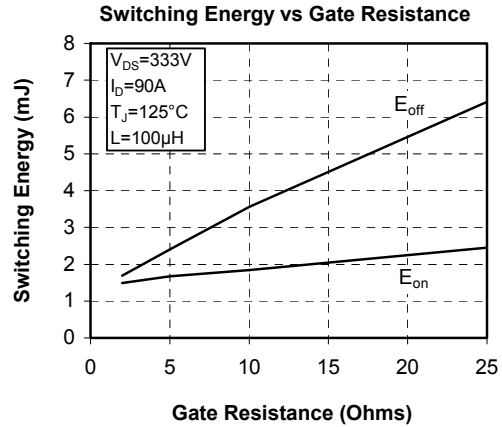
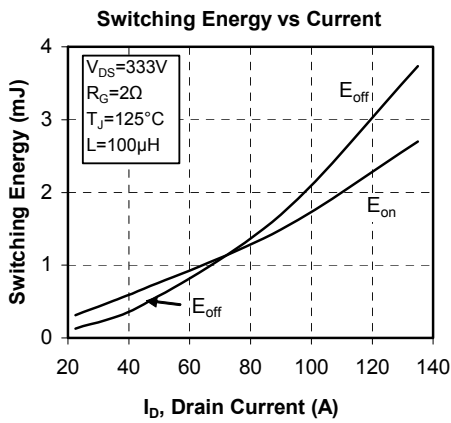
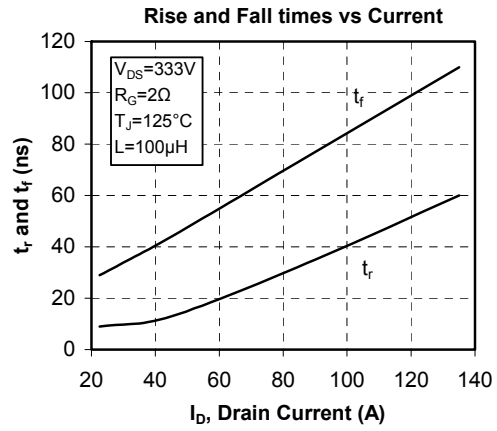
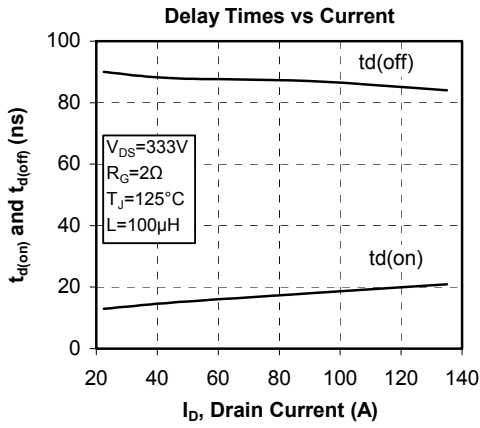
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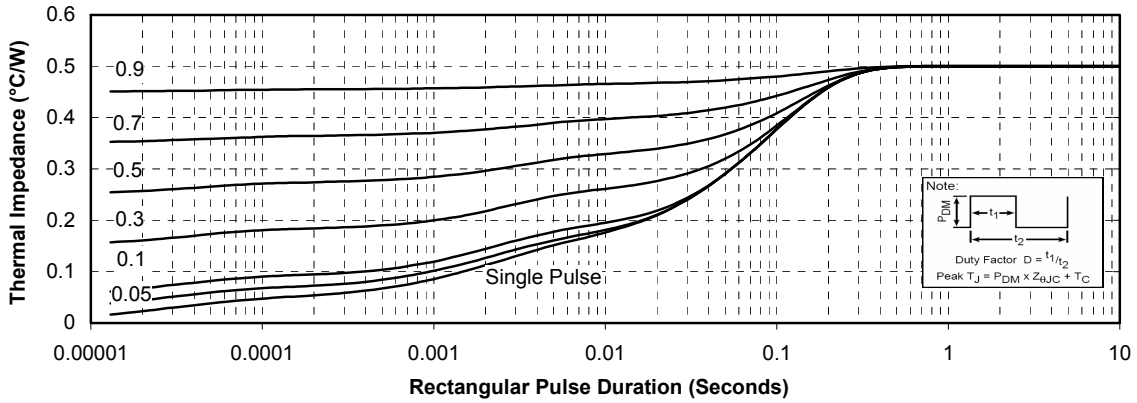
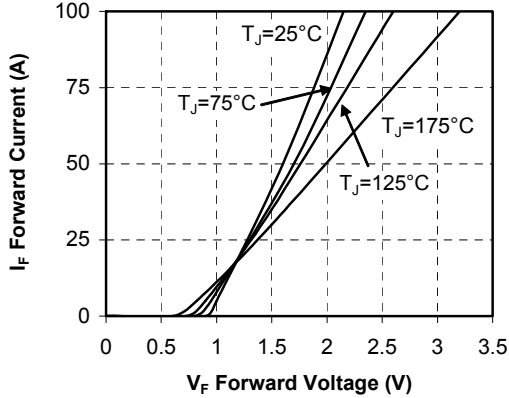
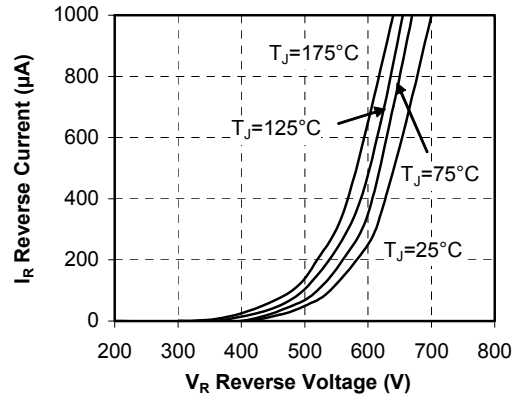
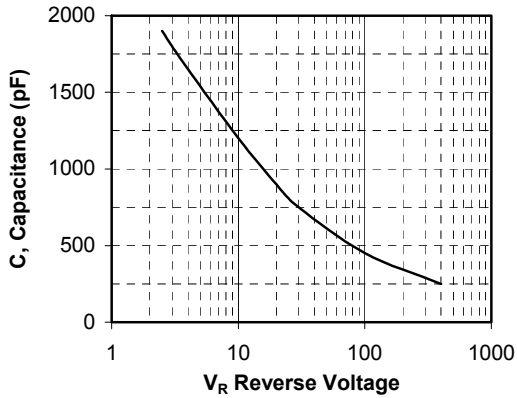
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

Typical MOSFET Performance Curve







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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