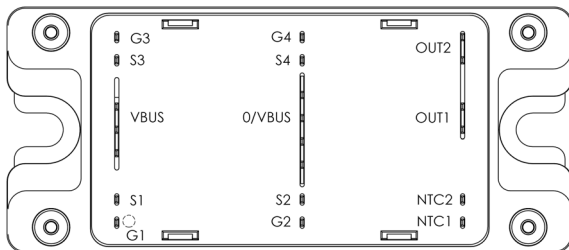
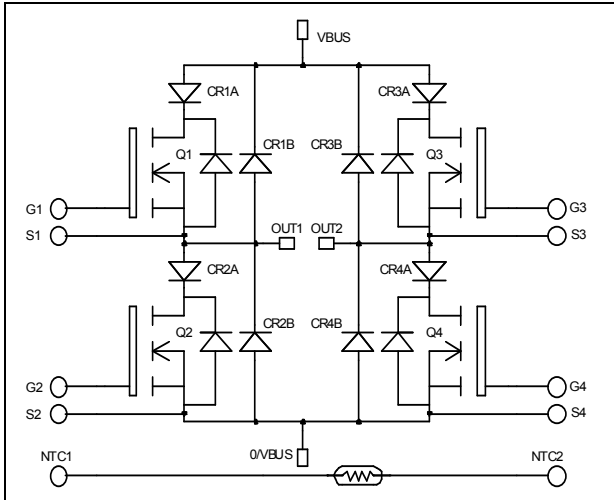


**Full – Bridge Series & SiC parallel diodes  
Super Junction MOSFET Power Module**

**$V_{DSS} = 600V$   
 $R_{DSon} = 45m\Omega \text{ max @ } T_j = 25^\circ C$   
 $I_D = 49A \text{ @ } T_c = 25^\circ C$**



### Application

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

### Features

- CoolMOS™
  - 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
- 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 Voltage	600	V
$I_D$	Continuous Drain Current	$T_c = 25^\circ C$	49
		$T_c = 80^\circ C$	38
$I_{DM}$	Pulsed Drain current	130	A
$V_{GS}$	Gate - Source Voltage	$\pm 20$	V
$R_{DSon}$	Drain - Source ON Resistance	45	$m\Omega$
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	250
$I_{AR}$	Avalanche current (repetitive and non repetitive)	15	A
$E_{AR}$	Repetitive Avalanche Energy	3	mJ
$E_{AS}$	Single Pulse Avalanche Energy	1900	

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on [www.microsemi.com](http://www.microsemi.com)

**Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 600V			25	μA
		T <sub>j</sub> = 25°C				
		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 600V			250	
R <sub>DS(on)</sub>	Drain – Source on Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 22.5A		40	45	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 3mA	2.1	3	3.9	V
I <sub>GSS</sub>	Gate – Source Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0V			100	nA

**Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V ; V <sub>DS</sub> = 25V f = 1MHz		7.2		nF
C <sub>oss</sub>	Output Capacitance			8.5		
Q <sub>g</sub>	Total gate Charge	V <sub>GS</sub> = 10V V <sub>Bus</sub> = 300V I <sub>D</sub> = 44A		150		nC
Q <sub>gs</sub>	Gate – Source Charge			34		
Q <sub>gd</sub>	Gate – Drain Charge			51		
T <sub>d(on)</sub>	Turn-on Delay Time	<b>Inductive switching @ 125°C</b> V <sub>GS</sub> = 10V V <sub>Bus</sub> = 400V I <sub>D</sub> = 50A R <sub>G</sub> = 5Ω		21		ns
T <sub>r</sub>	Rise Time			30		
T <sub>d(off)</sub>	Turn-off Delay Time			100		
T <sub>f</sub>	Fall Time			45		
E <sub>on</sub>	Turn-on Switching Energy	<b>Inductive switching @ 25°C</b> V <sub>GS</sub> = 10V ; V <sub>Bus</sub> = 400V I <sub>D</sub> = 50A ; R <sub>G</sub> = 5Ω		405		μJ
E <sub>off</sub>	Turn-off Switching Energy			520		
E <sub>on</sub>	Turn-on Switching Energy	<b>Inductive switching @ 125°C</b> V <sub>GS</sub> = 10V ; V <sub>Bus</sub> = 400V I <sub>D</sub> = 50A ; R <sub>G</sub> = 5Ω		658		μJ
E <sub>off</sub>	Turn-off Switching Energy			635		
R <sub>thJC</sub>	Junction to Case Thermal Resistance				0.5	°C/W

**Series diode ratings and characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V <sub>RRM</sub>	Peak Repetitive Reverse Voltage				600	V
I <sub>RM</sub>	Reverse Leakage Current	V <sub>R</sub> = 600V			50	μA
I <sub>F</sub>	DC Forward current	T <sub>c</sub> = 80°C		50		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 50A V <sub>GE</sub> = 0V	T <sub>j</sub> = 25°C	1.6	2	V
			T <sub>j</sub> = 150°C	1.5		
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 50A V <sub>R</sub> = 300V di/dt = 1800A/μs	T <sub>j</sub> = 25°C	100		ns
			T <sub>j</sub> = 150°C	150		
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>j</sub> = 25°C	2.6		μC
			T <sub>j</sub> = 150°C	5.4		
E <sub>rr</sub>	Reverse Recovery Energy		T <sub>j</sub> = 25°C	0.60		mJ
			T <sub>j</sub> = 150°C	1.2		
R <sub>thJC</sub>	Junction to Case Thermal Resistance				1.42	°C/W

**Parallel diode ratings and characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage		600			V
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> =600V		100	400	μA
				200	2000	
I <sub>F</sub>	DC Forward Current			20		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 20A		1.6	1.8	V
				2.0	2.4	
Q <sub>C</sub>	Total Capacitive Charge	I <sub>F</sub> = 20A, V <sub>R</sub> = 300V di/dt = 800A/μs		28		nC
C	Total Capacitance	f = 1MHz, V <sub>R</sub> = 200V		130		pF
		f = 1MHz, V <sub>R</sub> = 400V		100		
R <sub>thJC</sub>	Junction to Case Thermal Resistance				1.5	°C/W

**Thermal and package characteristics**

Symbol	Characteristic	Min	Max	Unit		
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t = 1 min, 50/60Hz	4000		V		
T <sub>J</sub>	Operating junction temperature range	-40	150	°C		
T <sub>JOP</sub>	Recommended junction temperature under switching conditions	-40	T <sub>Jmax</sub> -25			
T <sub>STG</sub>	Storage Temperature Range	-40	125			
T <sub>C</sub>	Operating Case Temperature	-40	100			
Torque	Mounting torque	To Heatsink	M5	1.5	4.7	N.m
Wt	Package Weight				160	g

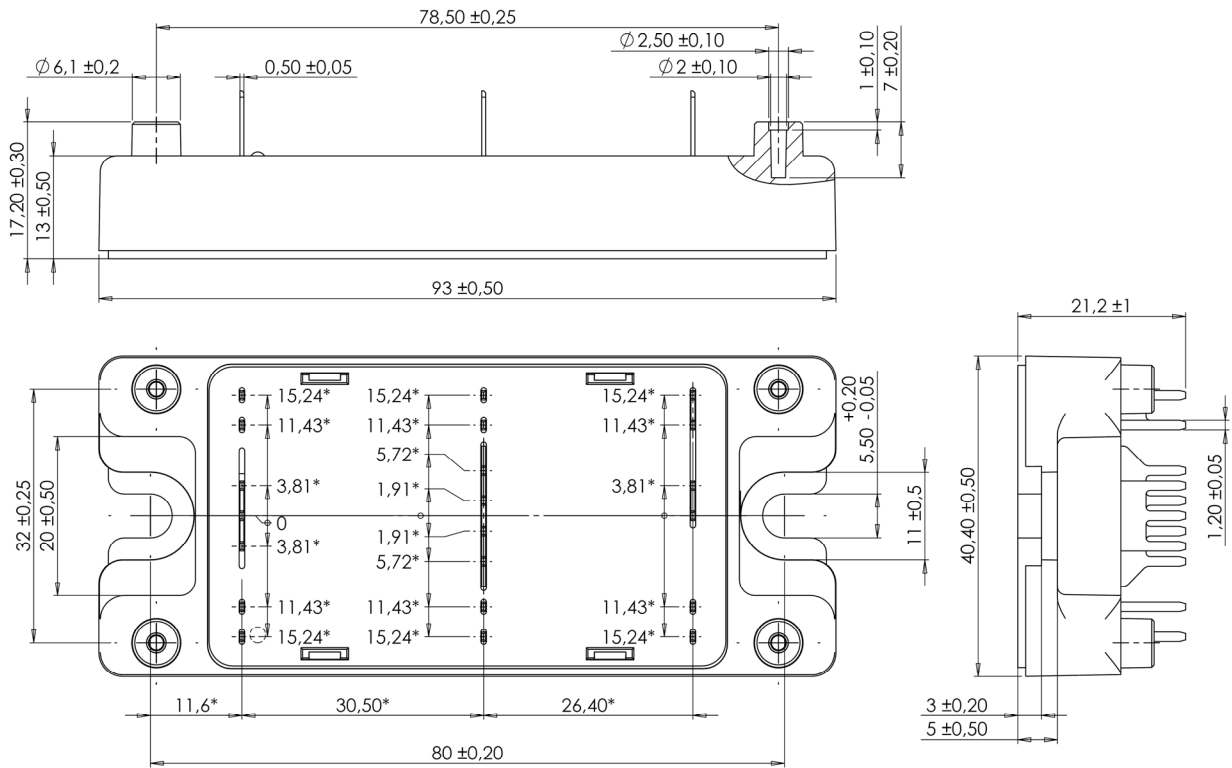
**Temperature sensor NTC** (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic	Min	Typ	Max	Unit
R <sub>25</sub>	Resistance @ 25°C		50		kΩ
ΔR <sub>25</sub> /R <sub>25</sub>			5		%
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K
ΔB/B		T <sub>C</sub> =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<sub>T</sub>: Thermistor value at T

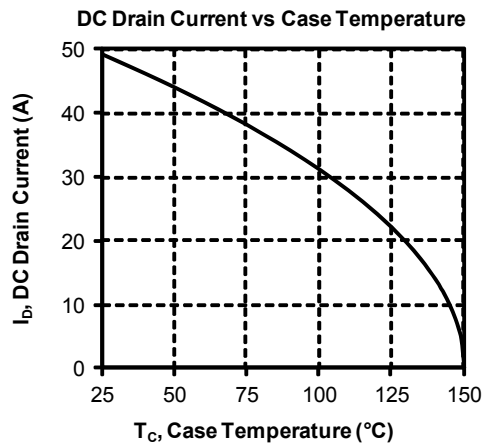
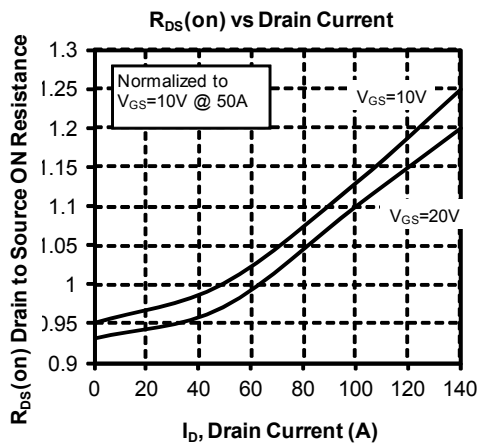
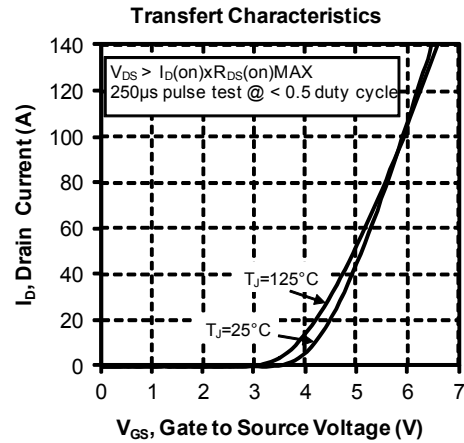
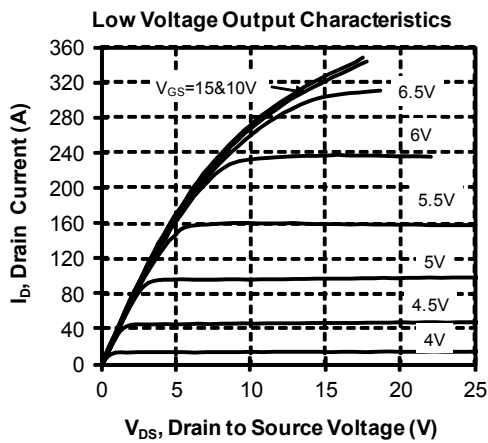
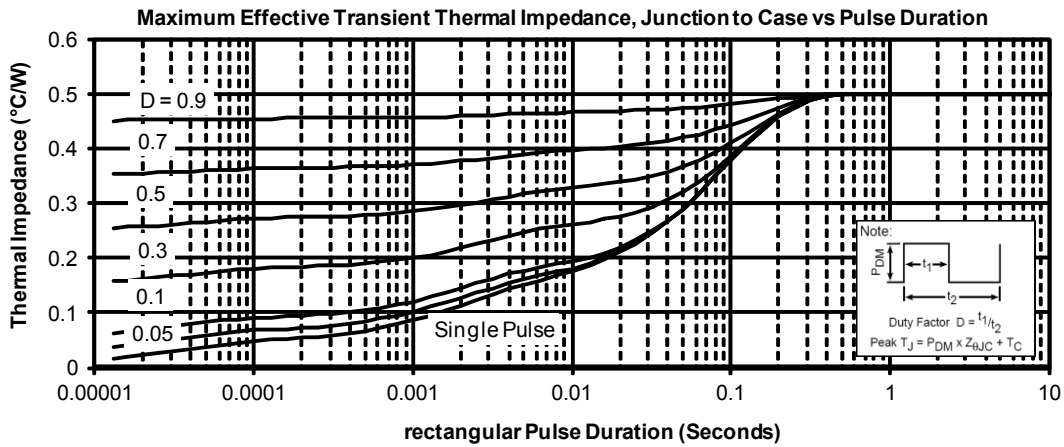
**SP4 Package outline** (dimensions in mm)

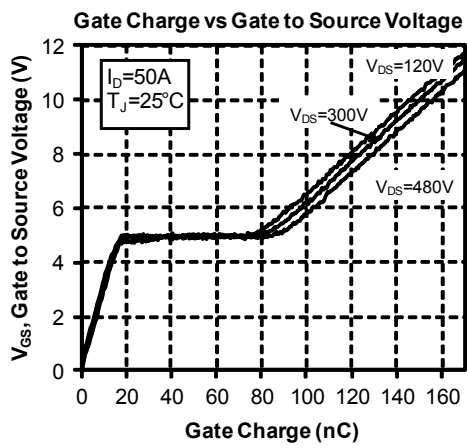
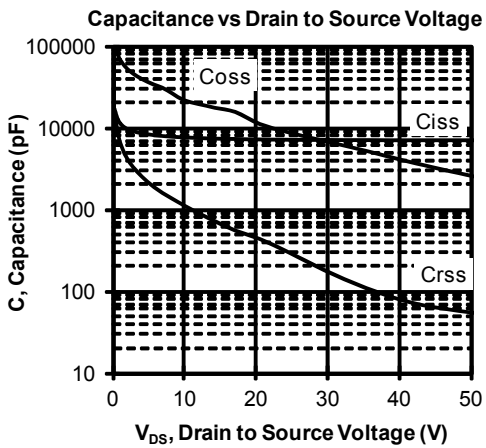
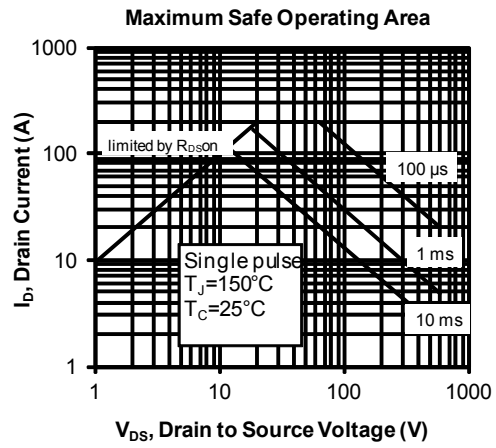
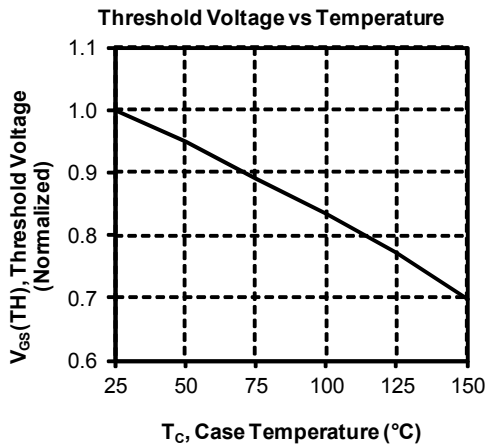
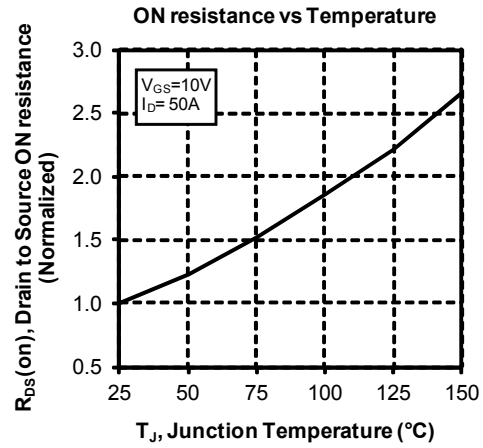
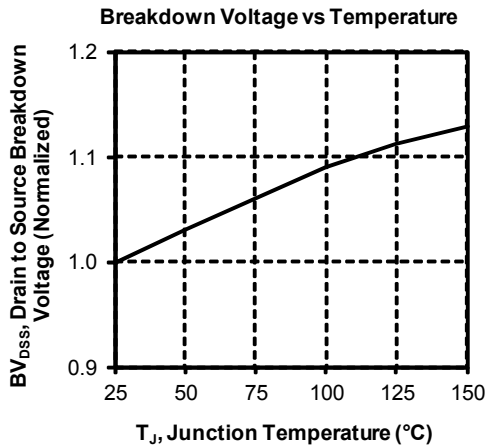


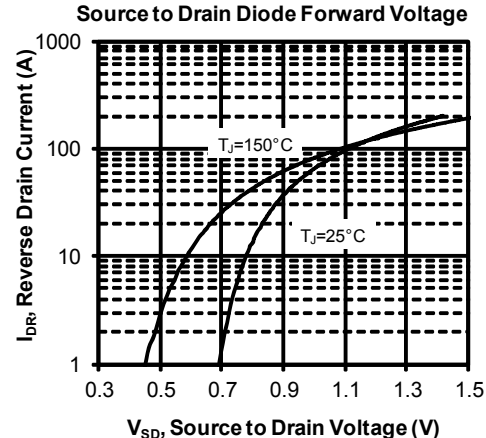
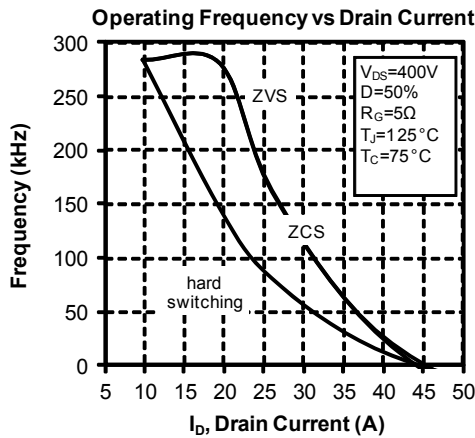
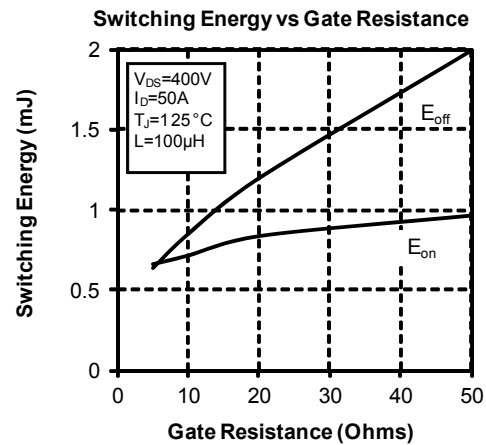
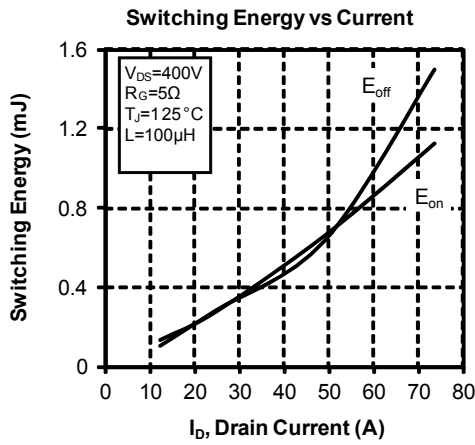
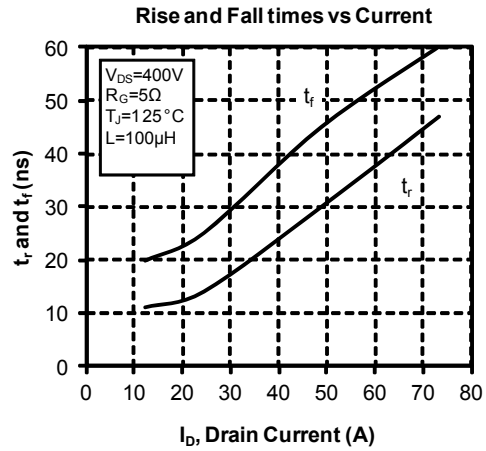
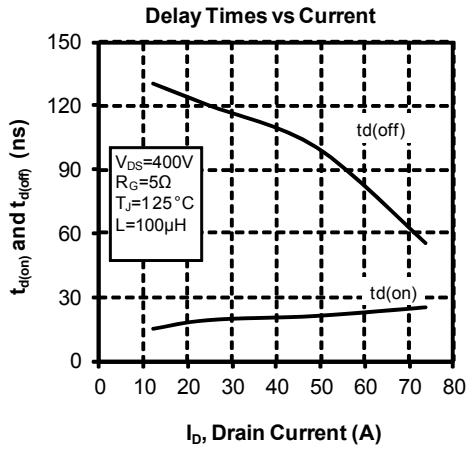
ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\pm \phi 1$

See application note APT0501 - Mounting Instructions for SP4 Power Modules on [www.microsemi.com](http://www.microsemi.com)

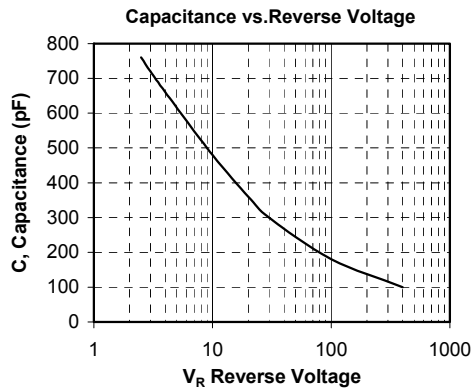
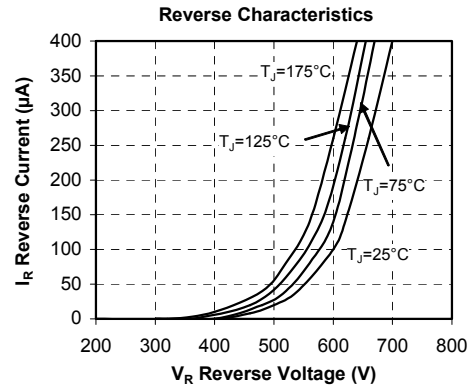
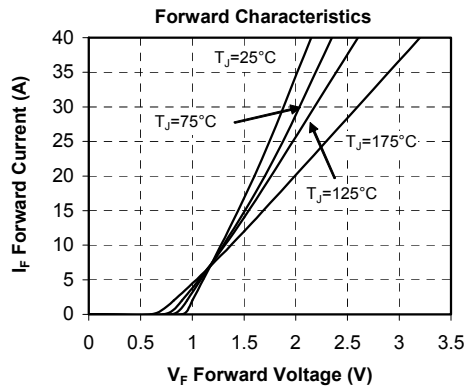
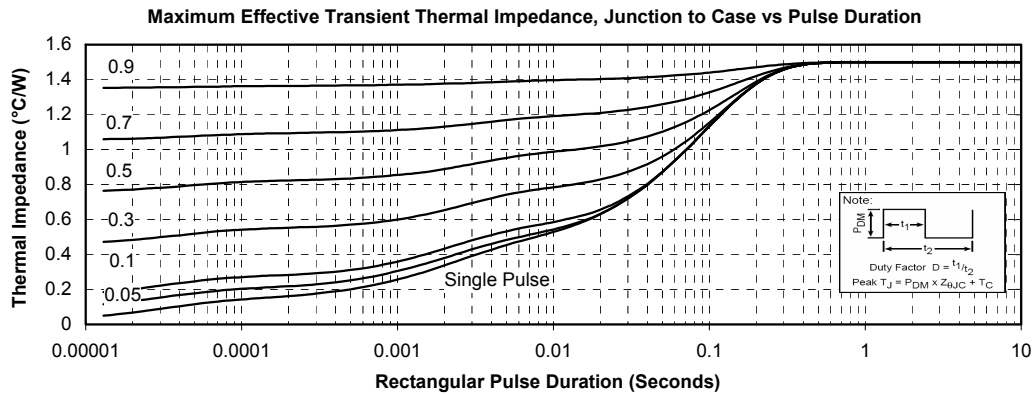
## Typical CoolMOS Performance Curve







## Typical SiC Diode Performance Curve



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