

**Full bridge  
Series & SiC parallel diodes  
MOSFET Power Module**

$V_{DSS} = 1000V$

$R_{DSon} = 450m\Omega$  typ @  $T_j = 25^\circ C$

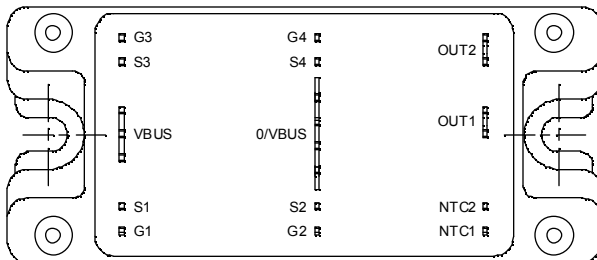
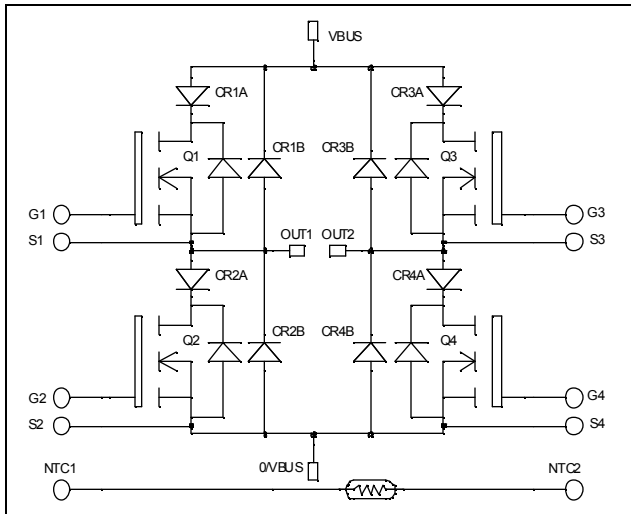
$I_D = 18A$  @  $T_c = 25^\circ C$

### Application

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

### Features

- **Power MOS 7<sup>®</sup> 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

### Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
$V_{DSS}$	Drain - Source Breakdown Voltage	1000	V
$I_D$	Continuous Drain Current	$T_c = 25^\circ C$	18
		$T_c = 80^\circ C$	14
$I_{DM}$	Pulsed Drain current	72	A
$V_{GS}$	Gate - Source Voltage	$\pm 30$	V
$R_{DSon}$	Drain - Source ON Resistance	540	$m\Omega$
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	357
$I_{AR}$	Avalanche current (repetitive and non repetitive)	18	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](http://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	$V_{GS} = 0\text{V}, V_{DS} = 1000\text{V}$			100	$\mu\text{A}$
		$V_{GS} = 0\text{V}, V_{DS} = 800\text{V}$			500	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10\text{V}, I_D = 9\text{A}$		450	540	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 2.5\text{mA}$	3		5	V
$I_{CSS}$	Gate – Source Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

**Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$		4350		pF
$C_{oss}$	Output Capacitance	$V_{DS} = 25\text{V}$		715		
$C_{rss}$	Reverse Transfer Capacitance	$f = 1\text{MHz}$		120		
$Q_g$	Total gate Charge	$V_{GS} = 10\text{V}$		154		nC
$Q_{gs}$	Gate – Source Charge	$V_{Bus} = 500\text{V}$		26		
$Q_{gd}$	Gate – Drain Charge	$I_D = 18\text{A}$		97		
$T_{d(on)}$	Turn-on Delay Time	<b>Inductive switching @ 125°C</b> $V_{GS} = 15\text{V}$ $V_{Bus} = 667\text{V}$ $I_D = 18\text{A}$ $R_G = 5\Omega$		10		ns
$T_r$	Rise Time			12		
$T_{d(off)}$	Turn-off Delay Time			121		
$T_f$	Fall Time			35		
$E_{on}$	Turn-on Switching Energy	<b>Inductive switching @ 25°C</b> $V_{GS} = 15\text{V}, V_{Bus} = 667\text{V}$ $I_D = 18\text{A}, R_G = 5\Omega$		383		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			380		
$E_{on}$	Turn-on Switching Energy	<b>Inductive switching @ 125°C</b> $V_{GS} = 15\text{V}, V_{Bus} = 667\text{V}$ $I_D = 18\text{A}, R_G = 5\Omega$		627		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			451		

**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	$V_R = 200\text{V}$	$T_j = 25^\circ\text{C}$		250	$\mu\text{A}$
			$T_j = 125^\circ\text{C}$		500	
$I_F$	DC Forward Current			30		A
$V_F$	Diode Forward Voltage	$I_F = 30\text{A}$		1.1	1.15	V
		$I_F = 60\text{A}$		1.4		
		$I_F = 30\text{A}$	$T_j = 125^\circ\text{C}$		0.9	
$t_{rr}$	Reverse Recovery Time	$I_F = 30\text{A}$ $V_R = 133\text{V}$ $di/dt = 200\text{A}/\mu\text{s}$	$T_j = 25^\circ\text{C}$		24	ns
			$T_j = 125^\circ\text{C}$		48	
$Q_{rr}$	Reverse Recovery Charge	$I_F = 30\text{A}$ $V_R = 133\text{V}$ $di/dt = 200\text{A}/\mu\text{s}$	$T_j = 25^\circ\text{C}$		33	nC
			$T_j = 125^\circ\text{C}$		150	

**Parallel SiC diode ratings and characteristics**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage			1200			V
I <sub>RRM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> =1200V	T <sub>j</sub> = 25°C		100	400	μA
			T <sub>j</sub> = 150°C		200	2000	
I <sub>F</sub>	DC Forward Current	T <sub>c</sub> = 125°C			10		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 10A	T <sub>j</sub> = 25°C		1.6	1.8	V
			T <sub>j</sub> = 175°C		2.6	3.0	
Q <sub>C</sub>	Total Capacitive Charge	I <sub>F</sub> = 10A, V <sub>R</sub> = 600V di/dt = 800A/μs			28		nC
Q	Total Capacitance	f = 1MHz, V <sub>R</sub> = 200V			90		pF
		f = 1MHz, V <sub>R</sub> = 400V			66		

**Thermal and package characteristics**

<i>Symbol</i>	<i>Characteristic</i>			<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
R <sub>thJC</sub>	Junction to Case Thermal Resistance	Transistor				0.35	°C/W
		Series diode				1.2	
		Parallel diode				1.5	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t = 1 min, I <sub>isol</sub> < 1mA, 50/60Hz			2500			V
T <sub>J</sub>	Operating junction temperature range			-40		150	°C
T <sub>STG</sub>	Storage Temperature Range			-40		125	
T <sub>C</sub>	Operating Case Temperature			-40		100	
Torque	Mounting torque	To Heatsink	M5	2.5		4.7	N.m
Wt	Package Weight					160	g

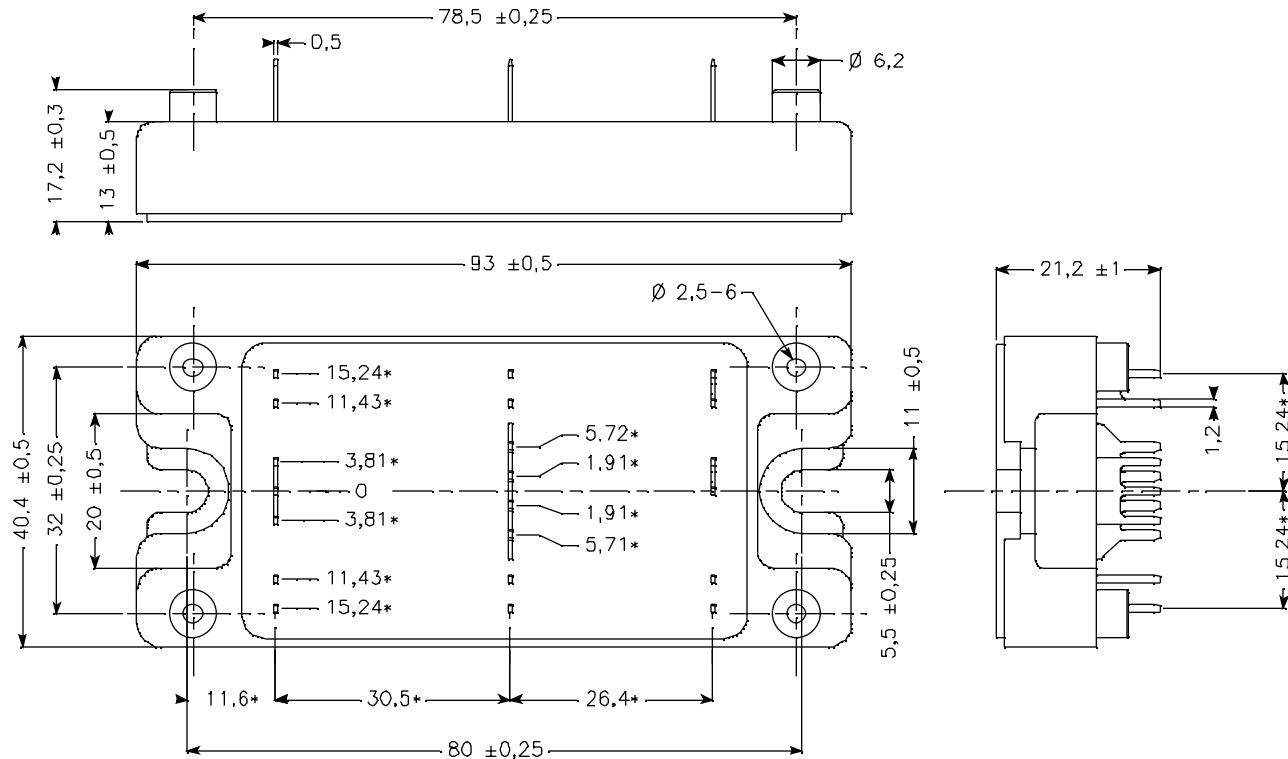
**Temperature sensor NTC** (see application note APT0406 on www.microsemi.com for more information).

<i>Symbol</i>	<i>Characteristic</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
R <sub>25</sub>	Resistance @ 25°C		50		kΩ
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K

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

T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

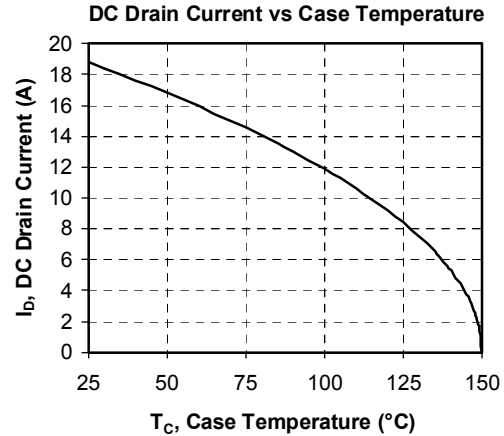
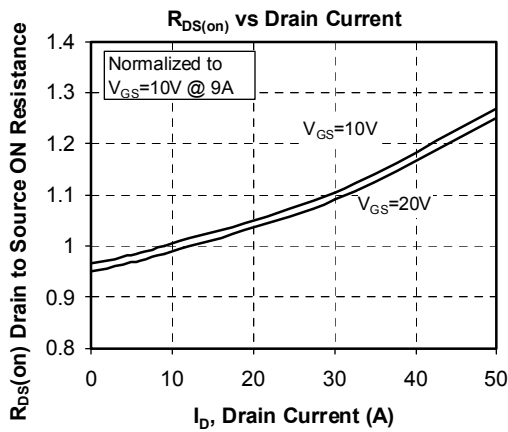
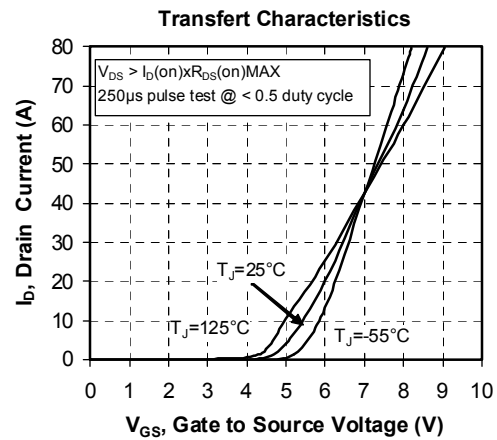
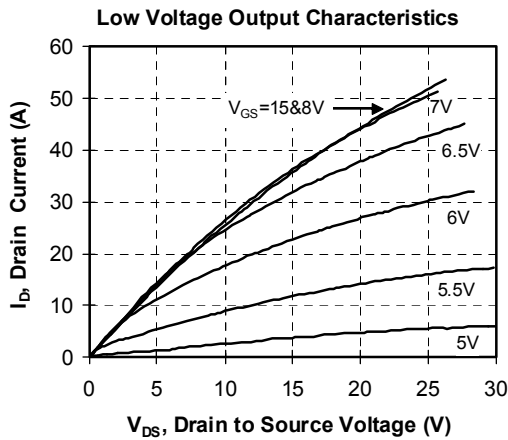
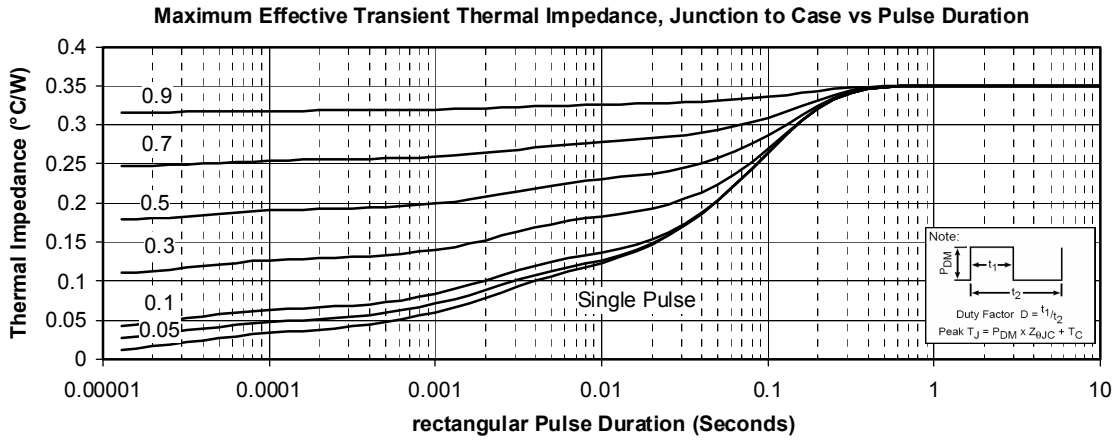
## SP4 Package outline (dimensions in mm)

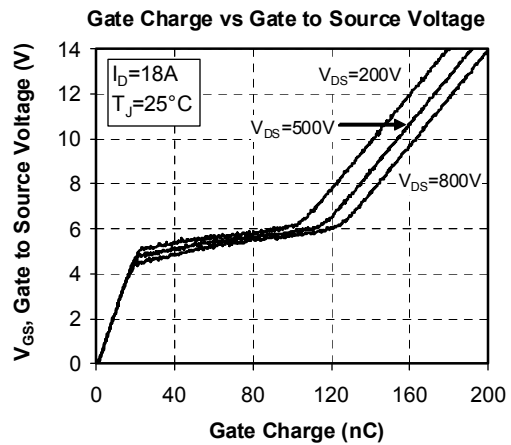
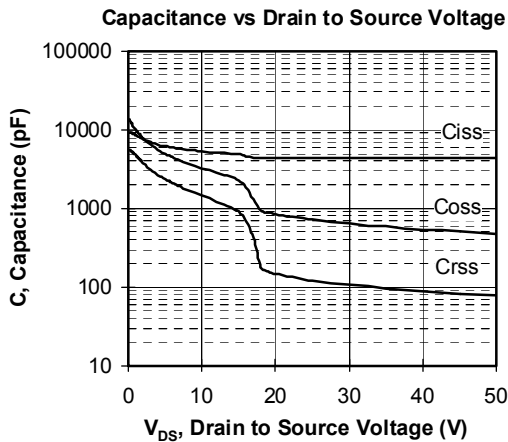
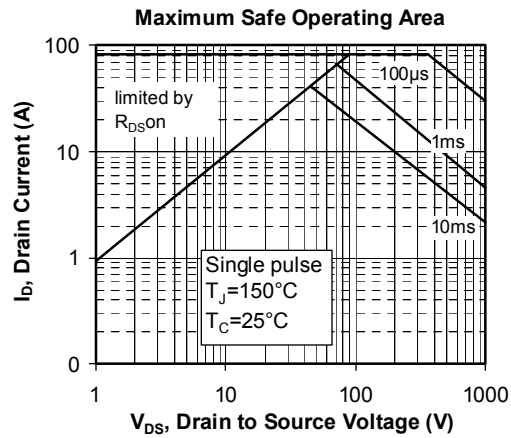
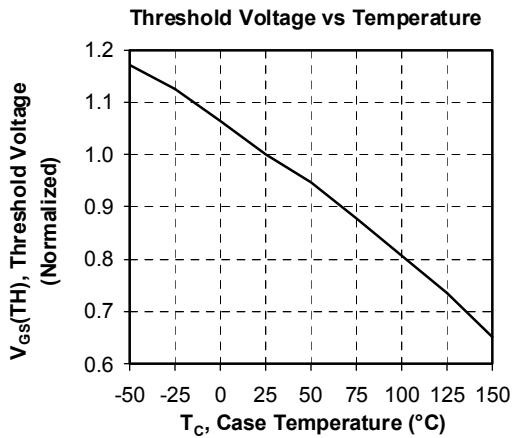
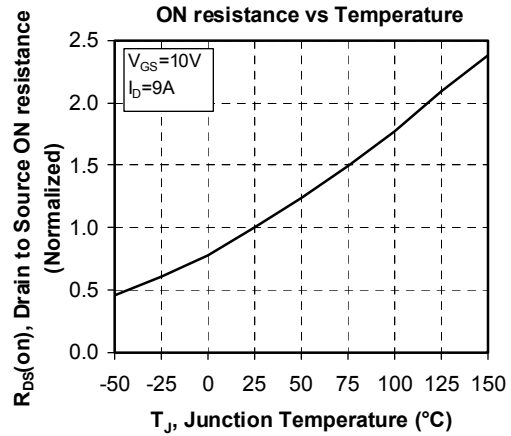
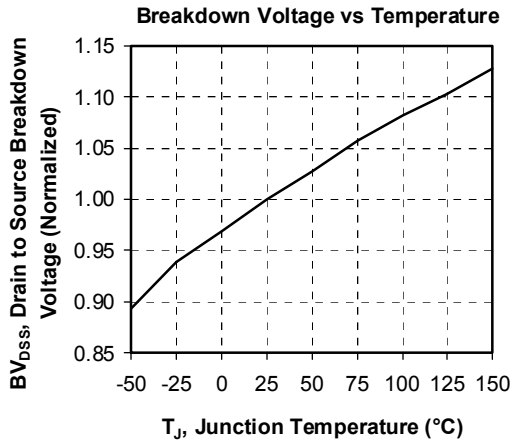


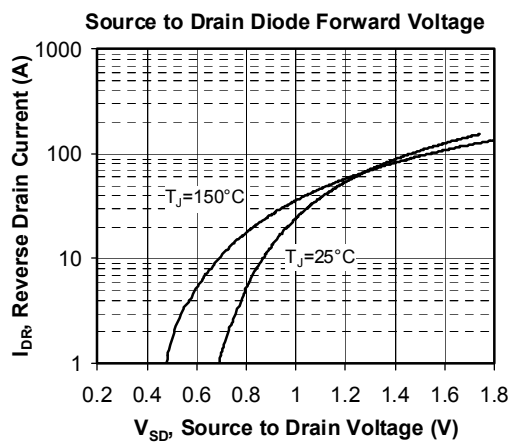
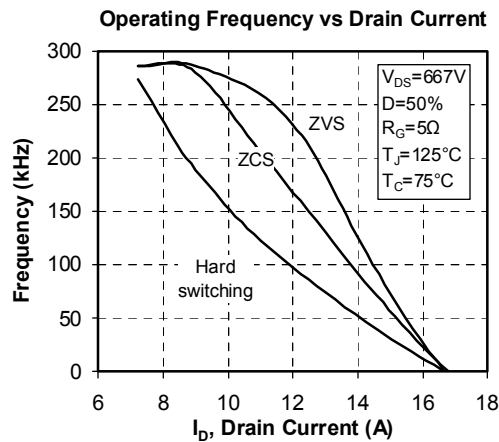
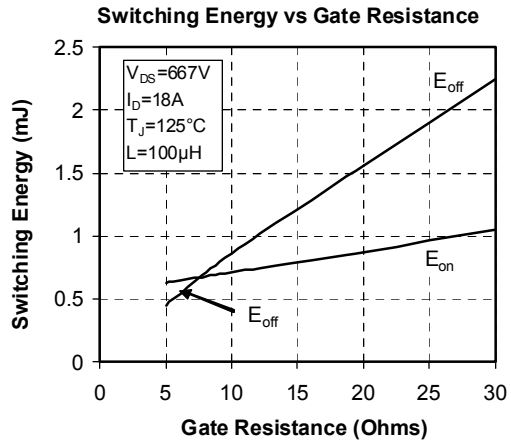
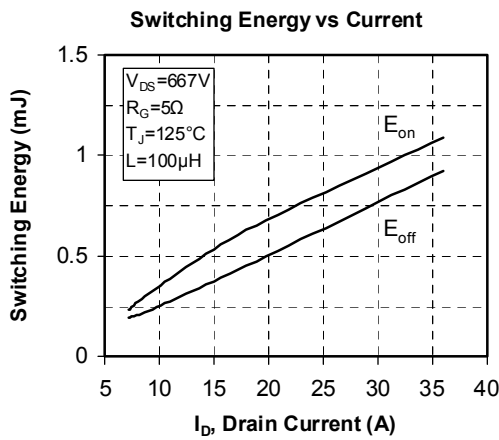
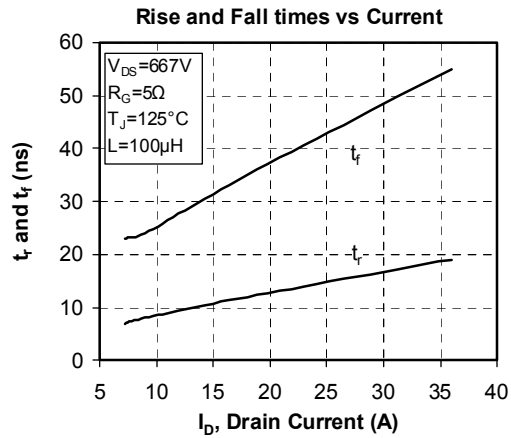
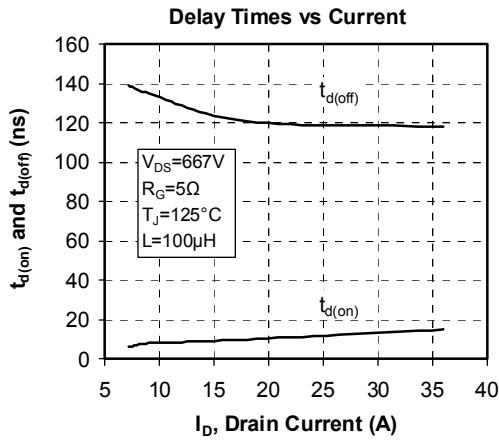
ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\pm 0,1$

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

## Typical MOSFET Performance Curve

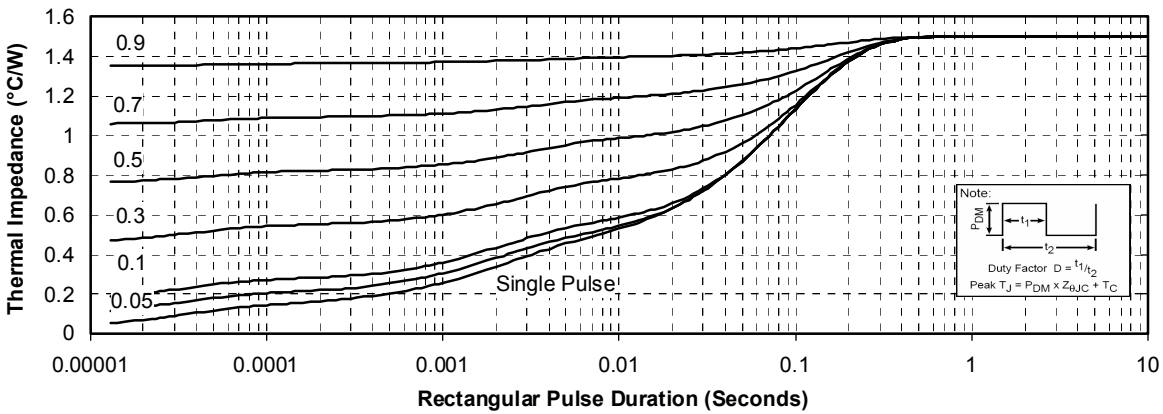




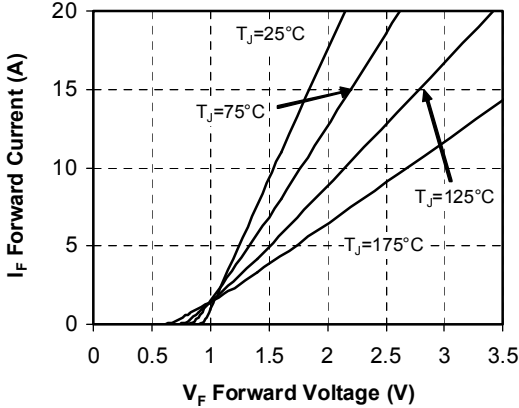


## Typical SiC Diode Performance Curve

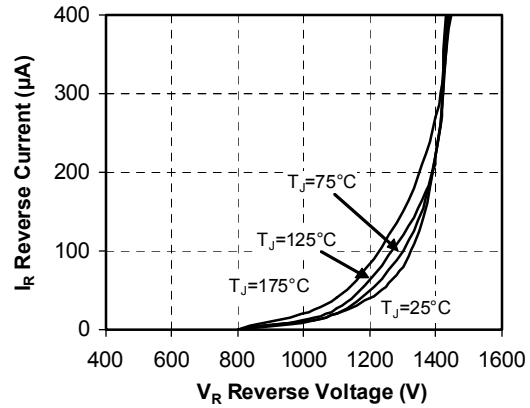
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



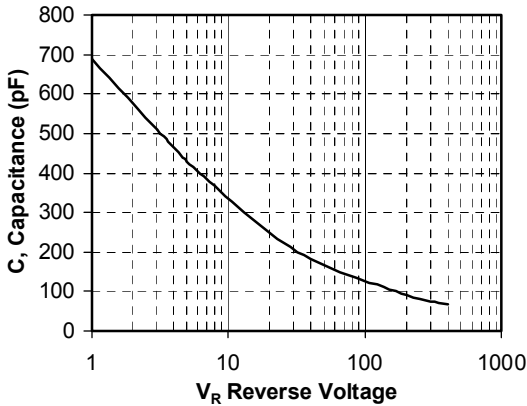
Forward Characteristics



Reverse Characteristics



Capacitance vs. Reverse Voltage



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