

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

$$V_{DSS} = 600V$$

$$R_{DSon} = 24m\Omega \text{ max @ } T_j = 25^\circ C$$

$$I_D = 95A \text{ @ } T_c = 25^\circ C$$

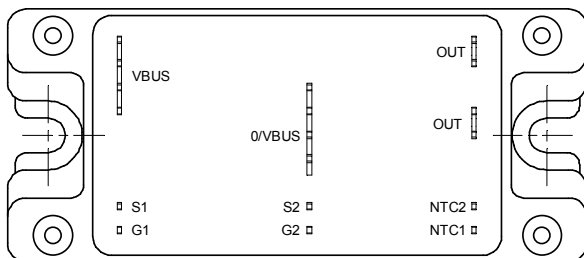
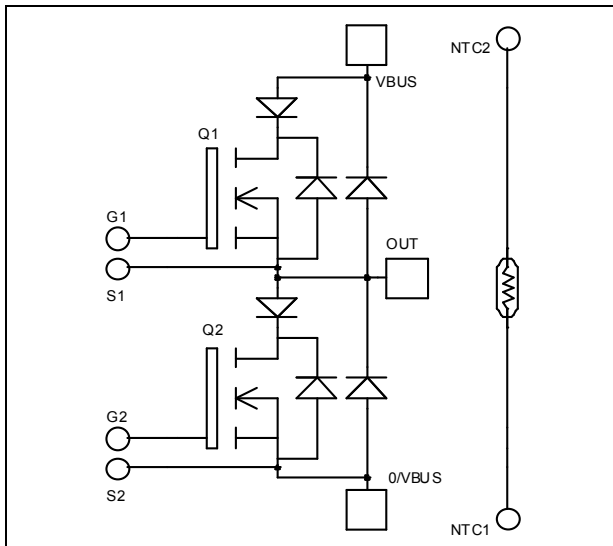
### Application

- 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	600	V
$I_D$	Continuous Drain Current	$T_c = 25^\circ C$	95
		$T_c = 80^\circ C$	70
$I_{DM}$	Pulsed Drain current	260	A
$V_{GS}$	Gate - Source Voltage	$\pm 20$	V
$R_{DSon}$	Drain - Source ON Resistance	24	$m\Omega$
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	462
$I_{AR}$	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)

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	$V_{GS} = 0V, V_{DS} = 600V$			350	$\mu\text{A}$
		$T_j = 25^\circ\text{C}$				
		$V_{GS} = 0V, V_{DS} = 600V$			600	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 47.5A$			24	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5\text{mA}$	2.1	3	3.9	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	$V_{GS} = 0V ; V_{DS} = 25V$ $f = 1\text{MHz}$		14.4		nF
$C_{oss}$	Output Capacitance			17		
$Q_g$	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 300V$ $I_D = 95A$		300		nC
$Q_{gs}$	Gate – Source Charge			68		
$Q_{gd}$	Gate – Drain Charge			102		
$T_{d(on)}$	Turn-on Delay Time	<b>Inductive Switching (<math>125^\circ\text{C}</math>)</b> $V_{GS} = 10V$ $V_{Bus} = 400V$ $I_D = 95A$ $R_G = 2.5\Omega$		21		ns
$T_r$	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			100		
$T_f$	Fall Time			45		
$E_{on}$	Turn-on Switching Energy	<b>Inductive switching @ <math>25^\circ\text{C}</math></b> $V_{GS} = 10V ; V_{Bus} = 400V$ $I_D = 95A ; R_G = 2.5\Omega$		810		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			1040		
$E_{on}$	Turn-on Switching Energy	<b>Inductive switching @ <math>125^\circ\text{C}</math></b> $V_{GS} = 10V ; V_{Bus} = 400V$ $I_D = 95A ; R_G = 2.5\Omega$		1320		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			1270		

**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	$V_R = 200V$	$T_j = 25^\circ\text{C}$		500	$\mu\text{A}$
			$T_j = 125^\circ\text{C}$		750	
$I_F$	DC Forward Current	$T_c = 85^\circ\text{C}$		90		A
$V_F$	Diode Forward Voltage	$I_F = 90A$		1.1	1.15	V
		$I_F = 180A$		1.4		
		$I_F = 90A$	$T_j = 125^\circ\text{C}$	0.9		
$t_{rr}$	Reverse Recovery Time	$I_F = 90A$ $V_R = 133V$	$T_j = 25^\circ\text{C}$	24		ns
			$T_j = 125^\circ\text{C}$	48		
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 600A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	99		nC
			$T_j = 125^\circ\text{C}$	450		

## SiC 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	T <sub>j</sub> = 25°C		200	800	μA
			T <sub>j</sub> = 175°C		400	4000	
I <sub>F</sub>	DC Forward Current	T <sub>c</sub> = 100°C			40		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 40A	T <sub>j</sub> = 25°C		1.6	1.8	V
			T <sub>j</sub> = 175°C		2.0	2.4	
Q <sub>C</sub>	Total Capacitive Charge	I <sub>F</sub> = 40A, V <sub>R</sub> = 300V di/dt = 1200A/μs			56		nC
C	Total Capacitance	f = 1MHz, V <sub>R</sub> = 200V			260		pF
		f = 1MHz, V <sub>R</sub> = 400V			200		

## Thermal and package characteristics

Symbol	Characteristic	Min	Typ	Max	Unit	
R <sub>thJC</sub>	Junction to Case Thermal Resistance	Transistor			0.27	°C/W
		Series diode			0.45	
		SiC Parallel diode			0.8	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t = 1 min, I <sub>isol</sub> < 1mA, 50/60Hz	4000			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

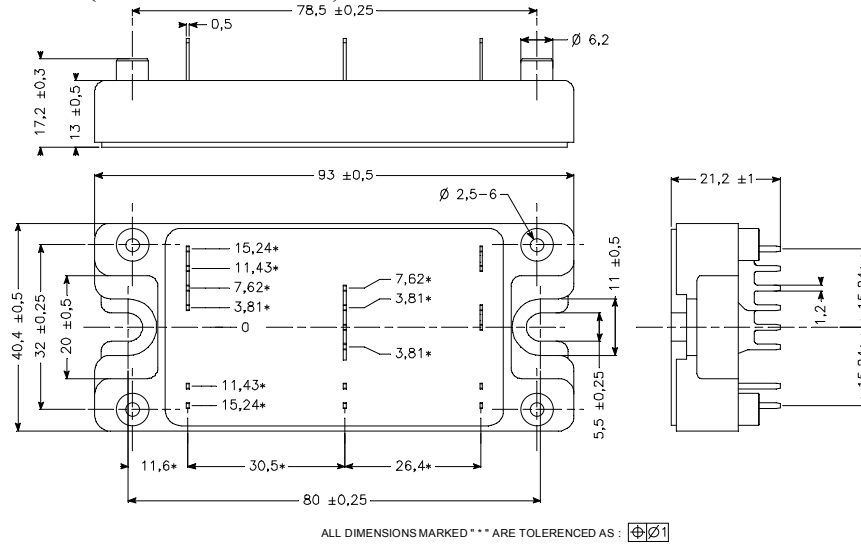
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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		%

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

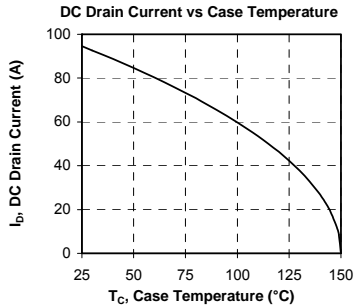
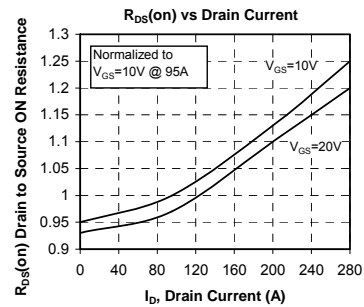
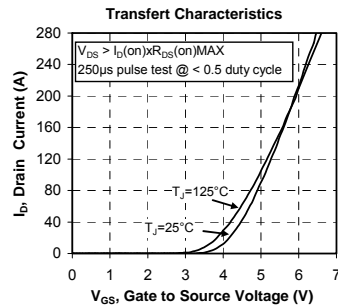
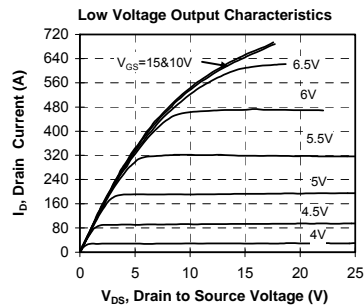
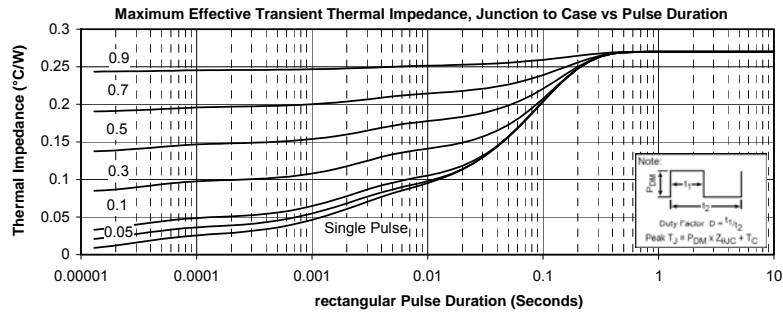
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

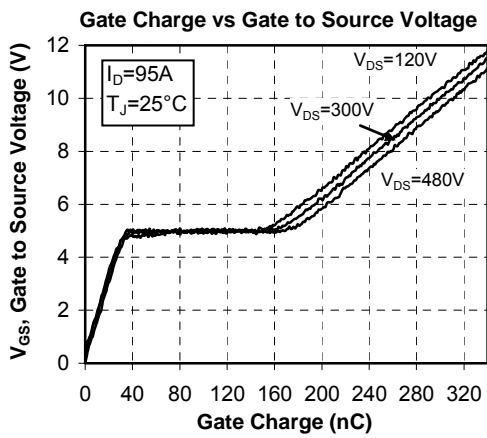
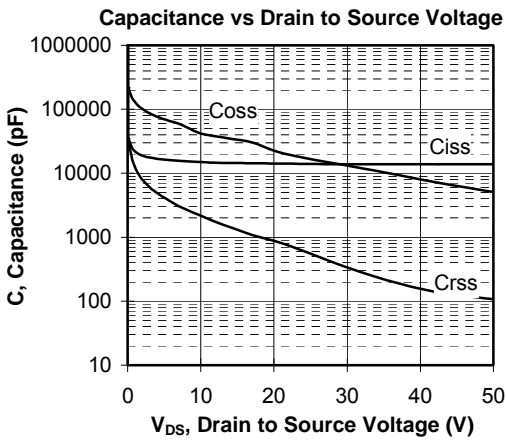
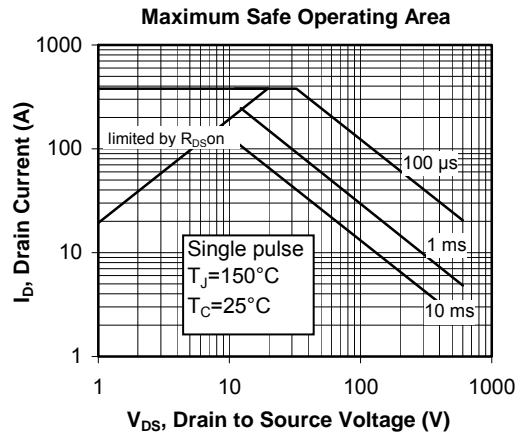
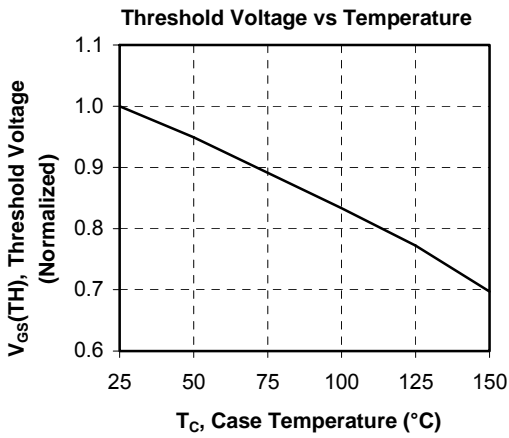
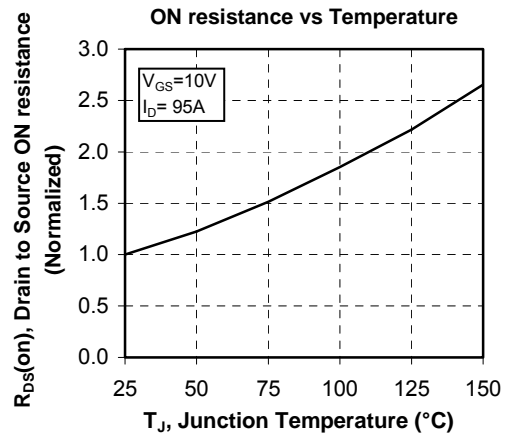
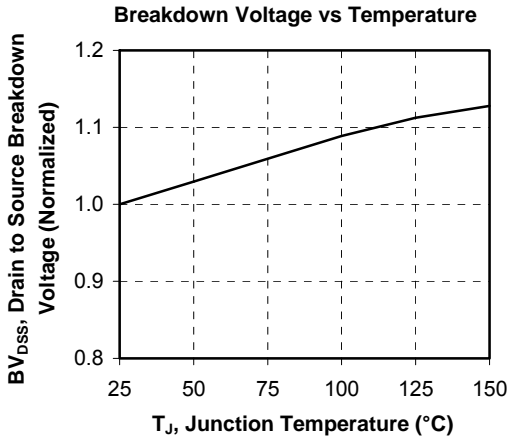
## SP4 Package outline (dimensions in mm)

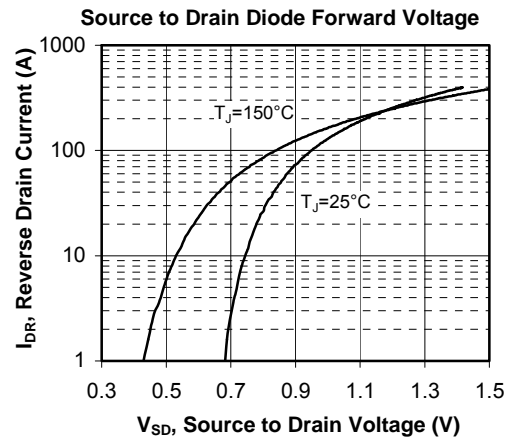
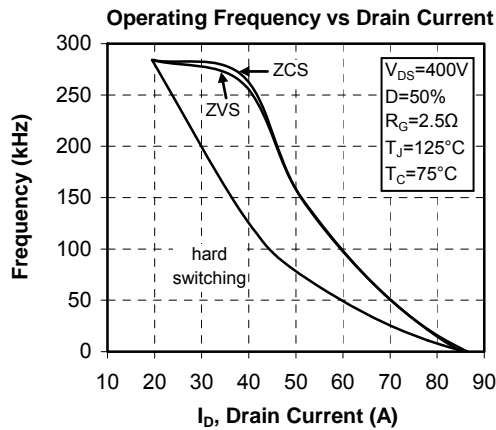
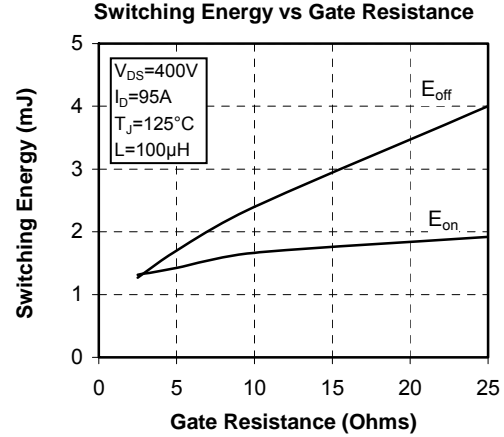
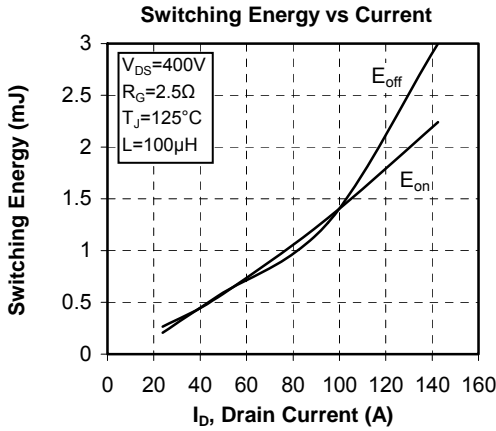
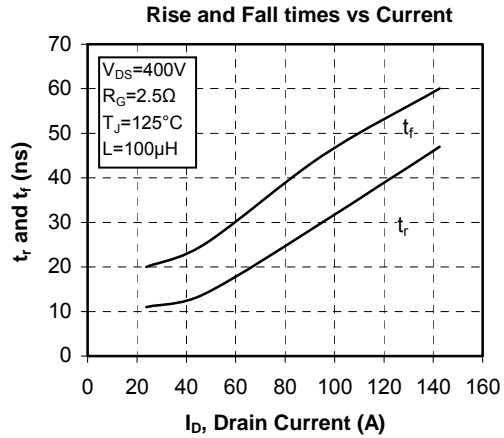
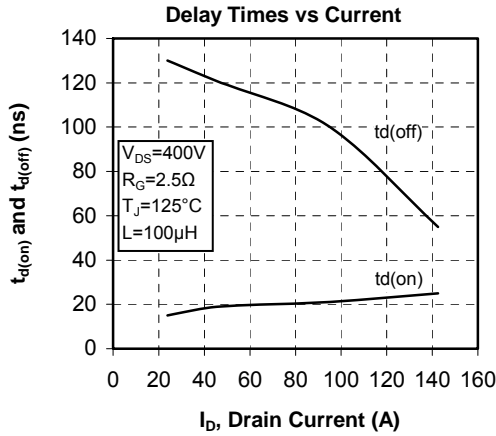


See application note APT0501 - Mounting Instructions for SP4 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical CoolMOS Performance Curve

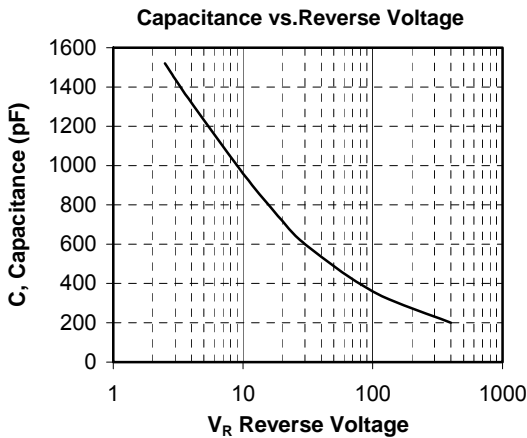
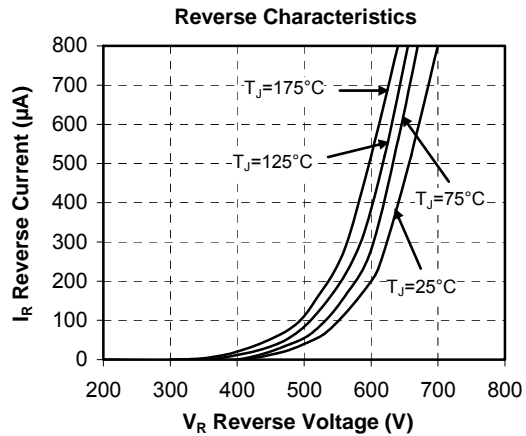
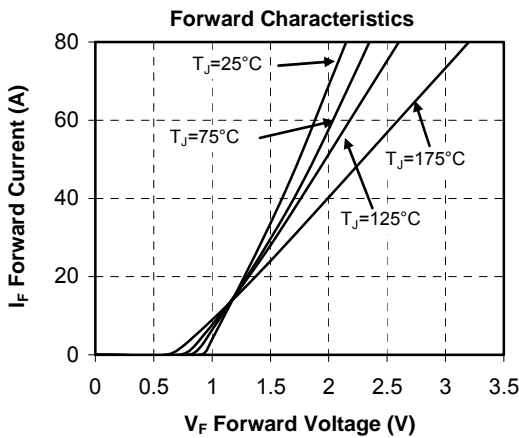
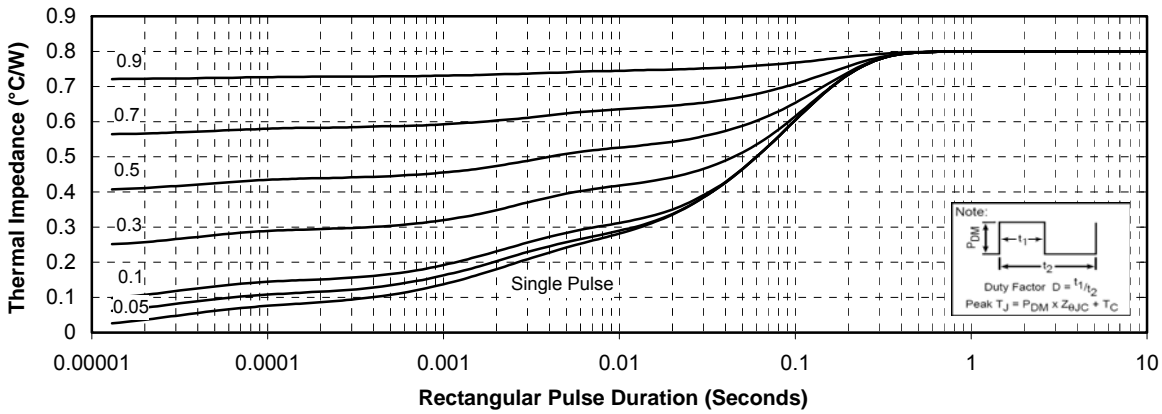






## Typical SiC parallel Diode Performance Curve

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



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