

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

$V_{DSS} = 800V$

$R_{DSon} = 150m\Omega \text{ max @ } T_j = 25^\circ C$

$I_D = 28A \text{ @ } T_c = 25^\circ C$

Application

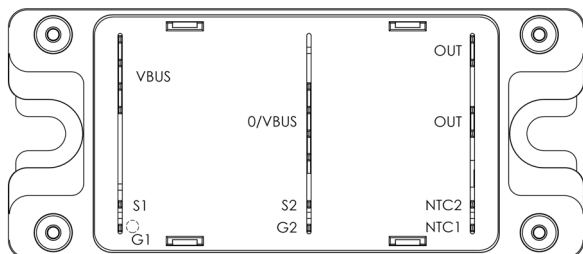
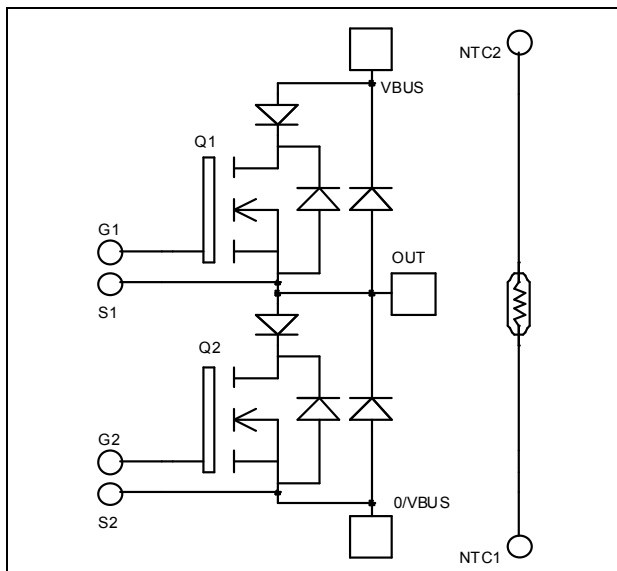
- Motor control
- Switched Mode Power Supplies
- Uninterruptible Power Supplies

Features

- **CoolMOST™**
 - 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



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

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	800	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	A
		$T_c = 80^\circ C$	
I_{DM}	Pulsed Drain current	112	
V_{GS}	Gate - Source Voltage	± 30	V
R_{DSon}	Drain - Source ON Resistance	150	$m\Omega$
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	W
I_{AR}	Avalanche current (repetitive and non repetitive)	17	A
E_{AR}	Repetitive Avalanche Energy	0.5	mJ
E_{AS}	Single Pulse Avalanche Energy	670	



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} = 800V, T _j = 25°C			50	μA
		V _{GS} = 0V, V _{DS} = 800V, T _j = 125°C			375	
R _{DS(on)}	Drain – Source on Resistance	V _{GS} = 10V, I _D = 14A			150	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 2mA	2.1	3	3.9	V
I _{GSS}	Gate – Source Leakage Current	V _{GS} = ±20 V, V _{DS} = 0V			±150	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{iss}	Input Capacitance	V _{GS} = 0V V _{DS} = 25V f = 1MHz		4507		pF
C _{oss}	Output Capacitance			2092		
C _{rss}	Reverse Transfer Capacitance			108		
Q _g	Total gate Charge	V _{GS} = 10V V _{Bus} = 400V I _D = 28A		180		nC
Q _{gs}	Gate – Source Charge			22		
Q _{gd}	Gate – Drain Charge			90		
T _{d(on)}	Turn-on Delay Time	Inductive switching @125°C V _{GS} = 15V V _{Bus} = 533V I _D = 28A R _G = 2.5Ω		10		ns
T _r	Rise Time			13		
T _{d(off)}	Turn-off Delay Time			83		
T _f	Fall Time			35		
E _{on}	Turn-on Switching Energy	Inductive switching @ 25°C V _{GS} = 15V, V _{Bus} = 533V I _D = 28A, R _G = 2.5Ω		291		μJ
E _{off}	Turn-off Switching Energy			278		
E _{on}	Turn-on Switching Energy	Inductive switching @ 125°C V _{GS} = 15V, V _{Bus} = 533V I _D = 28A, R _G = 2.5Ω		510		μJ
E _{off}	Turn-off Switching Energy			342		
R _{thJC}	Junction to Case Thermal Resistance				0.45	°C/W

Series diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{RRM}	Maximum Peak Repetitive Reverse Voltage		1000			V
I _{RM}	Maximum Reverse Leakage Current	V _R = 1000V			250	μA
I _F	DC Forward Current	T _c = 80°C		60		A
V _F	Diode Forward Voltage	I _F = 60A		1.9	2.3	V
		I _F = 120A		2.2		
		I _F = 60A, T _j = 125°C		1.7		
t _{rr}	Reverse Recovery Time	I _F = 60A V _R = 667V di/dt = 400A/μs	T _j = 25°C	290		ns
			T _j = 125°C	390		
Q _{rr}	Reverse Recovery Charge	I _F = 60A V _R = 667V di/dt = 400A/μs	T _j = 25°C	1.34		μC
			T _j = 125°C	4.7		
R _{thJC}	Junction to Case Thermal Resistance				0.65	°C/W

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		64	400	μA
		T _j = 25°C		112	2000	
I _F	DC Forward Current			20		A
V _F	Diode Forward Voltage	I _F = 20A		1.6	1.8	V
		T _j = 25°C		2.3		
Q _C	Total Capacitive Charge	I _F = 20A, V _R = 1200V di/dt = 1000A/μs		160		nC
Q	Total Capacitance	f = 1MHz, V _R = 200V		192		pF
		f = 1MHz, V _R = 400V		138		
R _{thJC}	Junction to Case Thermal Resistance				1	°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	2.5	4.7	N.m
Wt	Package Weight				160	g

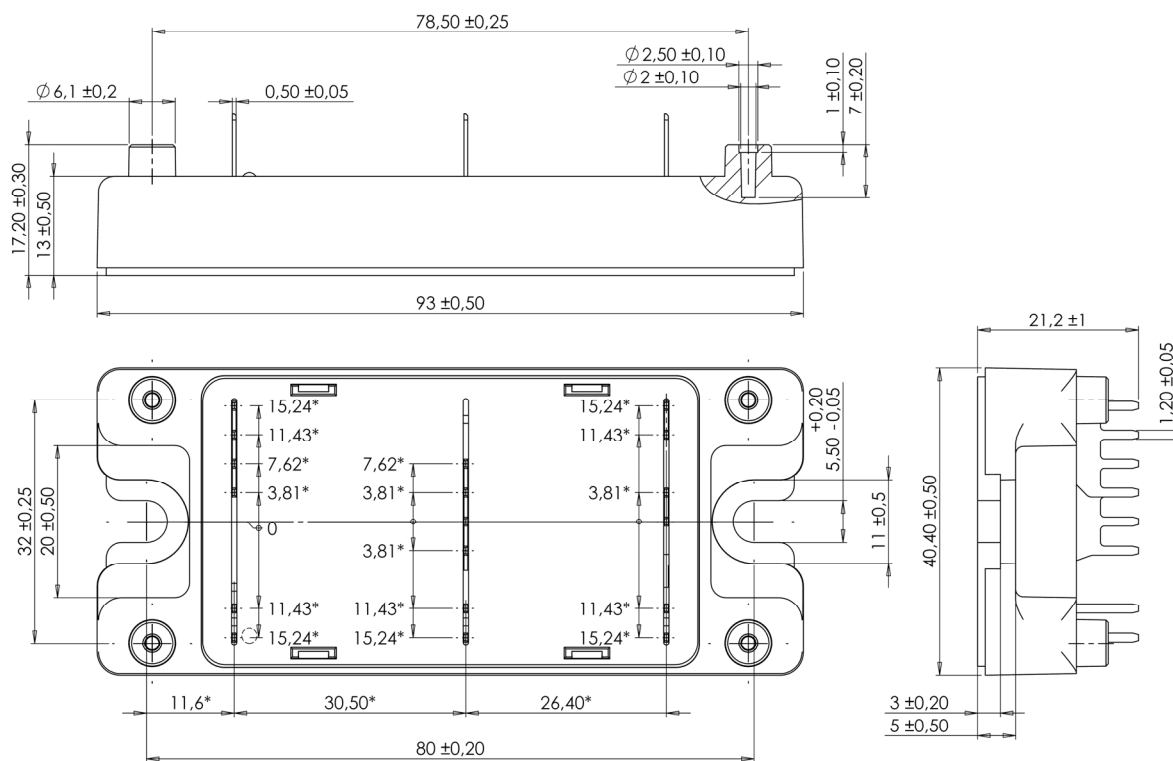
Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
B _{25/85}	T ₂₅ = 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_T: Thermistor value at T

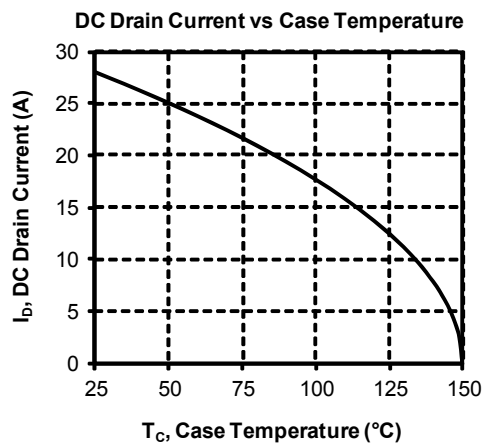
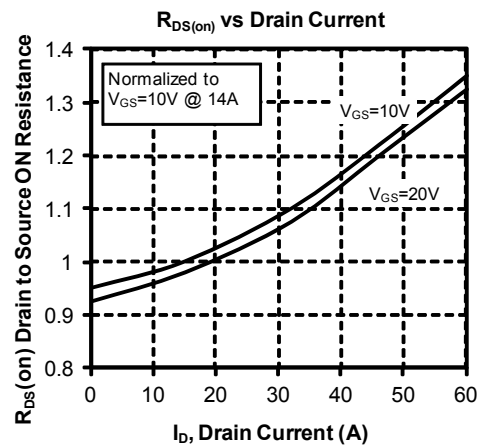
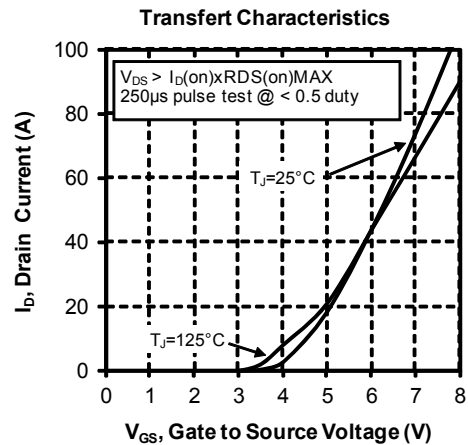
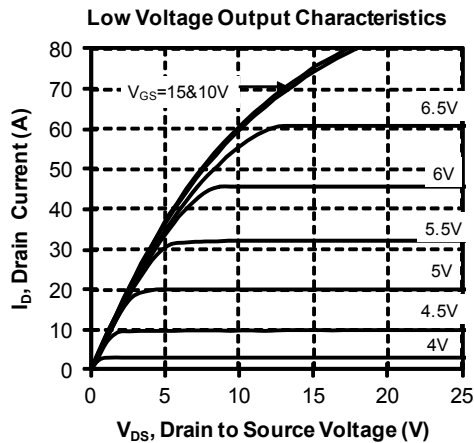
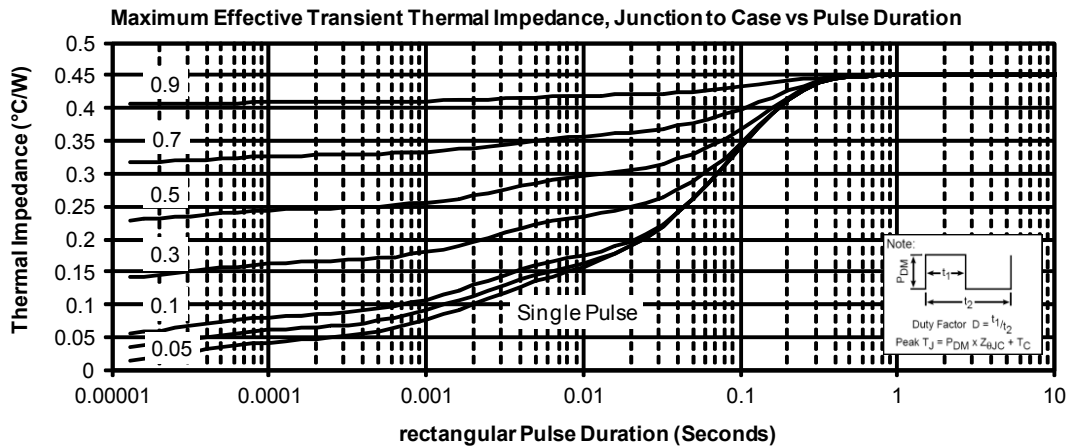
SP4 Package outline (dimensions in mm)

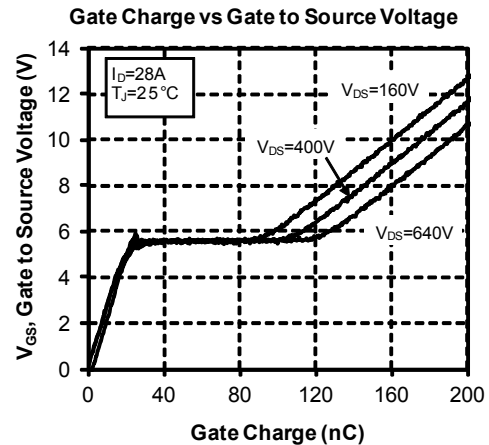
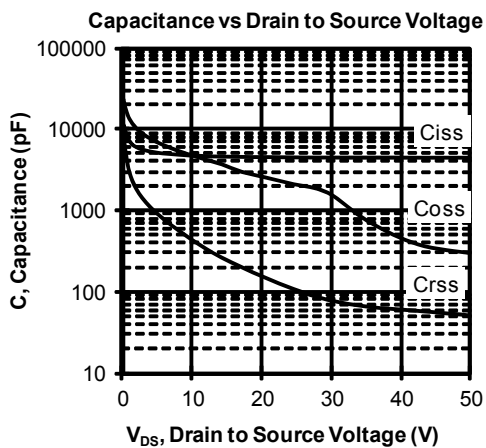
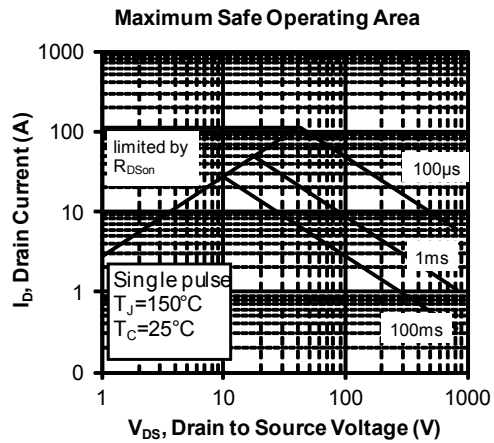
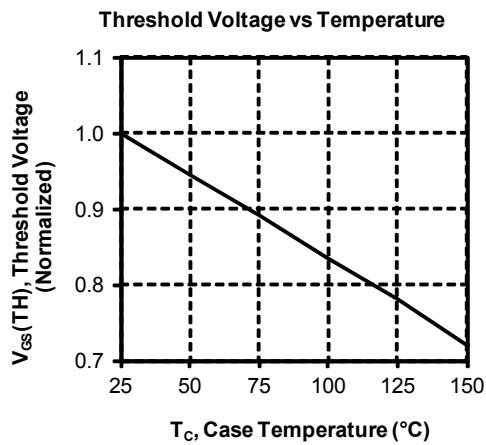
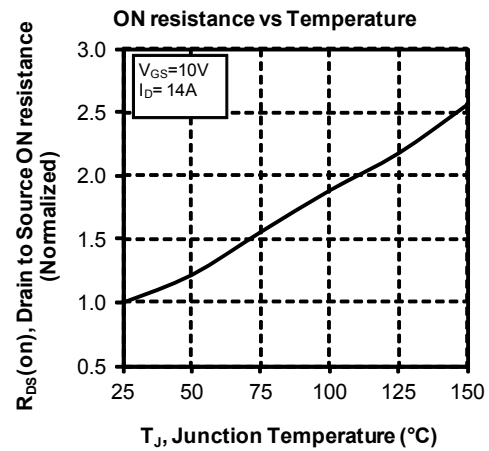
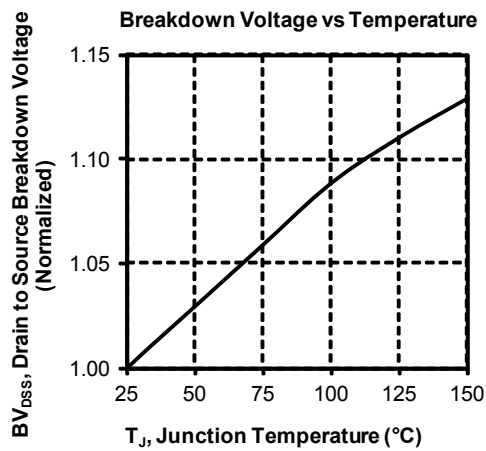


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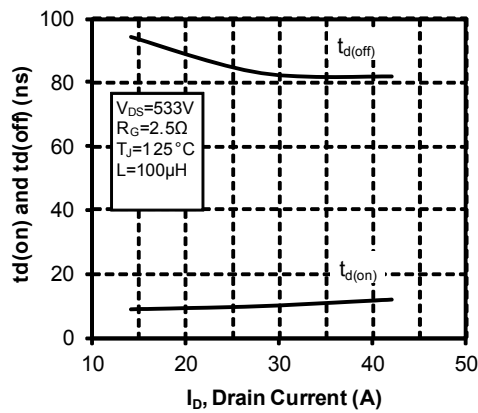
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

Typical CoolMOS Performance Curve

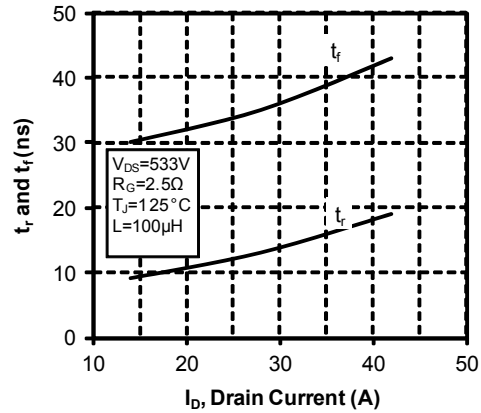




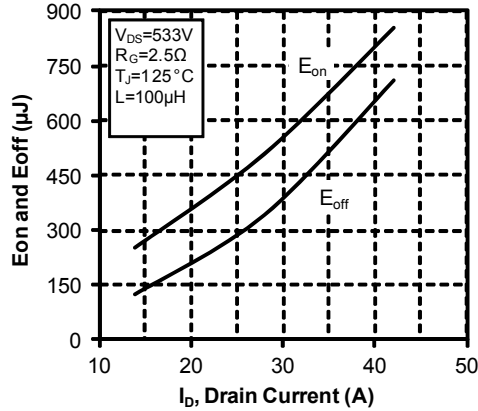
Delay Times vs Current



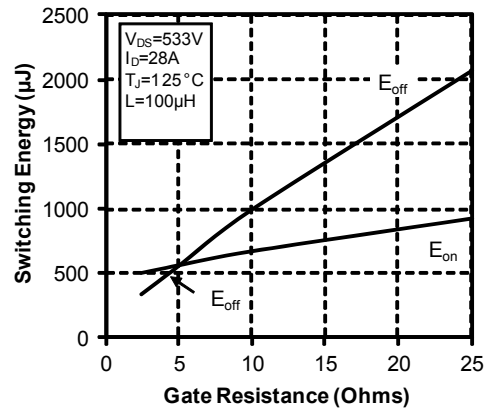
Rise and Fall times vs Current



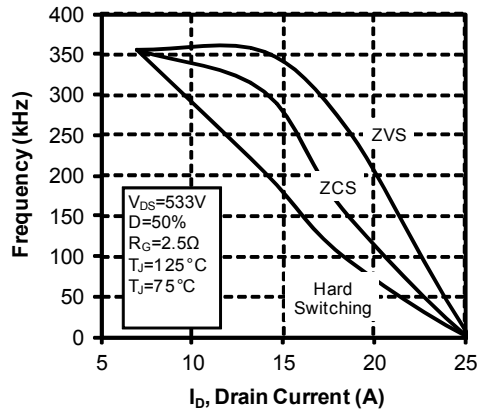
Switching Energy vs Current



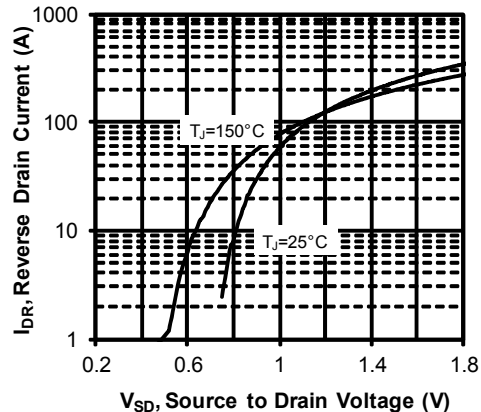
Switching Energy vs Gate Resistance



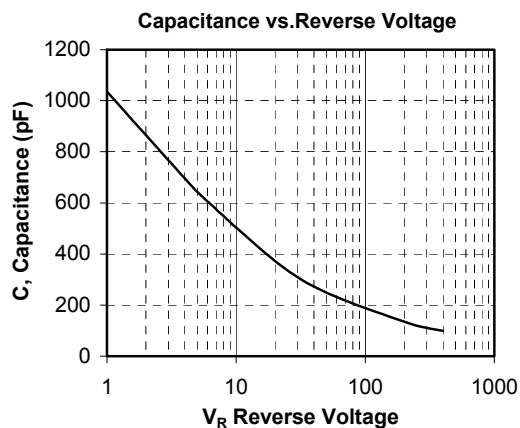
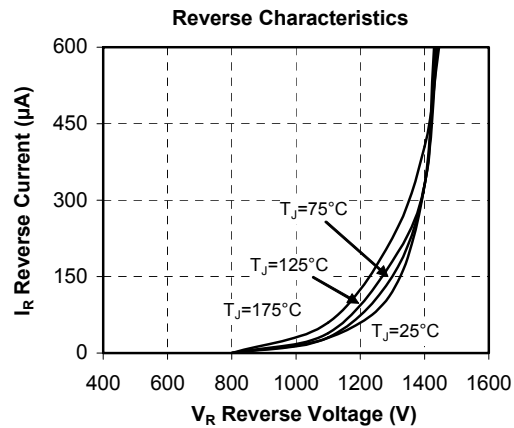
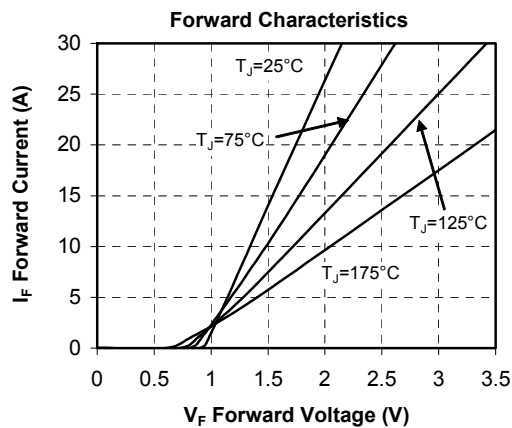
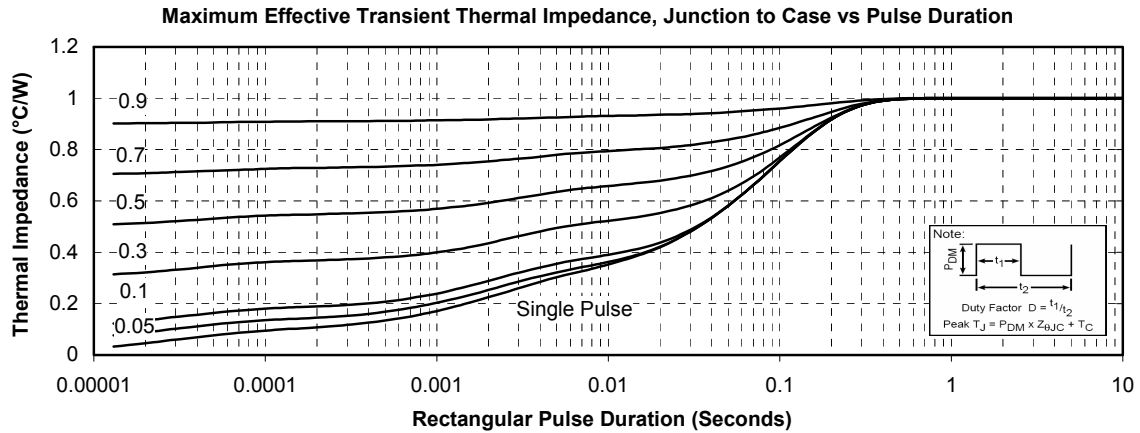
Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



Typical SiC Diode Performance Curve



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