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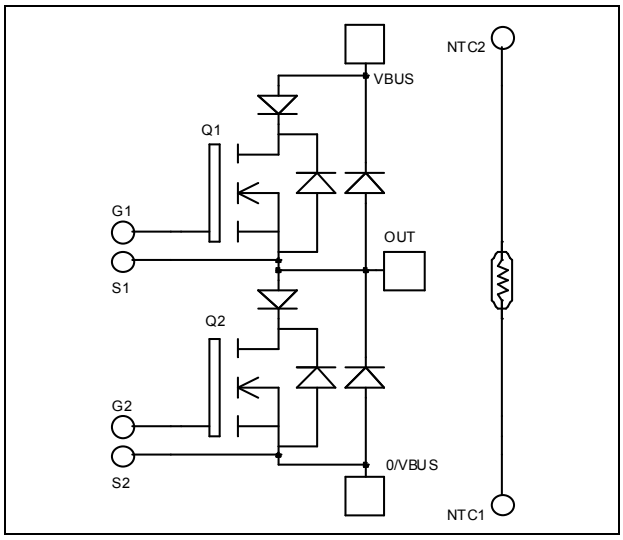
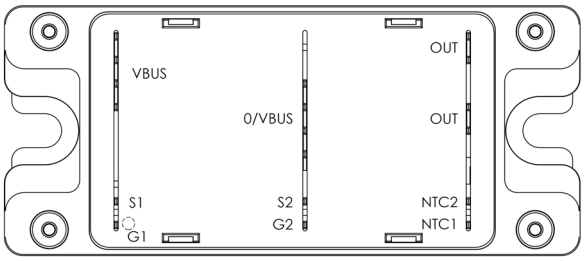
APTC80A10SCTG

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

V_{DSS} = 800V
R_{DSon} = 100mΩ max @ Tj = 25°C
I_D = 42A @ Tc = 25°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
  - 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°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°C	42	A
		T_c = 80°C	32	
I_{DM}	Pulsed Drain current		168	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		100	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	416	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			75	µA
		V_{GS} = 0V, V_{DS} = 800V	T_j = 125°C			750	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 21A				100	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 3mA		2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0V				±300	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		6761		pF
C_{oss}	Output Capacitance			3137		
C_{rss}	Reverse Transfer Capacitance			161		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 400V I_D = 42A		273		nC
Q_{gs}	Gate – Source Charge			36		
Q_{gd}	Gate – Drain Charge			138		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 533V I_D = 42A R_G = 1.8Ω		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 = 42A, R_G = 1.8Ω		437		µJ
E_{off}	Turn-off Switching Energy			417		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 533V I_D = 42A, R_G = 1.8Ω		765		µJ
E_{off}	Turn-off Switching Energy			513		
R_{thJC}	Junction to Case Thermal Resistance				0.3	°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				200	µA
I_F	DC Forward Current		T_c = 85°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 =630A V_R = 667V di/dt = 400A/µs	T_j = 25°C		290		ns
			T_j = 125°C		390		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		1340		nC
			T_j = 125°C		4700		
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	T_j = 25°C		200	800	µA
			T_j = 175°C		400	4000	
I_F	DC Forward Current		Tc = 125°C		20		A
V_F	Diode Forward Voltage	I_F = 20A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.6	3.0	
Q_C	Total Capacitive Charge	I_F = 20A, V_R = 600V di/dt =1200A/µs			56		nC
Q	Total Capacitance	f = 1MHz, V_R = 200V			180		pF
		f = 1MHz, V_R = 400V			132		
R_{thJC}	Junction to Case Thermal Resistance					0.8	°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	$T_J$max -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

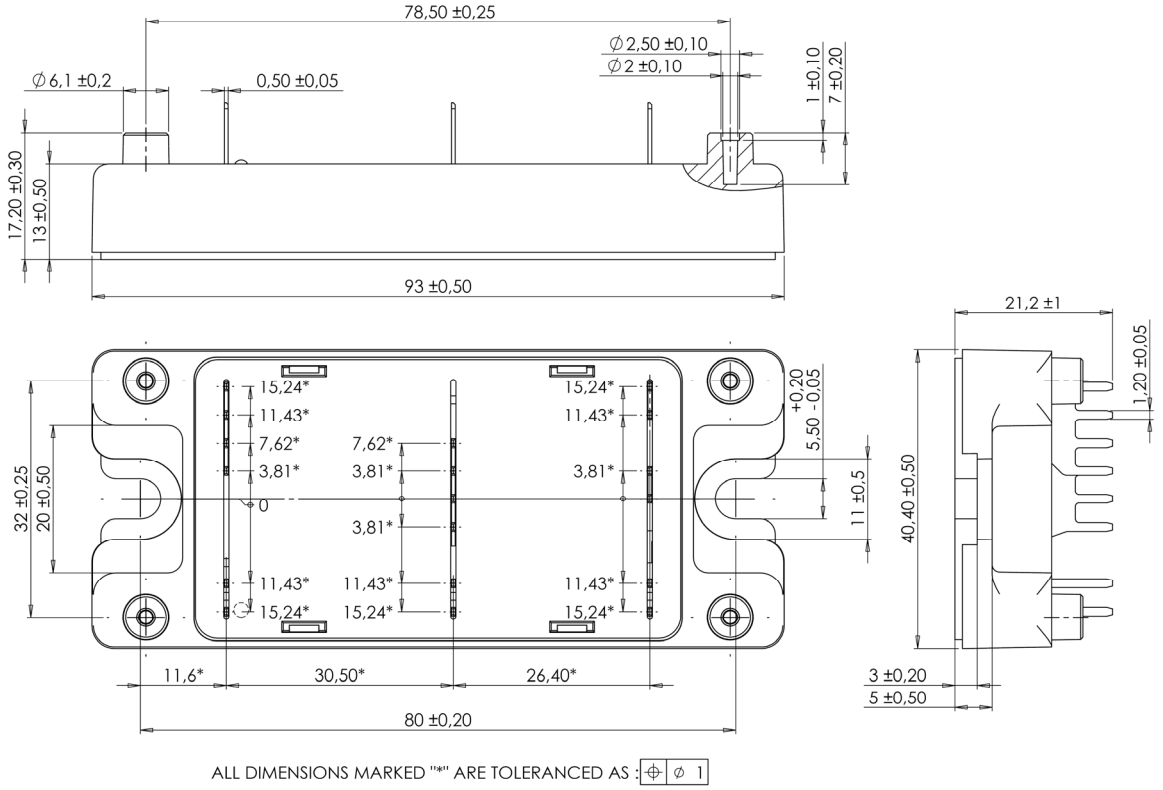
Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
ΔB/B		T_C=100°C		4		%

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

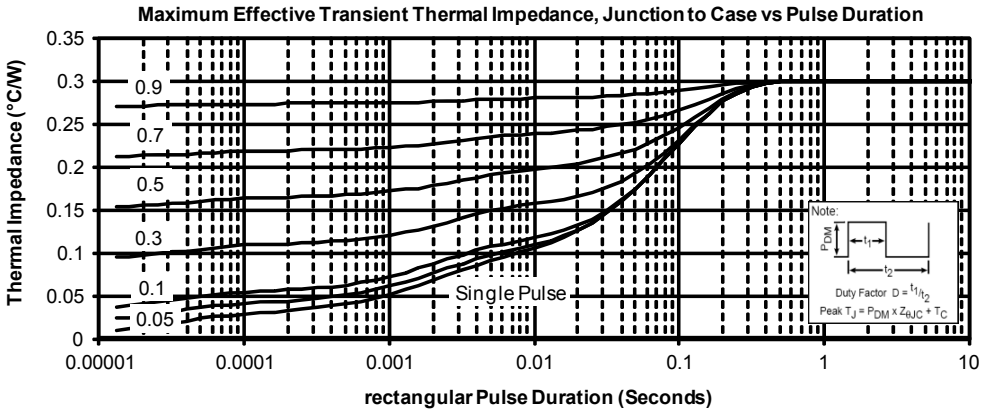
T: Thermistor temperature
R_T: Thermistor value at T

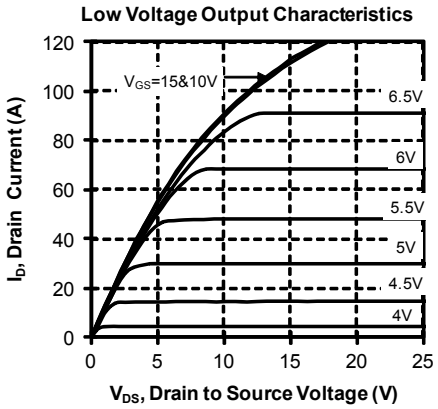
SP4 Package outline (dimensions in mm)

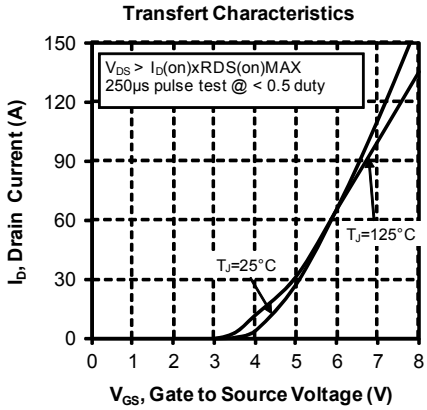


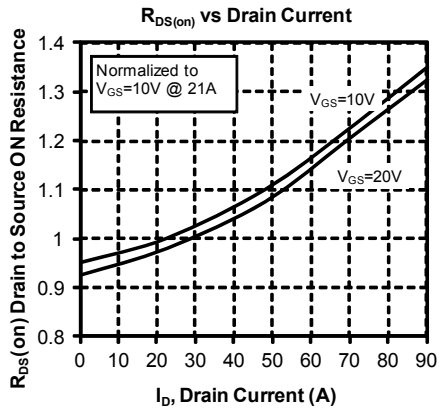
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

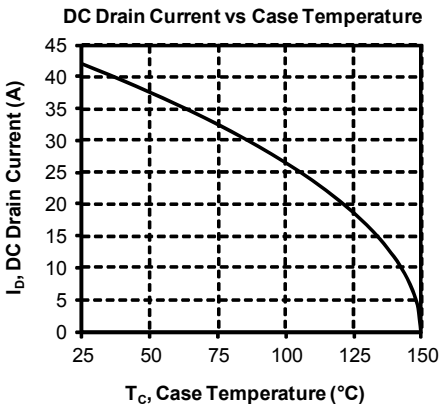
Typical CoolMOS Performance Curve



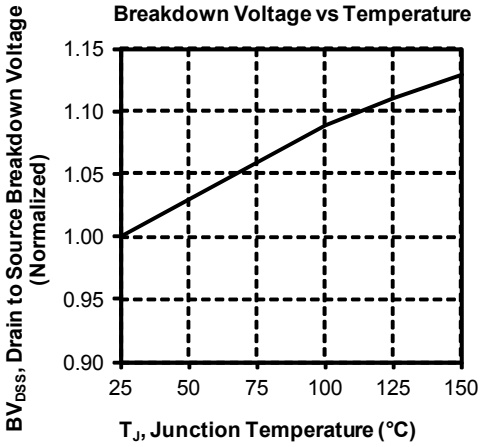




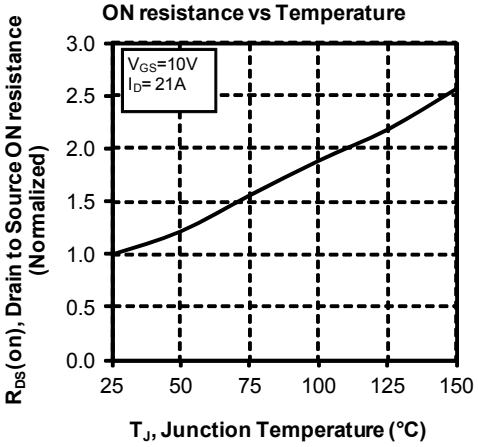




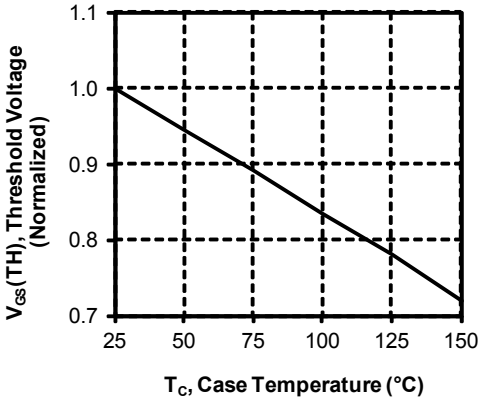
Breakdown Voltage vs Temperature



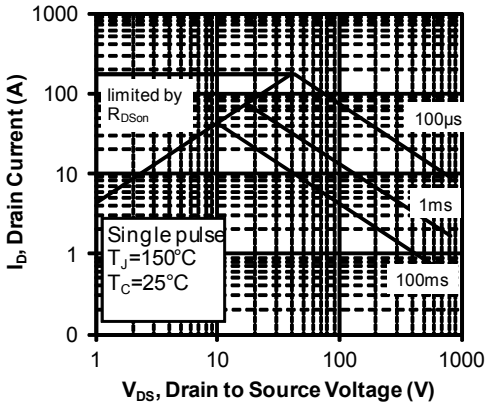
ON resistance vs Temperature



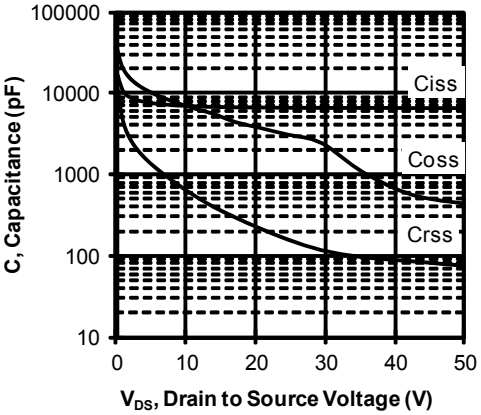
Threshold Voltage vs Temperature



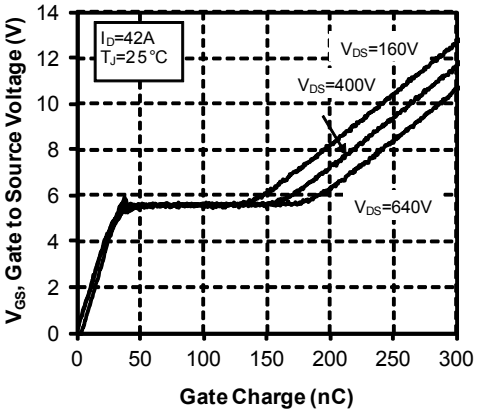
Maximum Safe Operating Area



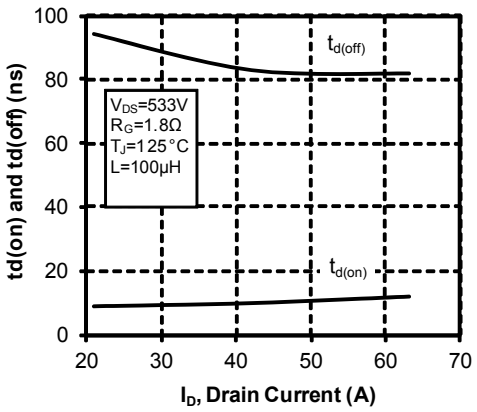
Capacitance vs Drain to Source Voltage



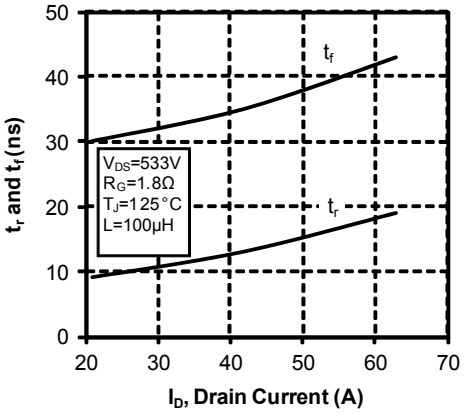
Gate Charge vs Gate to Source Voltage



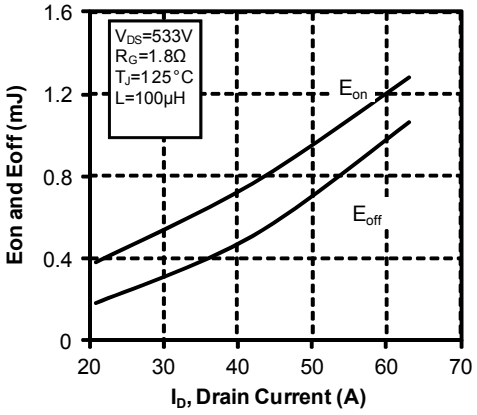
Delay Times vs Current



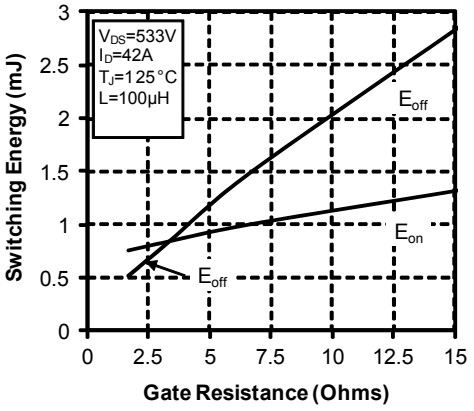
Rise and Fall times vs Current



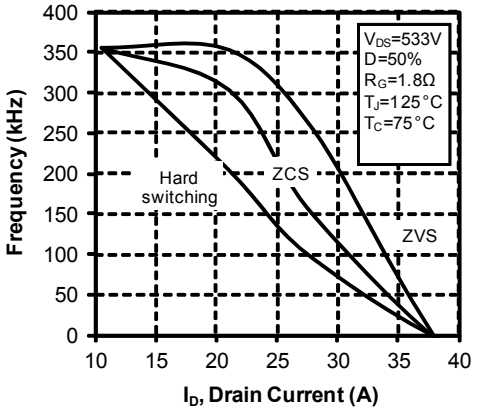
Switching Energy vs Current



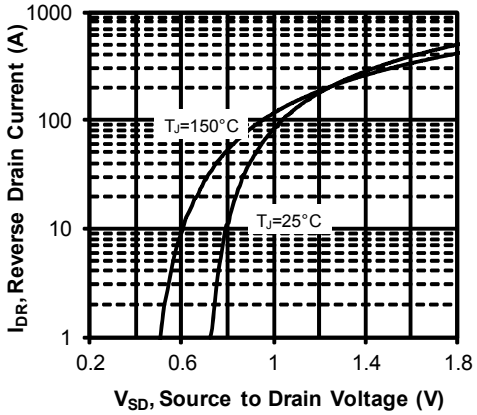
Switching Energy vs Gate Resistance



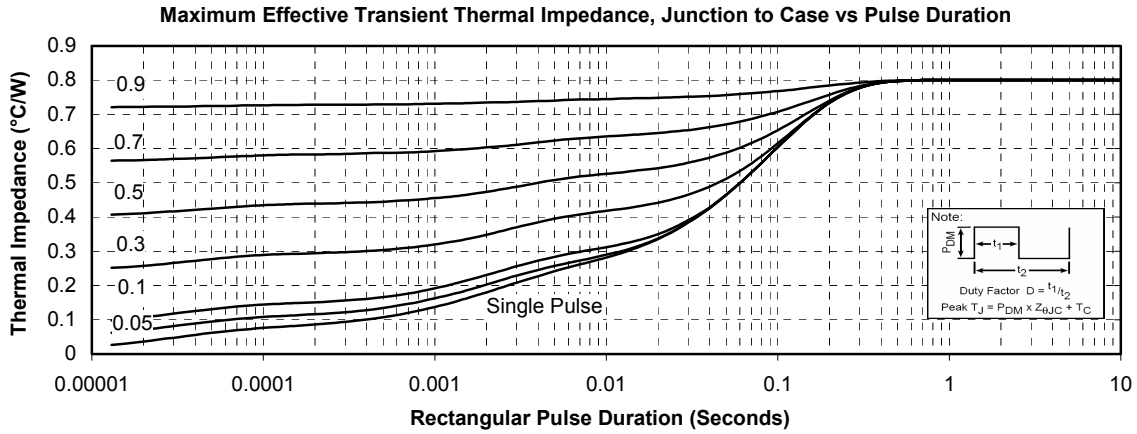
Operating Frequency vs Drain Current

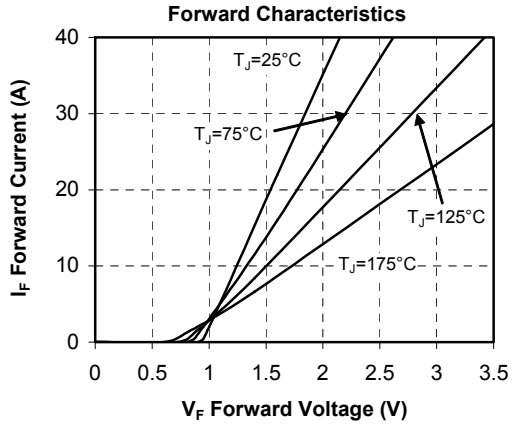


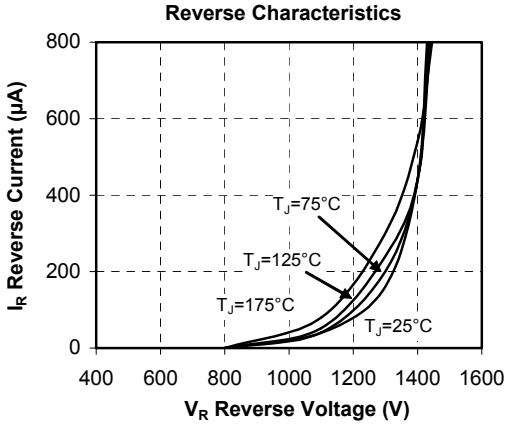
Source to Drain Diode Forward Voltage

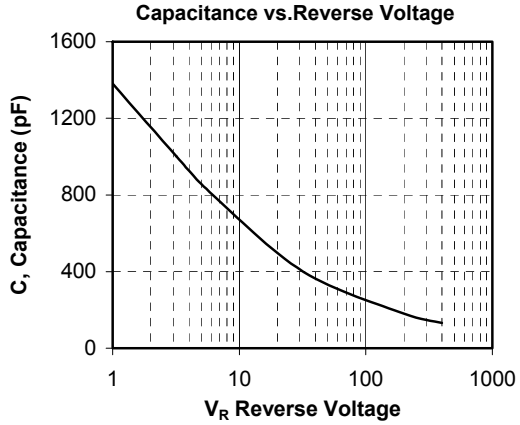


Typical SiC Diode Performance Curve









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