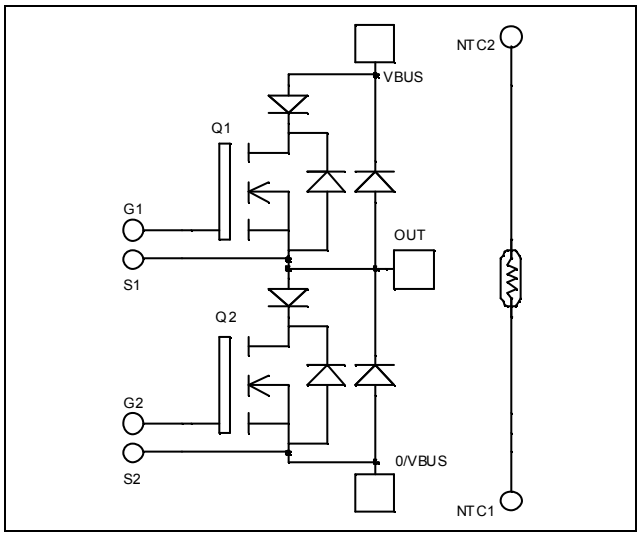
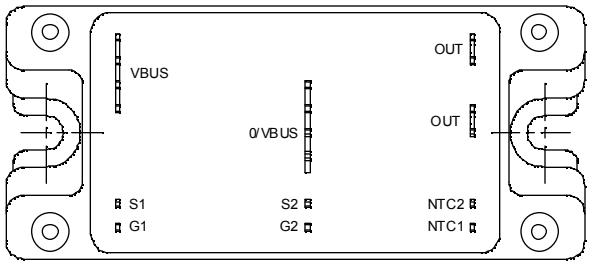
Phase leg
Serie & SiC parallel diodes
Super Junction
MOSFET Power Module

V_{DSS} = 800V
R_{DSon} = 150mΩ max @ Tj = 25°C
I_D = 28A @ Tc = 25°C





Application

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

Features

- COOLMOS Power Semiconductors
  - 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		800	V
I_D	Continuous Drain Current	T_c = 25°C	28	A
		T_c = 80°C	21	
I_{DM}	Pulsed Drain current		112	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		150	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	277	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 Handing Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

All ratings @ T_j = 25°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} = 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		

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°C			250	µA
			T_j = 125°C			500	
I_F	DC Forward Current		T_c = 85°C		30		A
V_F	Diode Forward Voltage	I_F = 30A			1.1	1.15	V
		I_F = 60A			1.4		
		I_F = 30A	T_j = 125°C		0.9		
t_{rr}	Reverse Recovery Time	I_F = 30A V_R = 133V di/dt = 200A/µs	T_j = 25°C		24		ns
			T_j = 125°C		48		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		33		nC
			T_j = 125°C		150		

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		150	600	µA
			T_j = 175°C		300	3000	
I_F	DC Forward Current		Tc = 125°C		15		A
V_F	Diode Forward Voltage	I_F = 15A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.6	3.0	
Q_C	Total Capacitive Charge	I_F = 15A, V_R = 600V di/dt =1000A/µs			42		nC
Q	Total Capacitance	f = 1MHz, V_R = 200V			135		pF
		f = 1MHz, V_R = 400V			99		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance		Transistor			0.45	°C/W
			Series diode			1.2	
			Parallel diode			1.0	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			2500			V
T_J	Operating junction temperature range			-40		150	°C
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

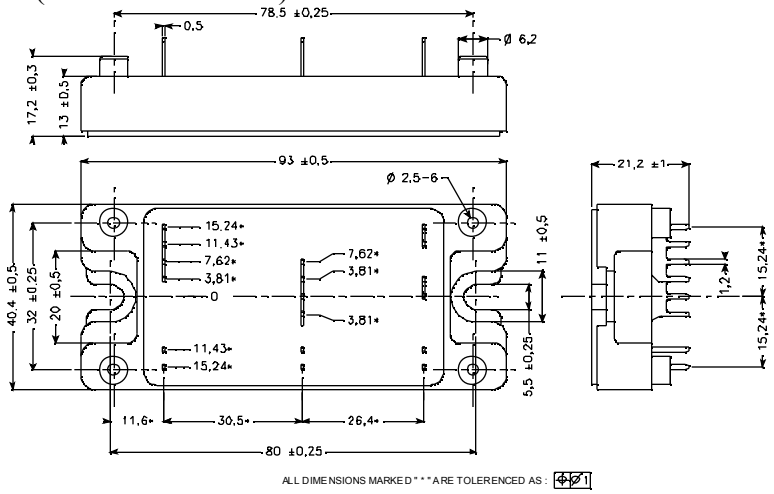
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C		50		kΩ
$B_{25/85}$	T_{25} = 298.15 K		3952		K

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

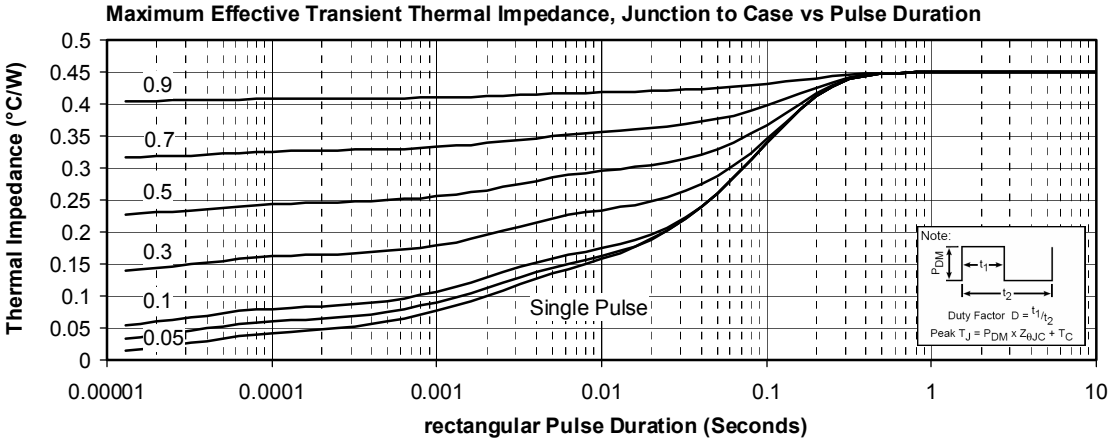
T: Thermistor temperature
R_T: Thermistor value at T

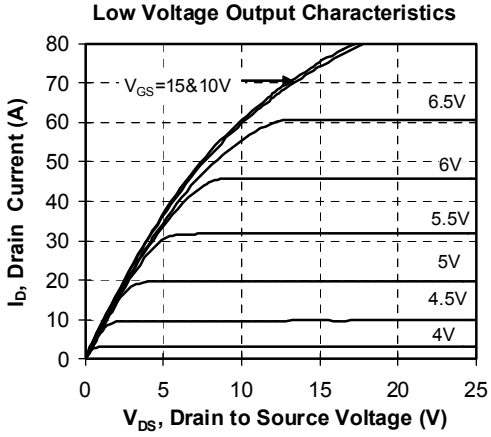
SP4 Package outline (dimensions in mm)

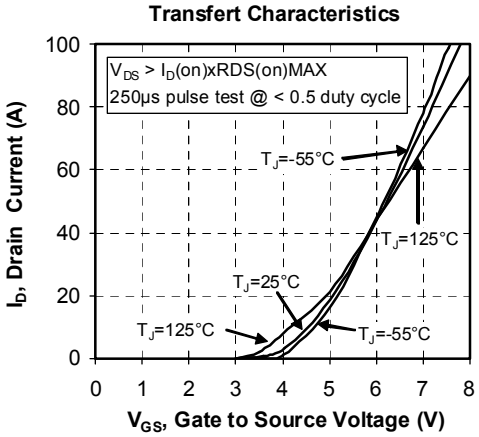


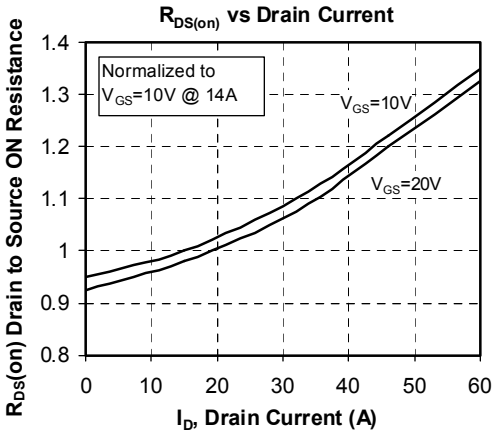
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

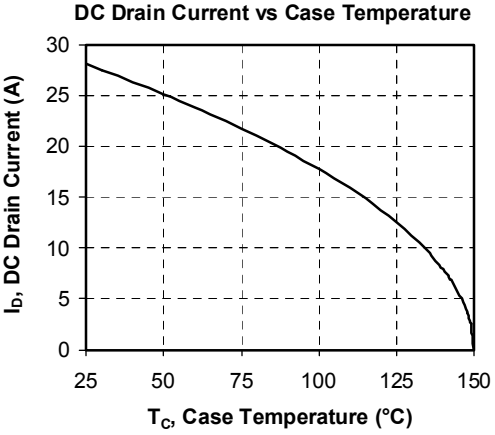
Typical CoolMOS Performance Curve



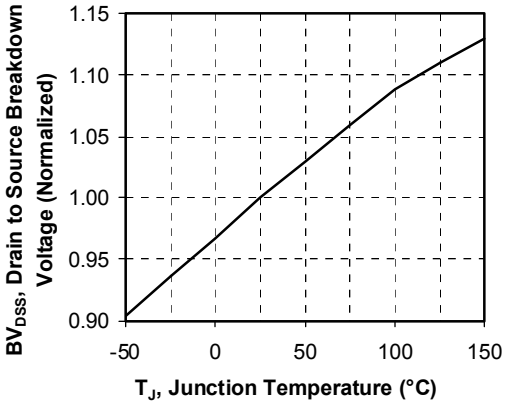




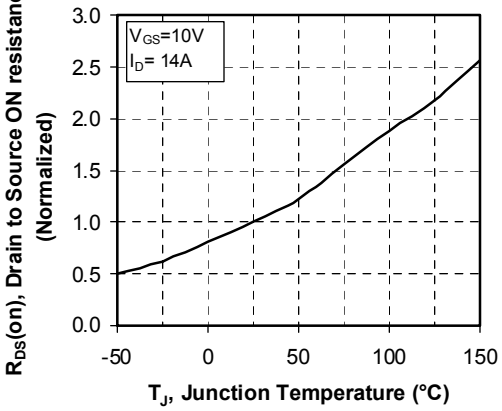




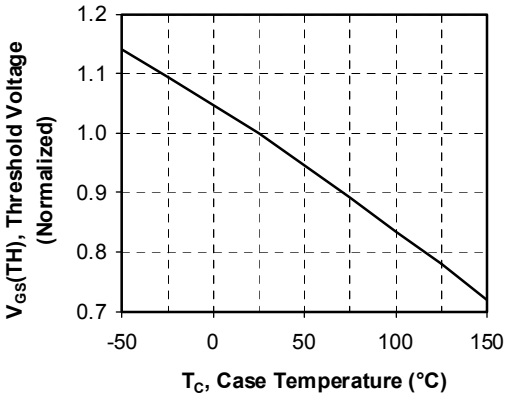
Breakdown Voltage vs Temperature



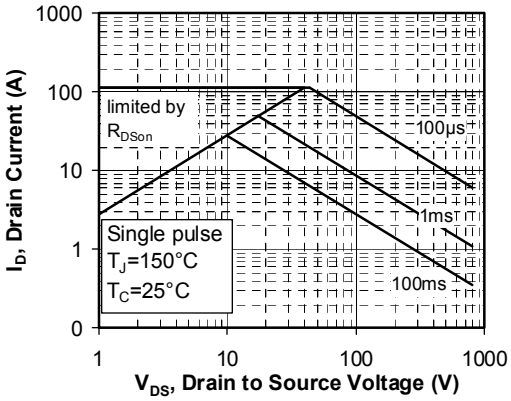
ON resistance vs Temperature



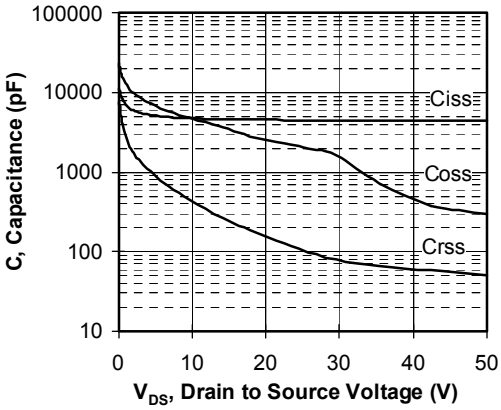
Threshold Voltage vs Temperature



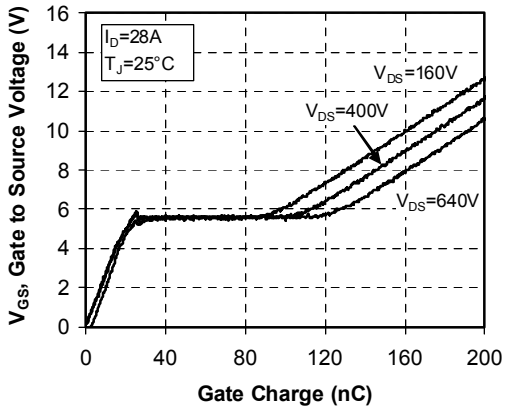
Maximum Safe Operating Area



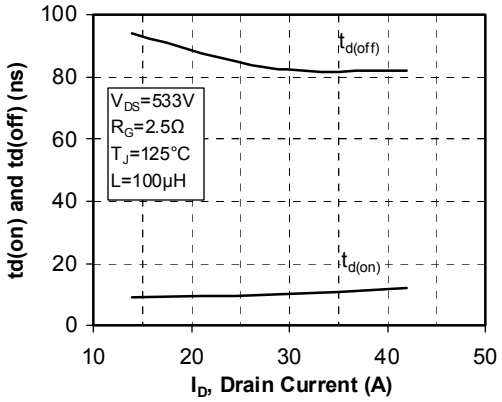
Capacitance vs Drain to Source Voltage



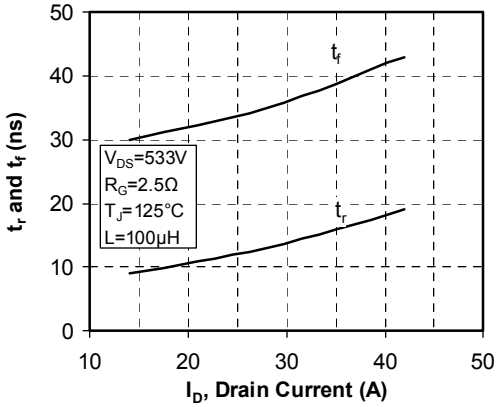
Gate Charge vs Gate to Source Voltage



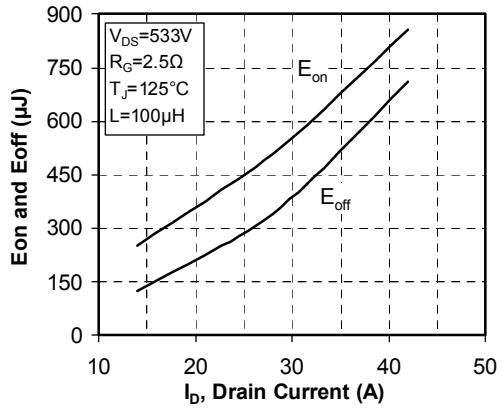
Delay Times vs Current



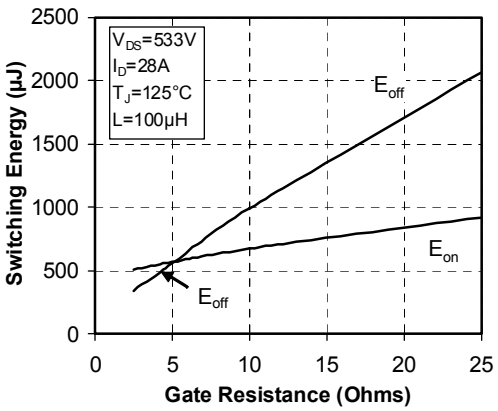
Rise and Fall times vs Current



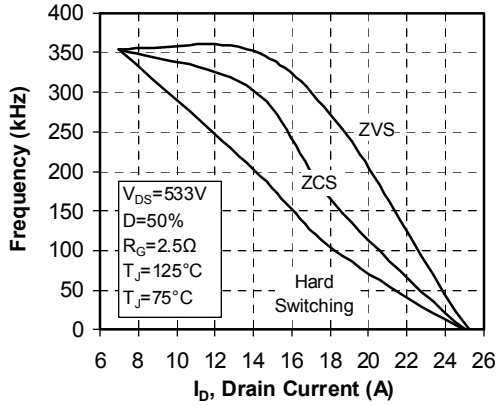
Switching Energy vs Current



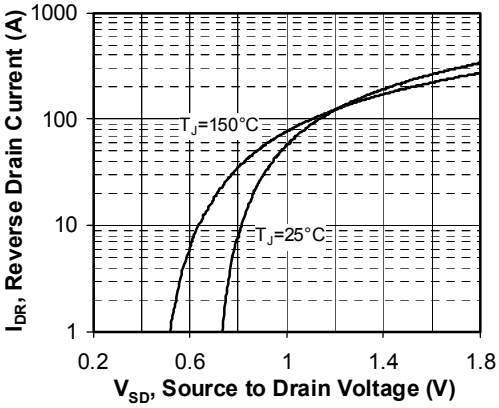
Switching Energy vs Gate Resistance



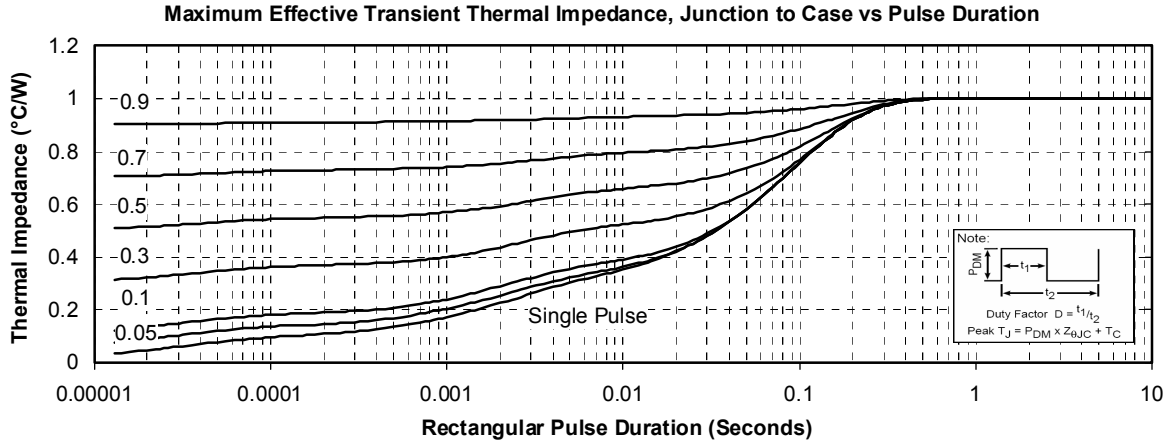
Operating Frequency vs Drain Current

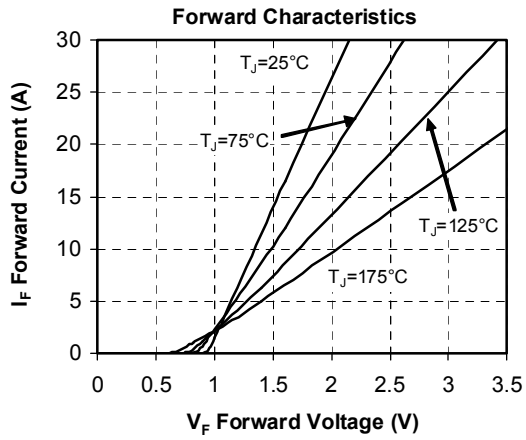


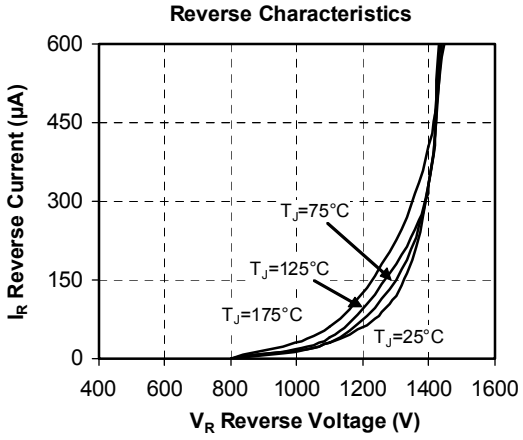
Source to Drain Diode Forward Voltage

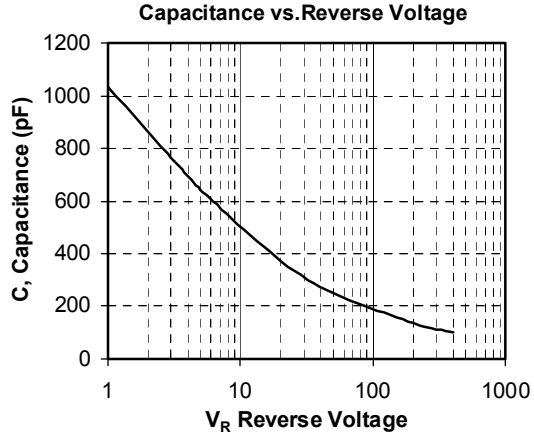


Typical SiC Diode Performance Curve









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