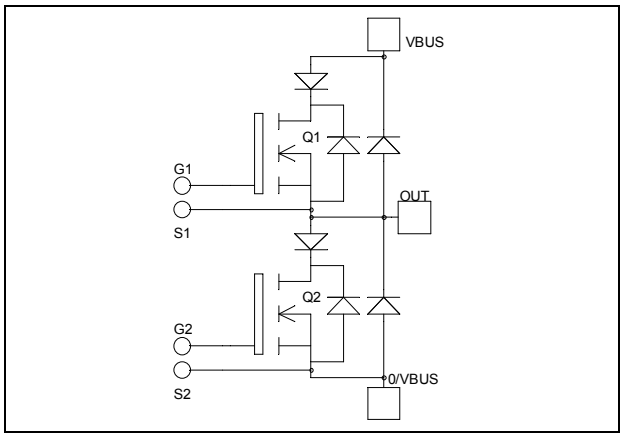
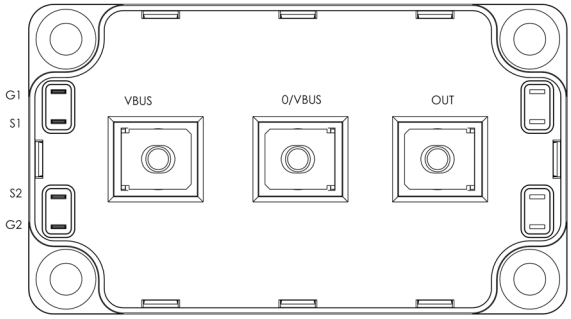
APTM100A13SCG

Phase leg
Series & SiC parallel diodes
MOSFET Power Module

V_{DSS} = 1000V
R_{DSon} = 130mΩ typ @ Tj = 25°C
I_D = 65A @ Tc = 25°C





Application

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

Features

- ***Power MOS 7® MOSFETs***
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
  - Very rugged
- ***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
  - M5 power connectors
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- 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		1000	V
I_D	Continuous Drain Current	T_c = 25°C	65	A
		T_c = 80°C	49	
I_{DM}	Pulsed Drain current		240	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		156	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	1250	W
I_{AR}	Avalanche current (repetitive and non repetitive)		24	A
E_{AR}	Repetitive Avalanche Energy		30	mJ
E_{AS}	Single Pulse Avalanche Energy		1300	

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} = 1000V	T_j = 25°C			600	µA
		V_{GS} = 0V, V_{DS} = 800V	T_j = 125°C			2	mA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 32.5A			130	156	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 6mA		3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V				±450	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		15.2		nF
C_{oss}	Output Capacitance			2.6		
C_{rss}	Reverse Transfer Capacitance			0.42		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 500V I_D = 65A		562		nC
Q_{gs}	Gate – Source Charge			75		
Q_{gd}	Gate – Drain Charge			363		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @125°C** V_{GS} = 15V V_{Bus} = 667V I_D = 65A R_G = 0.5Ω		9		ns
T_r	Rise Time			9		
$T_{d(off)}$	Turn-off Delay Time			50		
T_f	Fall Time			24		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 667V I_D = 65A, R_G = 0.5Ω		1278		µJ
E_{off}	Turn-off Switching Energy			462		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 667V I_D = 65A, R_G = 0.5Ω		2671		µJ
E_{off}	Turn-off Switching Energy			570		
R_{thJC}	Junction to Case Thermal Resistance				0.1	°C/W

Series diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Repetitive Reverse Voltage			1000			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1000V				350	µA
I_F	DC Forward Current		T_c = 100°C		120		A
V_F	Diode Forward Voltage	I_F = 120A			1.9	2.5	V
		I_F = 240A			2.2		
		I_F = 120A	T_j = 125°C		1.7		
t_{rr}	Reverse Recovery Time	I_F = 120A V_R = 667V di/dt = 400A/µs	T_j = 25°C		280		ns
			T_j = 125°C		350		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		1520		nC
			T_j = 125°C		7200		
R_{thJC}	Junction to Case Thermal Resistance					0.46	°C/W

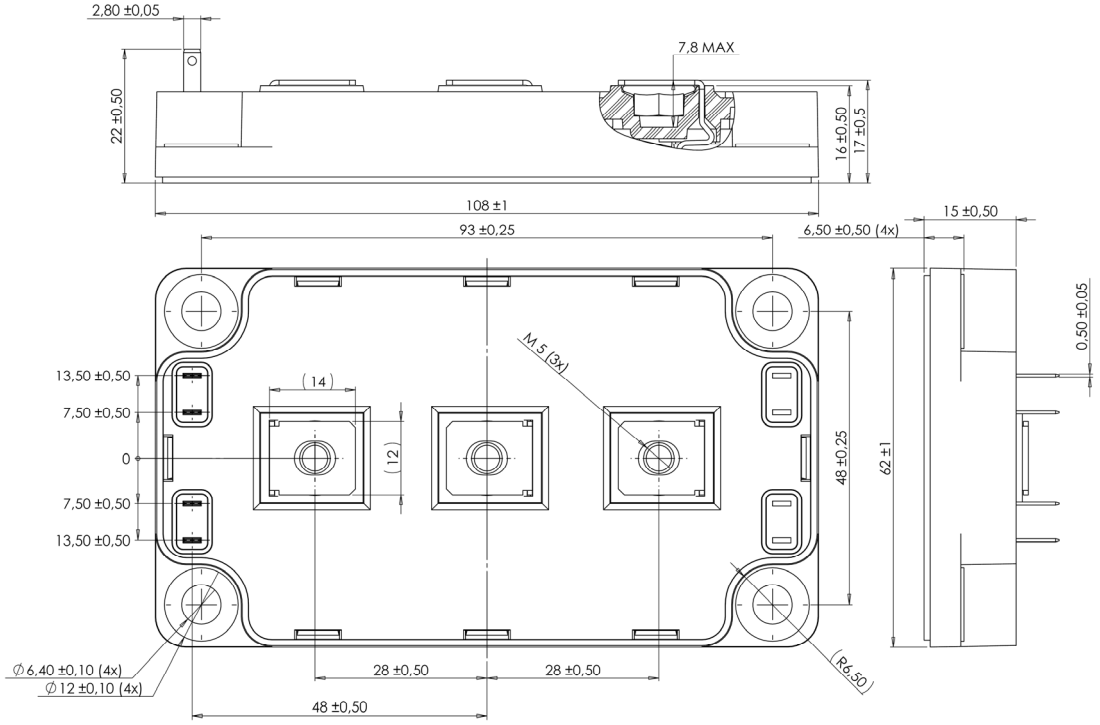
SiC Parallel diode ratings and characteristics

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		400	1600	µA
			T_j = 125°C		800	8000	
I_F	DC Forward Current		Tc = 125°C		40		A
V_F	Diode Forward Voltage	I_F = 40A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.6	3.0	
Q_C	Total Capacitive Charge	I_F = 40A, V_R = 600V di/dt =2000A/µs			112		nC
Q	Total Capacitance	f = 1MHz, V_R = 200V			360		pF
		f = 1MHz, V_R = 400V			264		
R_{thJC}	Junction to Case Thermal Resistance					0.35	°C/W

Thermal and package characteristics

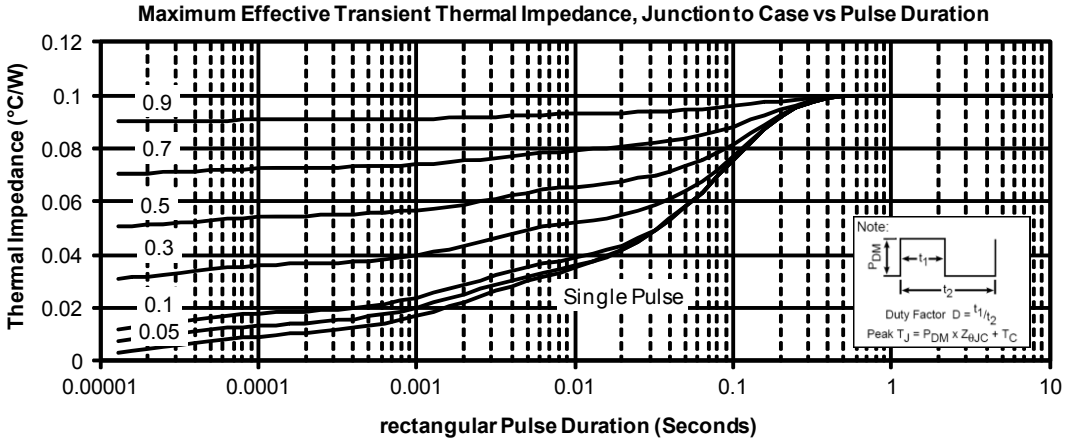
Symbol	Characteristic			Min	Typ	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
		For terminals	M5	2		3.5	
Wt	Package Weight					300	g

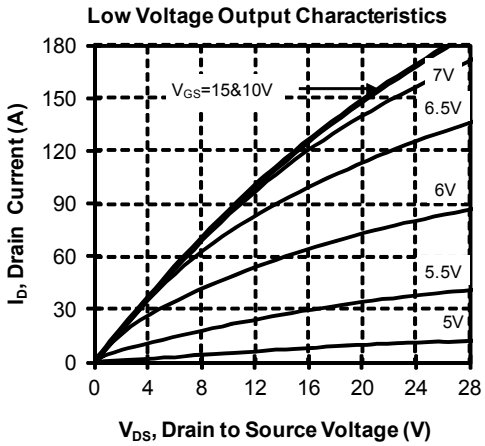
SP6 Package outline (dimensions in mm)

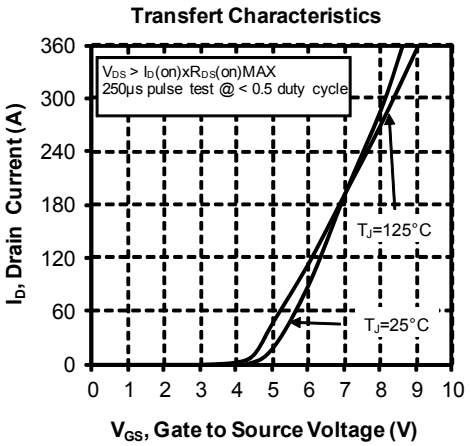


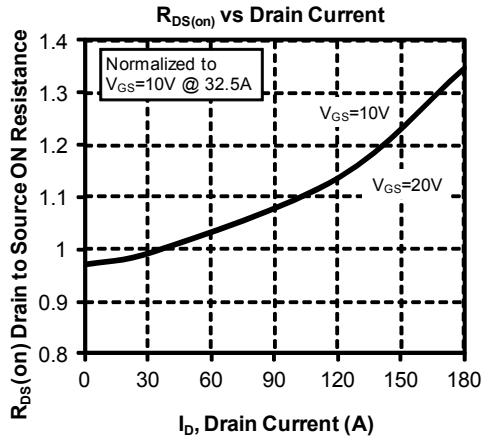
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

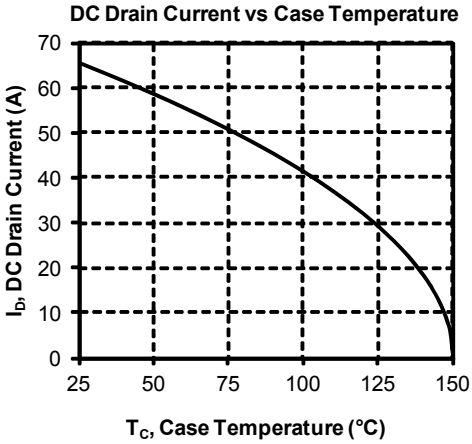
Typical MOSFET Performance Curve

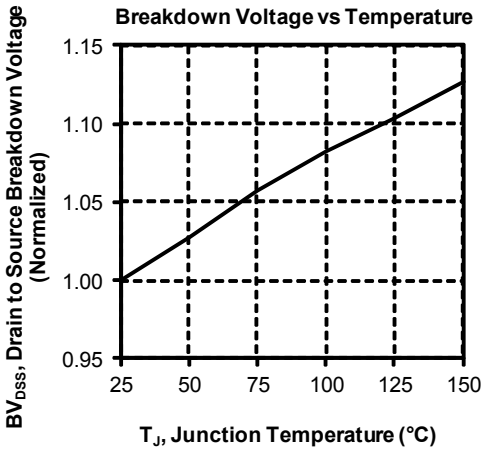


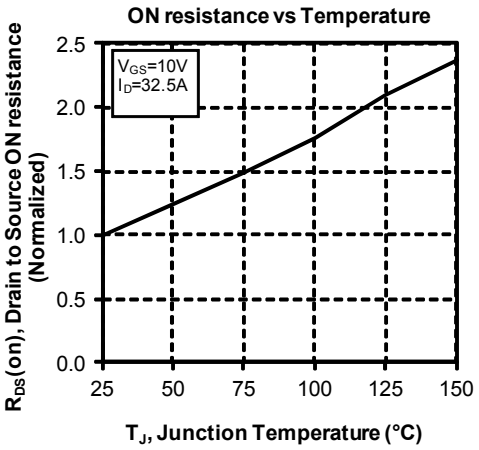


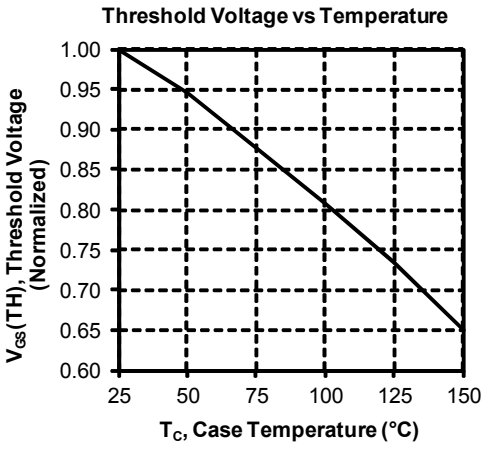


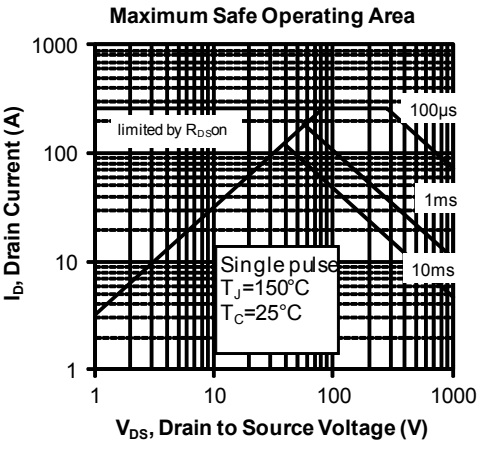


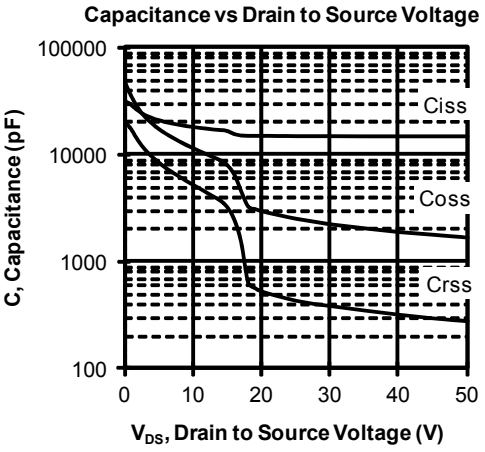


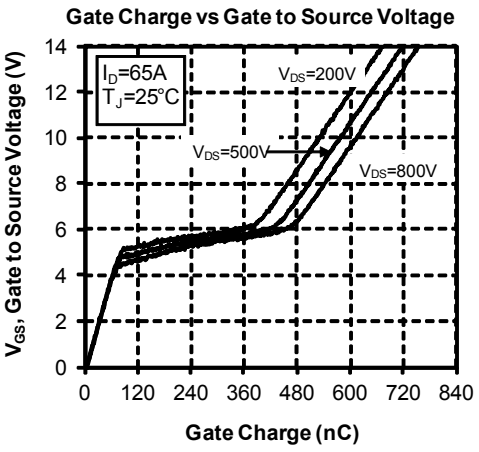

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
25
50
75
100
125
150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
VGS=10V
ID=32.5A
RDS(on), Drain to Source ON resistance (Normalized)
2.5
2.0
1.5
1.0
0.5
0.0
25
50
75
100
125
150
TJ, Junction Temperature (°C)

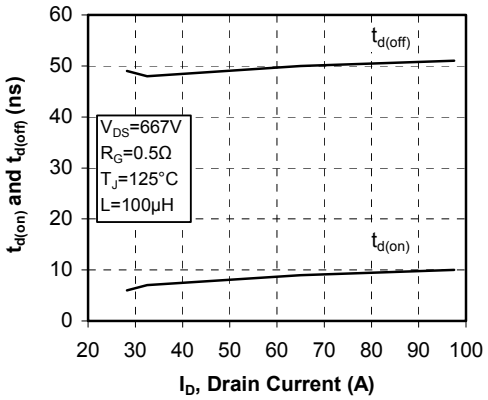

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
25
50
75
100
125
150
TC, Case Temperature (°C)


Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
limited by RDSon
100µs
1ms
10ms
Single pulse
TJ=150°C
TC=25°C
1
10
100
1000
VDS, Drain to Source Voltage (V)

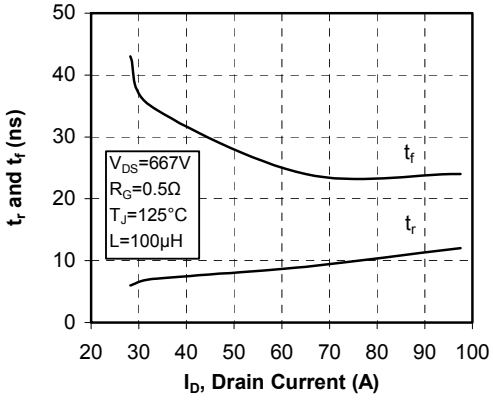

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
Ciss
Coss
Crss
0
10
20
30
40
50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
14
12
10
8
6
4
2
0
ID=65A
TJ=25°C
VDS=200V
VDS=500V
VDS=800V
0
120
240
360
480
600
720
840
Gate Charge (nC)

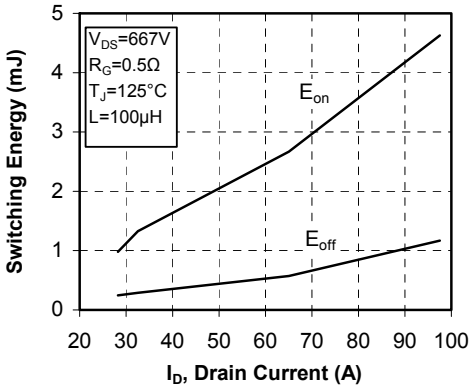
Delay Times vs Current



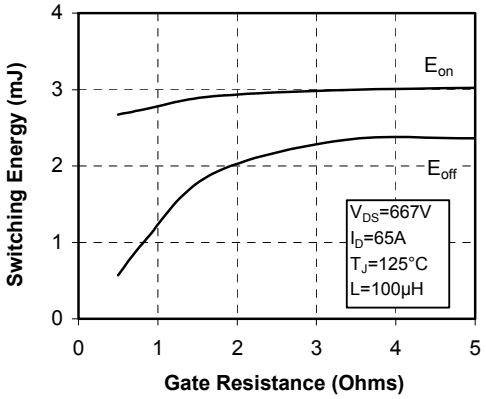
Rise and Fall times vs Current



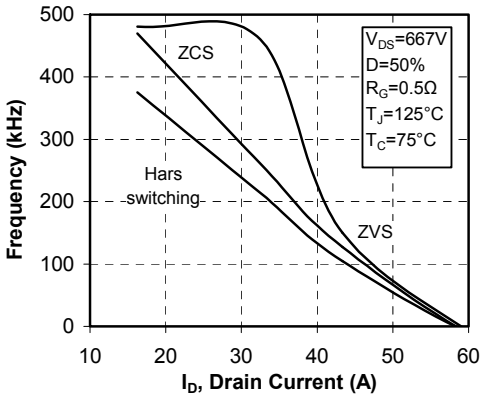
Switching Energy vs Current



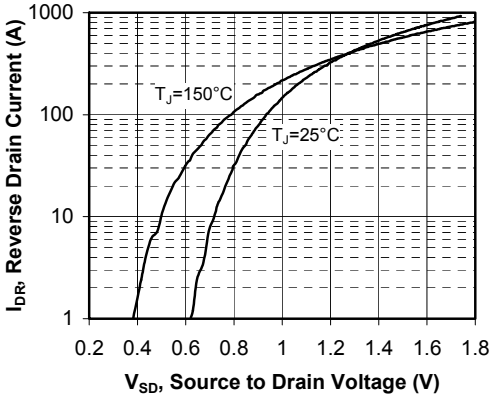
Switching Energy vs Gate Resistance



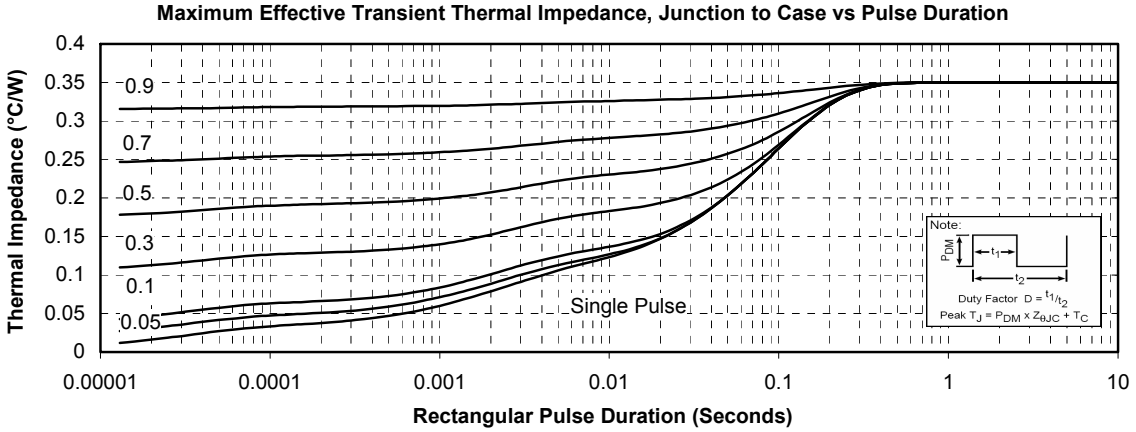
Operating Frequency vs Drain Current

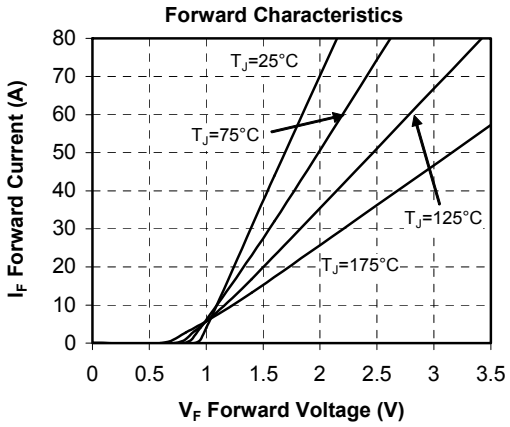


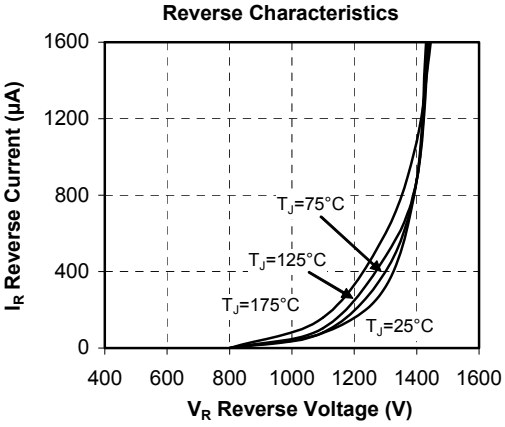
Source to Drain Diode Forward Voltage

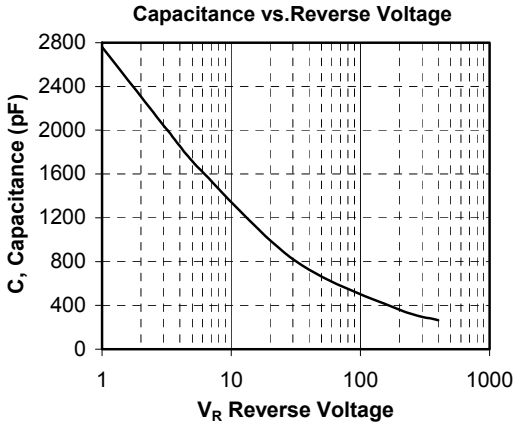


Typical SiC Diode Performance Curve









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