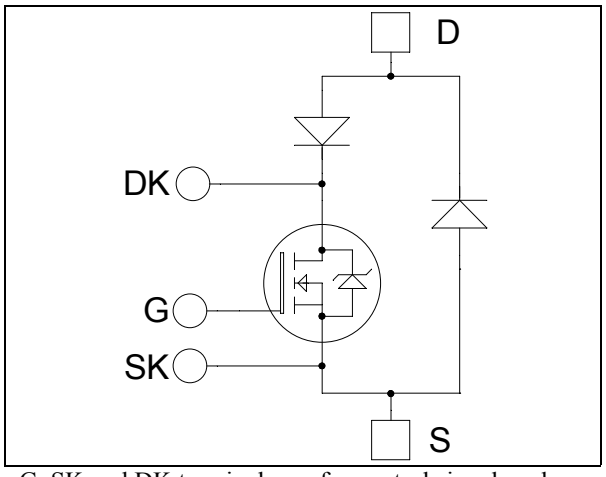
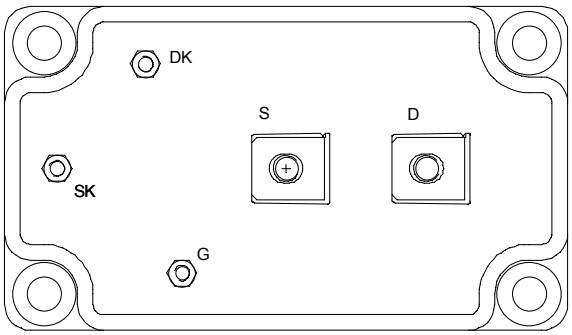
APTM120U10SCAVG

Single switch
Series & SiC parallel diodes
MOSFET Power Module

V_{DSS} = 1200V
R_{DSon} = 100mΩ typ @ Tj = 25°C
I_D = 116A @ Tc = 25°C



G, SK and DK terminals are for control signals only (not for power)



Application

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

Features

- ***Power MOS 7® MOSFETs***
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
  - Very rugged
- ***SiC Parallel Schottky Diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Kelvin source for easy drive
- Kelvin drain for voltage monitoring
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
  - M3 power connectors
- High level of integration
- AlN substrate for improved MOSFET thermal performance

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

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

Absolute maximum ratings

Symbol	Parameter		Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage		1200	V
I_D	Continuous Drain Current	T_c = 25°C	116	A
		T_c = 80°C	86	
I_{DM}	Pulsed Drain current		464	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		120	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	3290	W
I_{AR}	Avalanche current (repetitive and non repetitive)		24	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		3200	

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 1200V	T_j = 25°C			1	mA
		V_{GS} = 0V, V_{DS} = 1000V	T_j = 125°C			3	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 58A			100	120	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 20mA		3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V				±400	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz		28.9		nF
C_{oss}	Output Capacitance			4.4		
C_{rss}	Reverse Transfer Capacitance			0.8		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 600V I_D = 116A		1100		nC
Q_{gs}	Gate – Source Charge			128		
Q_{gd}	Gate – Drain Charge			716		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 800V I_D = 116A R_G =1.2Ω		20		ns
T_r	Rise Time			17		
$T_{d(off)}$	Turn-off Delay Time			245		
T_f	Fall Time			62		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 15V, V_{Bus} = 800V I_D = 116A, R_G = 1.2Ω		3		mJ
E_{off}	Turn-off Switching Energy			4.6		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 15V, V_{Bus} = 800V I_D = 116A, R_G = 1.2Ω		5.5		mJ
E_{off}	Turn-off Switching Energy			5.6		
R_{thJC}	Junction to Case Thermal Resistance				0.038	°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				500	µA
I_F	DC Forward Current		T_c = 100°C		240		A
V_F	Diode Forward Voltage	I_F = 240A			1.9	2.5	V
		I_F = 480A			2.2		
		I_F = 240A	T_j = 125°C		1.7		
t_{rr}	Reverse Recovery Time	I_F = 240A V_R = 667V di/dt = 800A/µs	T_j = 25°C		280		ns
			T_j = 125°C		350		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		3		µC
			T_j = 125°C		14.4		
R_{thJC}	Junction to Case Thermal Resistance					0.19	°C/W

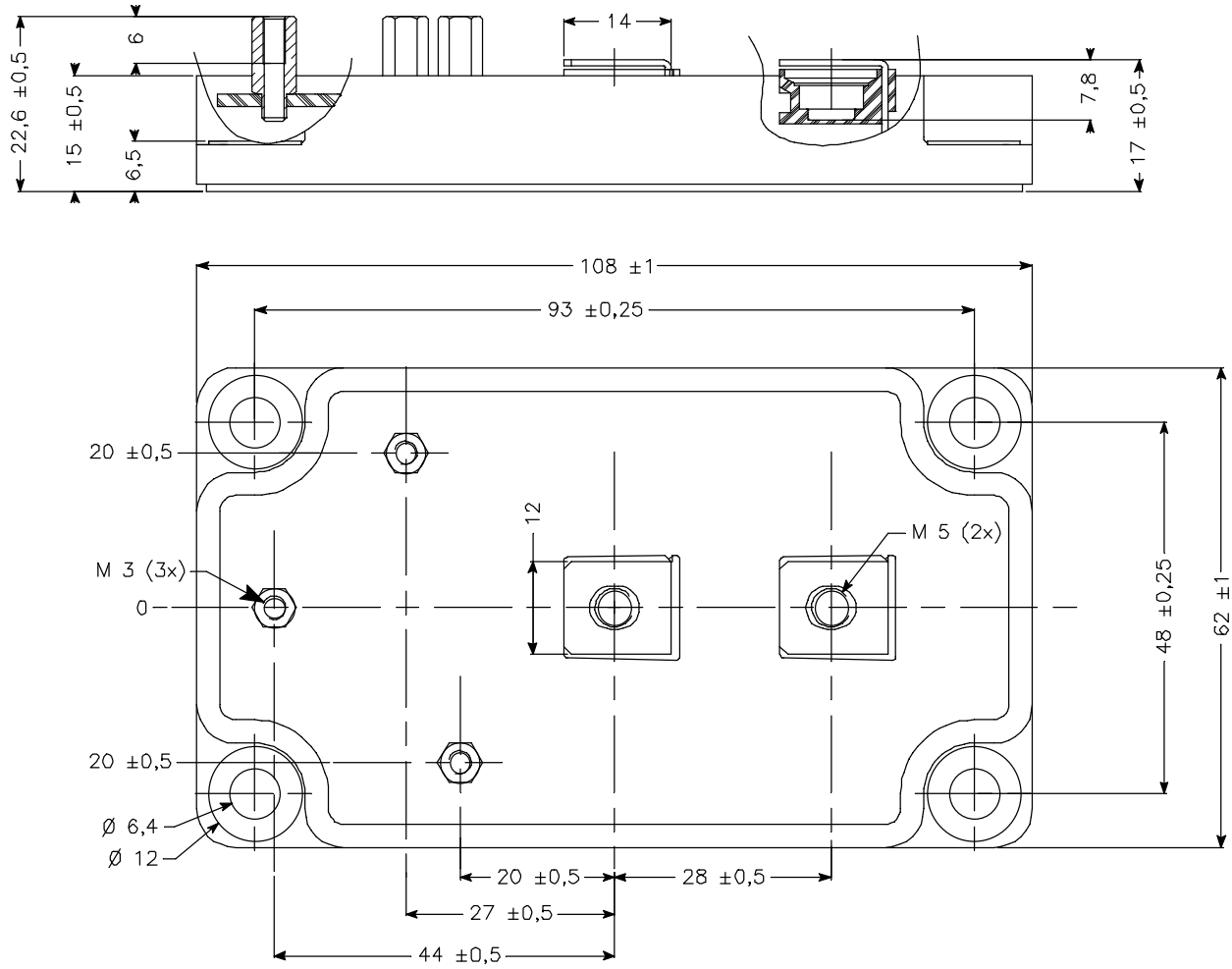
SiC Parallel diode ratings and characteristics

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		288	1800	µA
			T_j = 175°C		504	9000	
I_F	DC Forward Current		Tc = 100°C		90		A
V_F	Diode Forward Voltage	I_F = 90A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.3	3	
Q_C	Total Capacitive Charge	I_F = 90A, V_R = 1200V di/dt = 4500A/µs			720		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			864		pF
		f = 1MHz, V_R = 400V			621		
R_{thJC}	Junction to Case Thermal Resistance					0.22	°C/W

Thermal and package characteristics

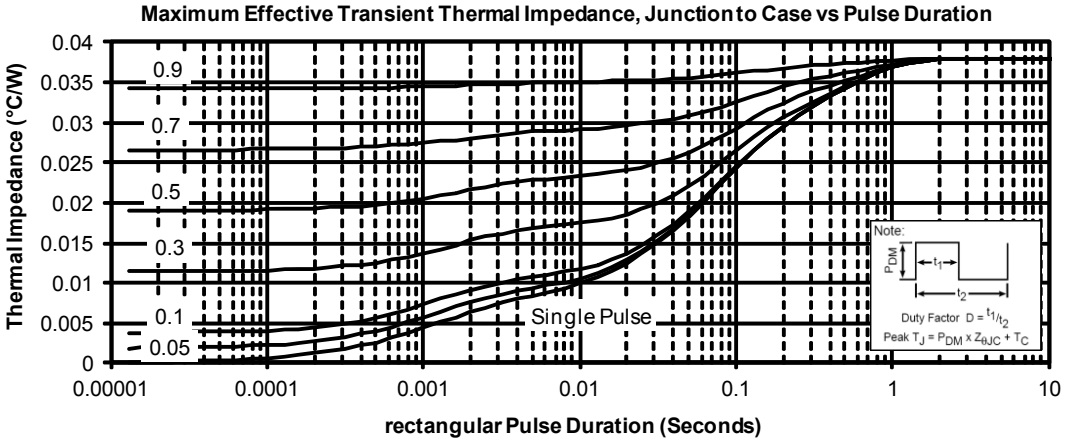
Symbol	Characteristic			Min	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000		V
T_J	Operating junction temperature range			-40	150	°C
T_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	
T_{STG}	Storage Temperature Range			-40	125	
T_C	Operating Case Temperature			-40	100	
Torque	Mounting torque	To heatsink	M6	3	5	N.m
		For terminals	M5	2	3.5	
			M3	1	1.5	
Wt	Package Weight				300	g

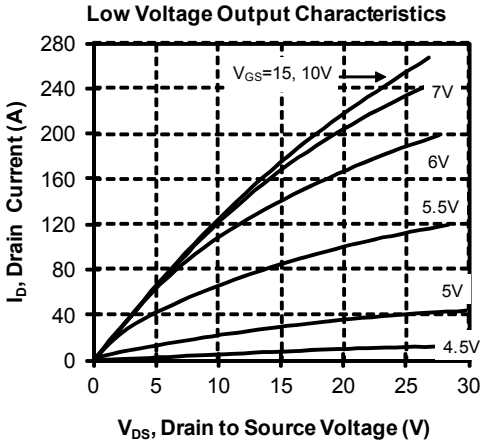
SP6 Package outline (dimensions in mm)

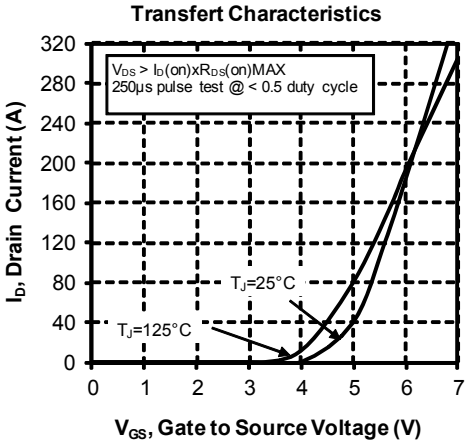


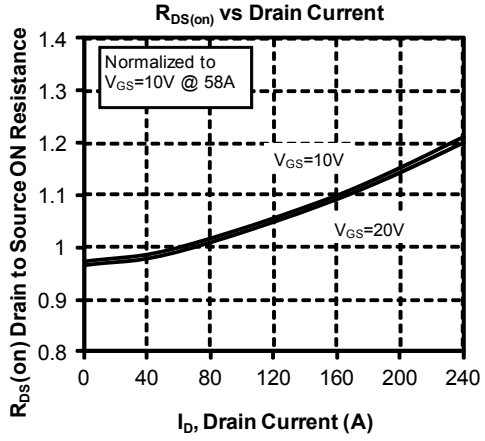
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

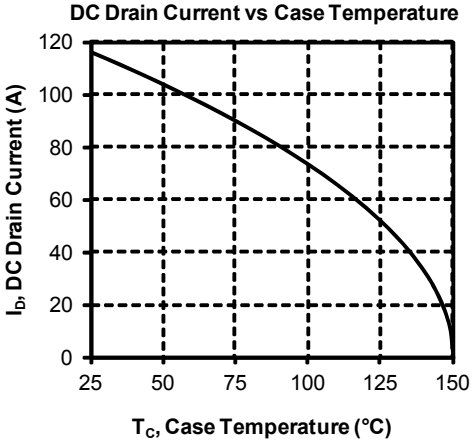
Typical MOSFET Performance Curve

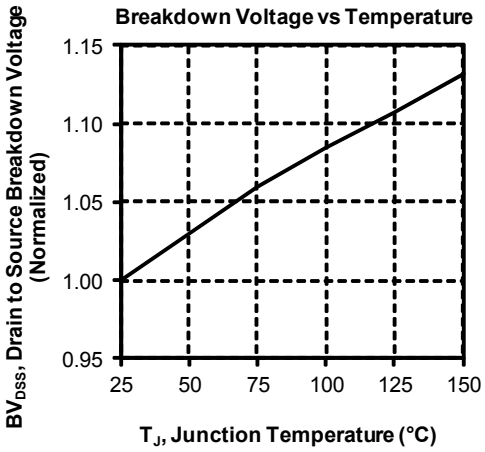


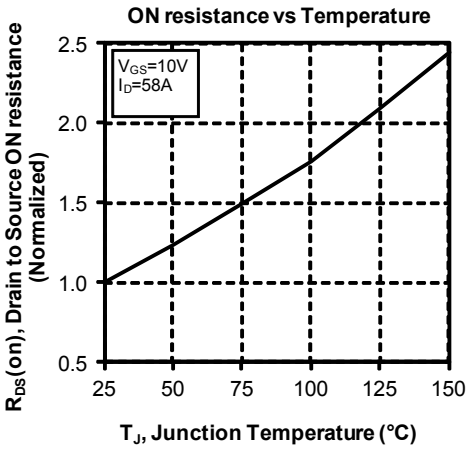


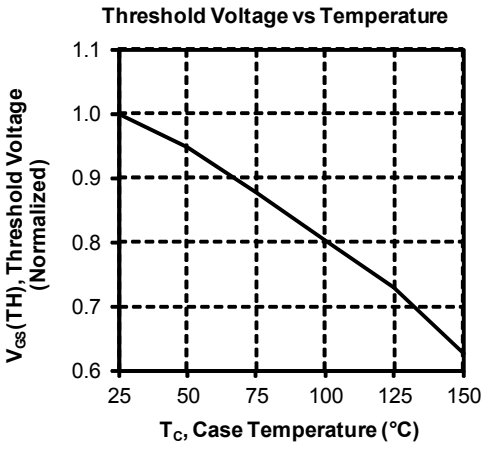


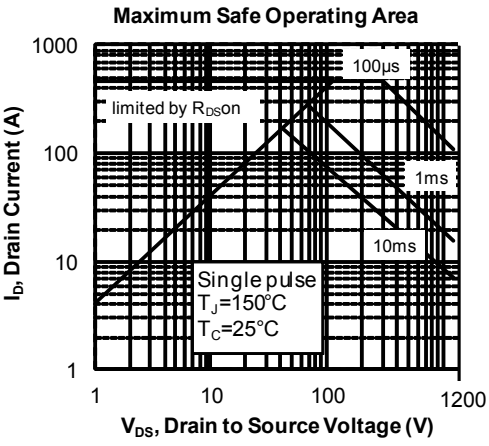


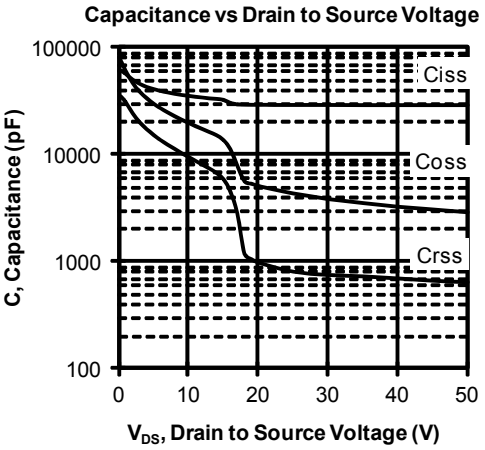


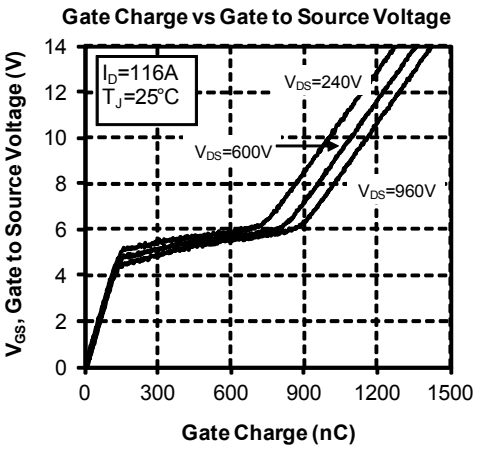

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
25
50
75
100
125
150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID=58A
2.5
2.0
1.5
1.0
0.5
25
50
75
100
125
150
TJ, Junction Temperature (°C)

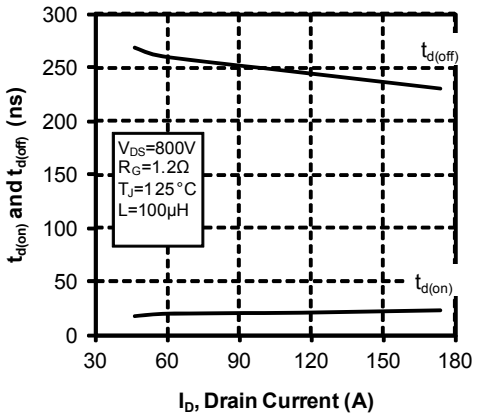

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.1
1.0
0.9
0.8
0.7
0.6
25
50
75
100
125
150
TC, Case Temperature (°C)


Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
100µs
limited by RDSon
1ms
10ms
Single pulse
TJ=150°C
TC=25°C
1
10
100
1200
VDS, Drain to Source Voltage (V)

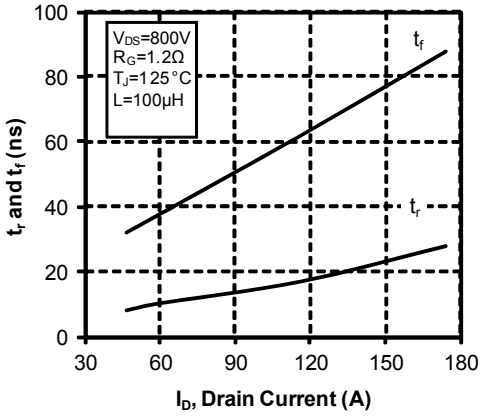

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
Ciss
Coss
Crss
0
10
20
30
40
50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
ID=116A
TJ=25°C
VDS=240V
VDS=600V
VDS=960V
14
12
10
8
6
4
2
0
0
300
600
900
1200
1500
Gate Charge (nC)

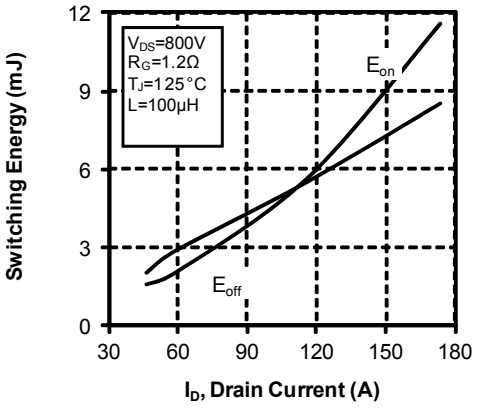
Delay Times vs Current



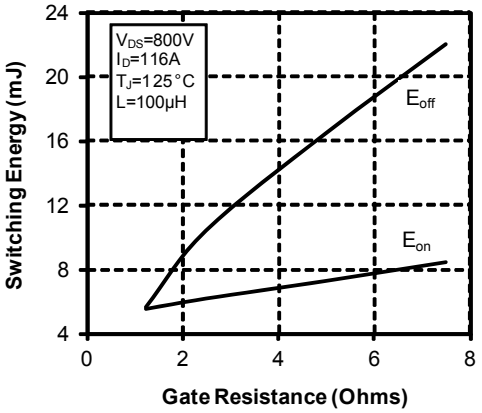
Rise and Fall times vs Current



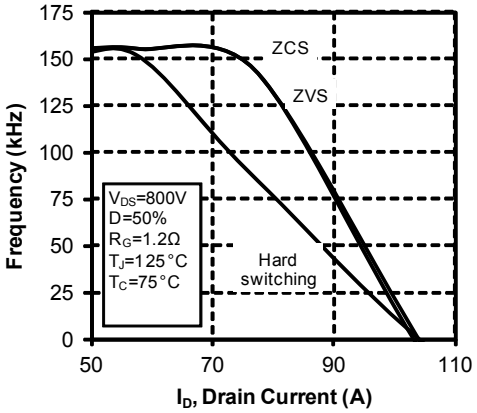
Switching Energy vs Current



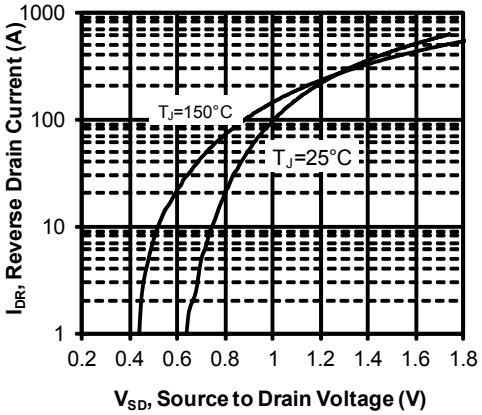
Switching Energy vs Gate Resistance



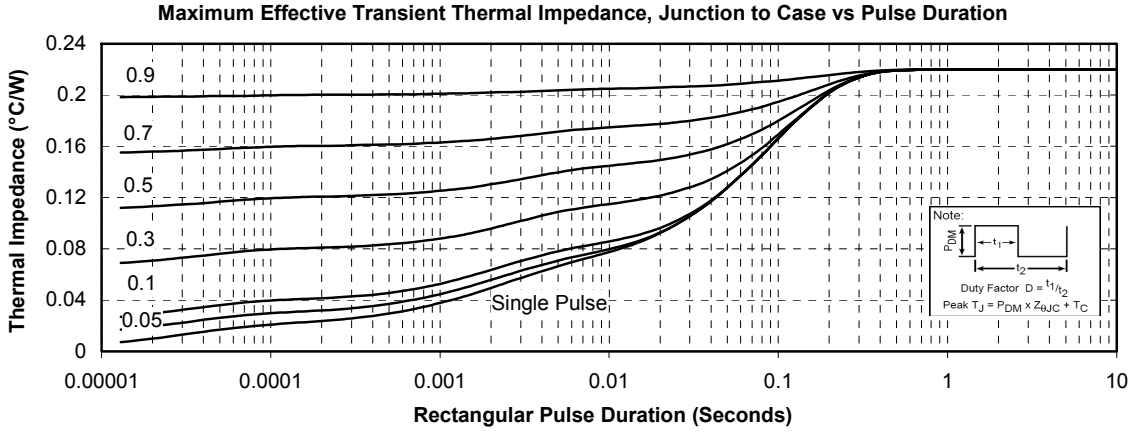
Operating Frequency vs Drain Current

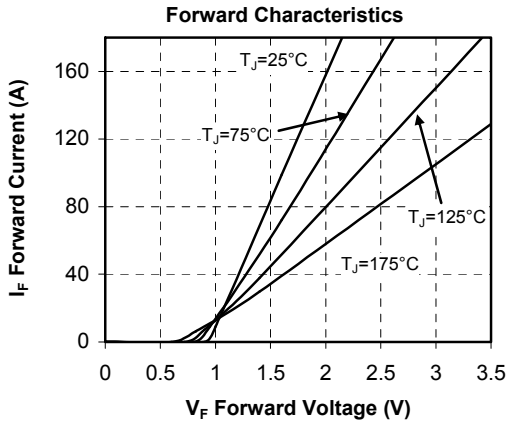


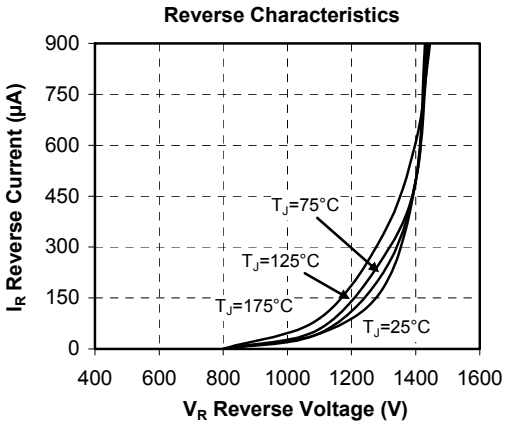
Source to Drain Diode Forward Voltage

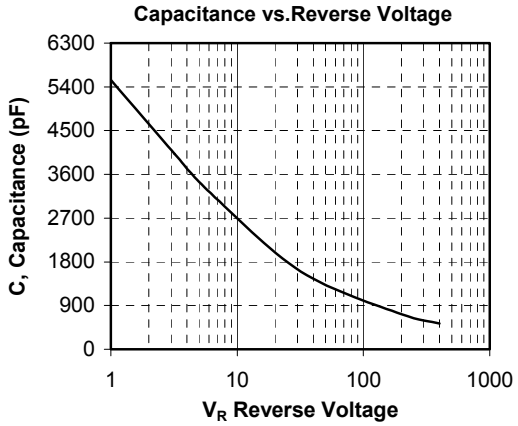


SiC Typical Performance Curve









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