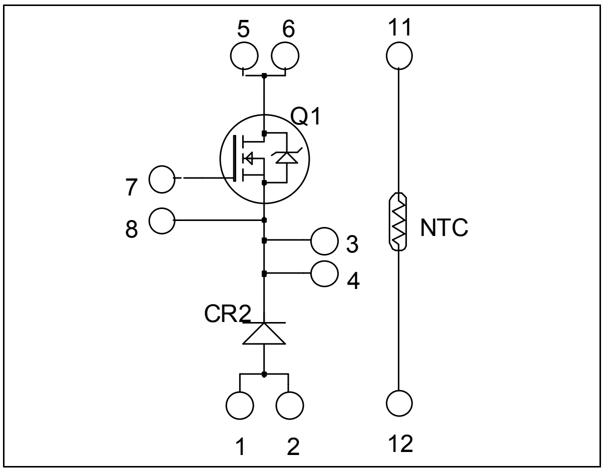
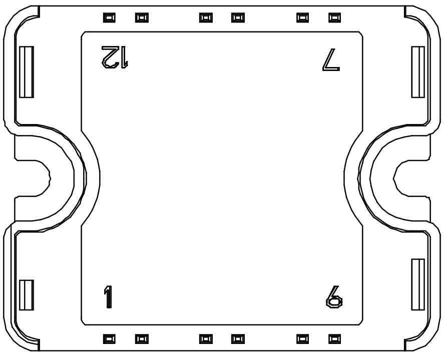
POWER PRODUCTS GROUP

APTC60SKM24CT1G

Buck chopper
Super Junction MOSFET
SiC chopper diode

V_{DSS} = 600V
R_{DSon} = 24mΩ max @ Tj = 25°C
I_D = 95A @ Tc = 25°C





Pins 1/2 ; 3/4 ; 5/6 must be shorted together

Application

- AC and DC motor control
- Switched Mode Power Supplies

Features

- COOLMOS Power Semiconductors
  - Ultra low R_{DSon}
  - Low Miller capacitance
  - Ultra low gate charge
  - Avalanche energy rated
  - Very rugged
- ***CR2 SiC Schottky Diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Very low stray inductance
- 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		600	V
I_D	Continuous Drain Current	T_c = 25°C	95	A
		T_c = 80°C	70	
I_{DM}	Pulsed Drain current		260	
V_{GS}	Gate - Source Voltage		±20	V
R_{DSon}	Drain - Source ON Resistance		24	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	462	W
I_{AR}	Avalanche current (repetitive and non repetitive)		15	A
E_{AR}	Repetitive Avalanche Energy		3	mJ
E_{AS}	Single Pulse Avalanche Energy		1900	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling 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} = 600V	T_j = 25°C			350	µA
		V_{GS} = 0V, V_{DS} = 600V	T_j = 125°C			600	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 47.5A				24	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 5mA		2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0V				200	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V ; V_{DS} = 25V f = 1MHz		14.4		nF
C_{oss}	Output Capacitance			17		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 300V I_D = 95A		300		nC
Q_{gs}	Gate – Source Charge			68		
Q_{gd}	Gate – Drain Charge			102		
$T_{d(on)}$	Turn-on Delay Time	**Inductive Switching (125°C)** V_{GS} = 10V V_{Bus} = 400V I_D = 95A R_G = 2.5Ω		21		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			100		
T_f	Fall Time			45		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** V_{GS} = 10V ; V_{Bus} = 400V I_D = 95A ; R_G = 2.5Ω		810		µJ
E_{off}	Turn-off Switching Energy			1040		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** V_{GS} = 10V ; V_{Bus} = 400V I_D = 95A ; R_G = 2.5Ω		1320		µJ
E_{off}	Turn-off Switching Energy			1270		

CR2 SiC diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I_{RM}	Maximum Reverse Leakage Current	V_R=600V	T_j = 25°C		200	800	µA
			T_j = 175°C		400	4000	
I_F	DC Forward Current		Tc = 100°C		40		A
V_F	Diode Forward Voltage	I_F = 40A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.0	2.4	
Q_C	Total Capacitive Charge	I_F = 40A, V_R = 300V di/dt =1200A/µs			56		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			260		pF
		f = 1MHz, V_R = 400V			200		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance	Transistor				0.27	°C/W
		SiC Diode				0.8	
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	M4	2		3	N.m
Wt	Package Weight					80	g

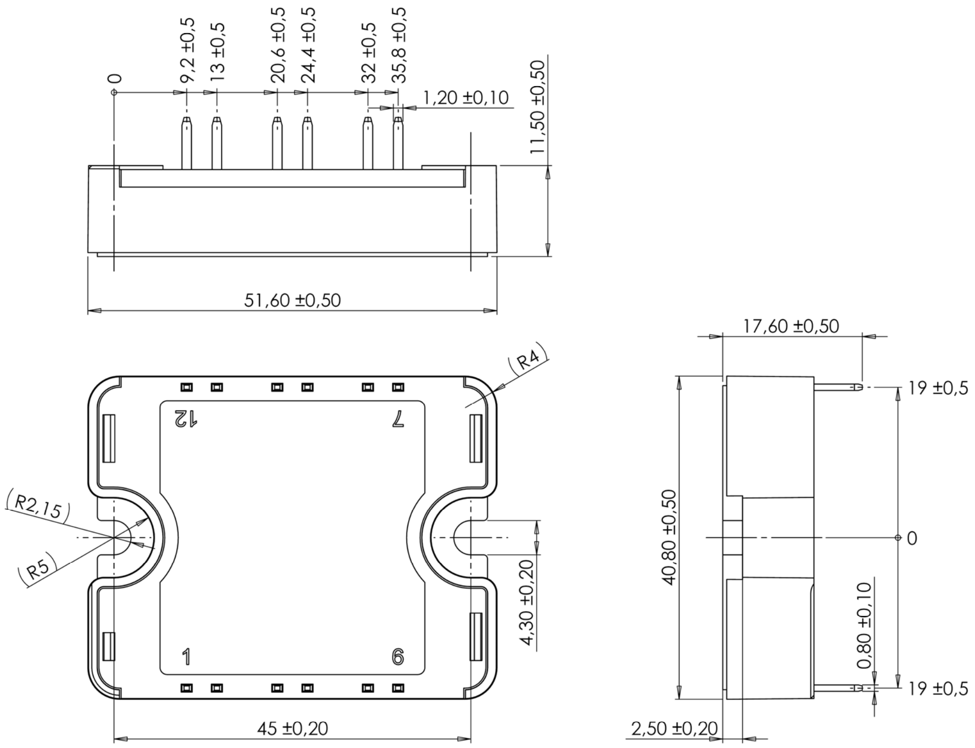
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

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

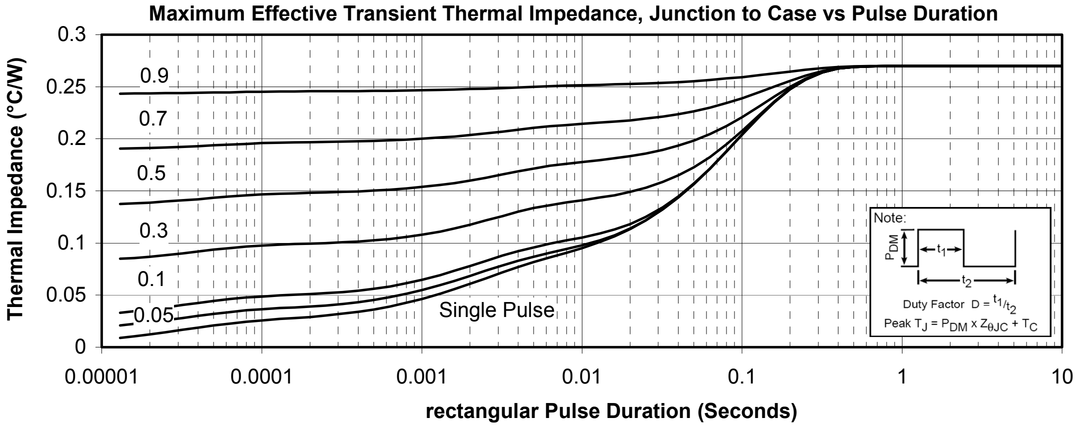
T: Thermistor temperature
R_T: Thermistor value at T

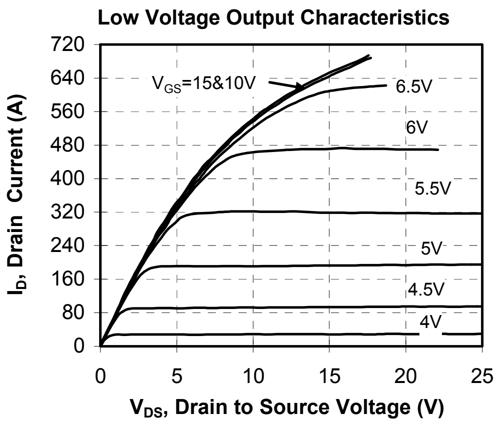
SP1 Package outline (dimensions in mm)

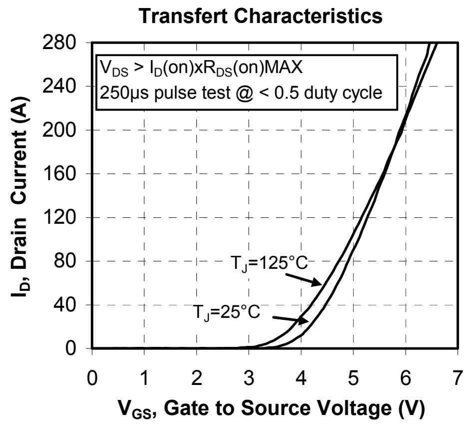


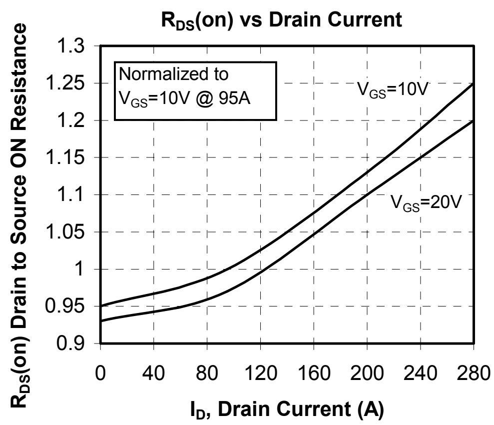
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

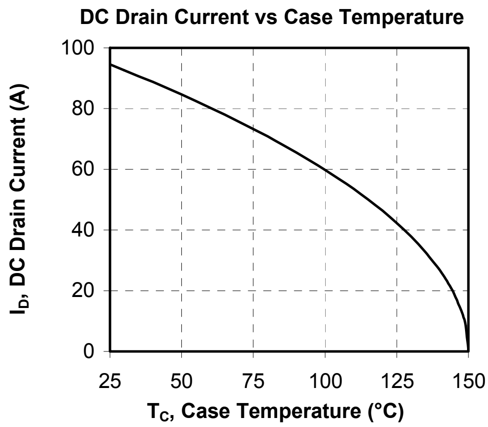
Typical CoolMOS Performance Curve

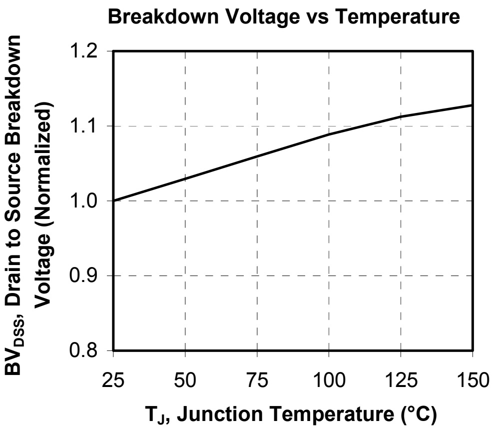


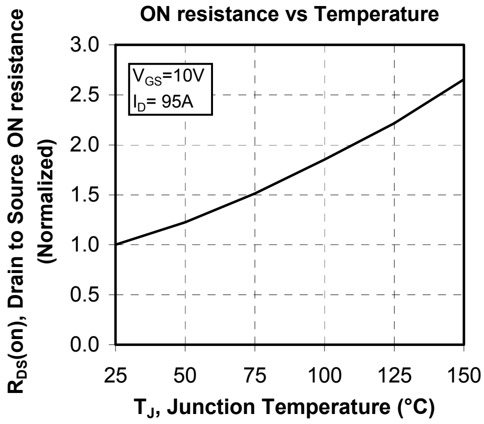


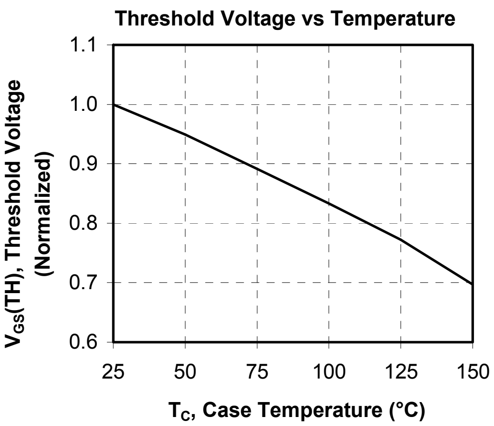


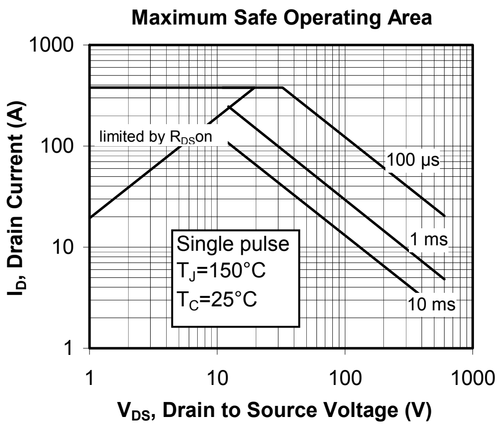


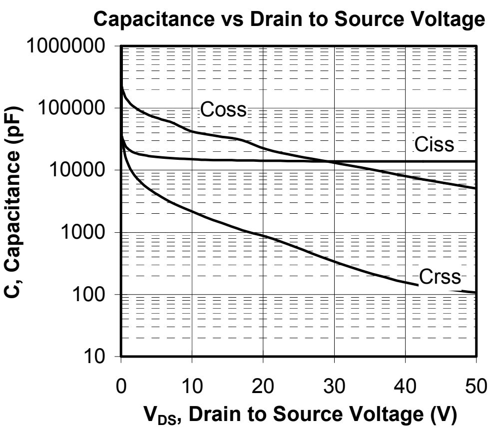


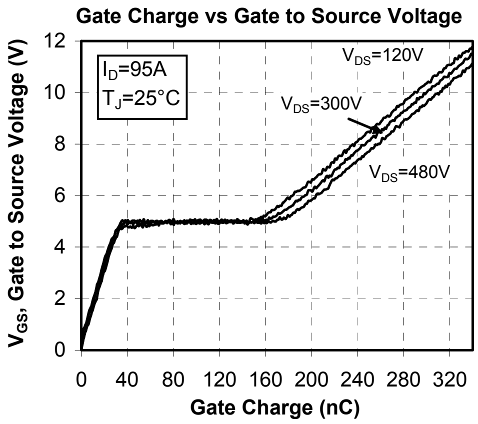

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
25 50 75 100 125 150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID= 95A
3.0
2.5
2.0
1.5
1.0
0.5
0.0
25 50 75 100 125 150
TJ, Junction Temperature (°C)

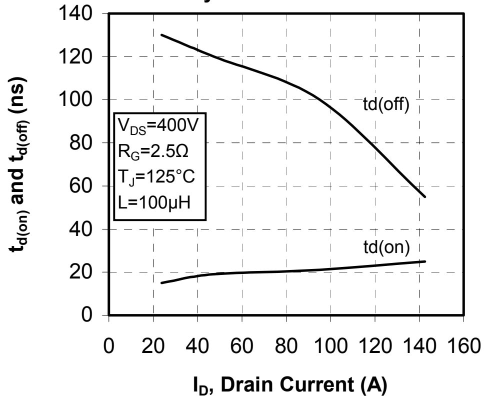

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.1
1.0
0.9
0.8
0.7
0.6
25 50 75 100 125 150
TC, Case Temperature (°C)


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

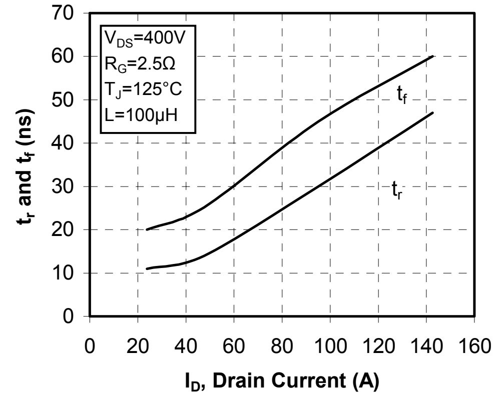

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
1000000
100000
10000
1000
100
10
Coss
Ciss
Crss
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
ID=95A
TJ=25°C
VDS=120V
VDS=300V
VDS=480V
12
10
8
6
4
2
0
0 40 80 120 160 200 240 280 320
Gate Charge (nC)

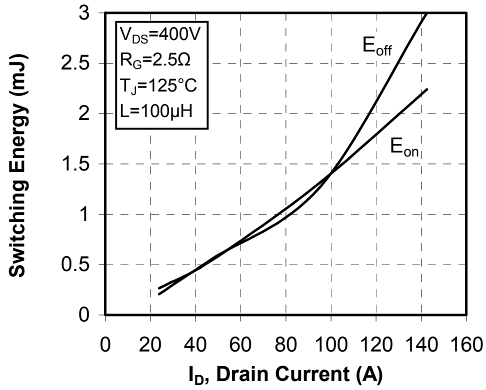
Delay Times vs Current



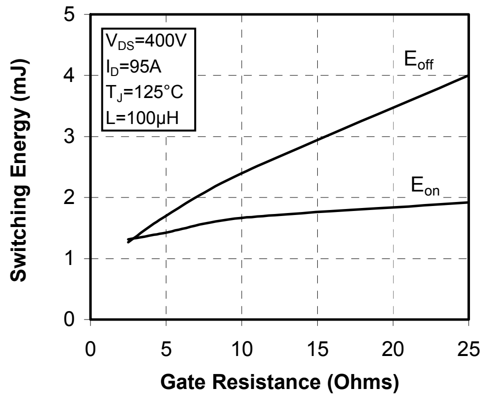
Rise and Fall times vs Current



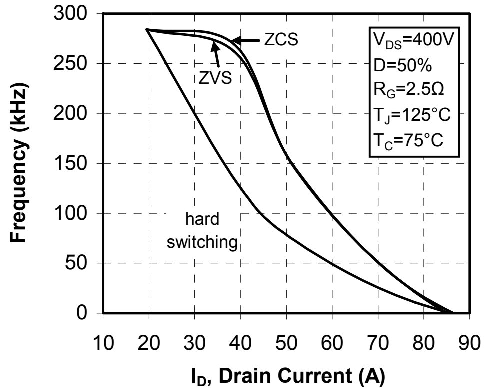
Switching Energy vs Current



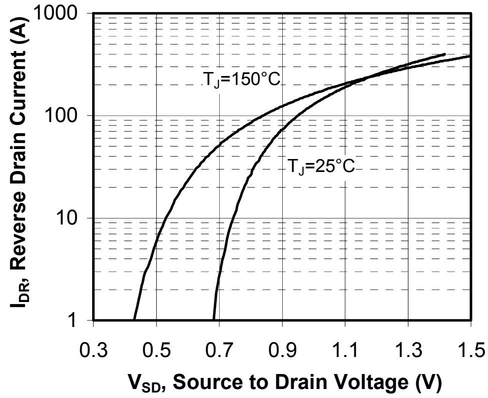
Switching Energy vs Gate Resistance



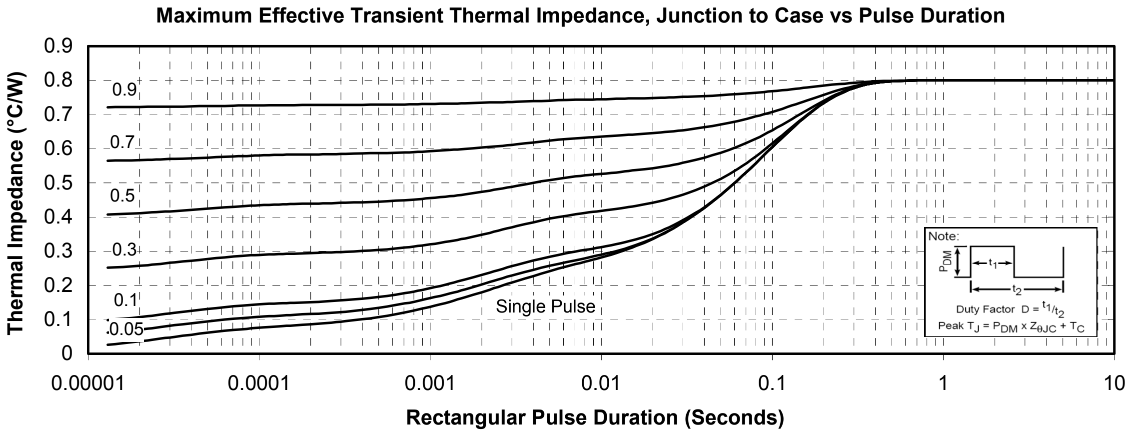
Operating Frequency vs Drain Current

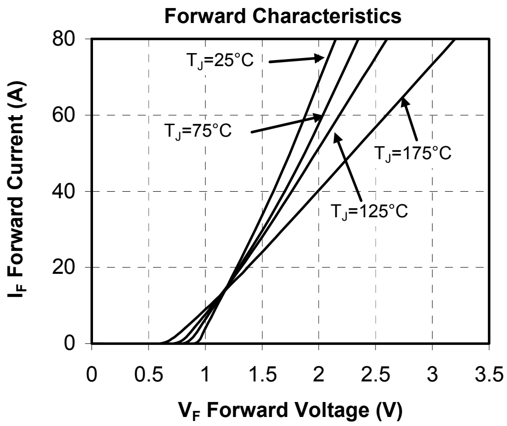


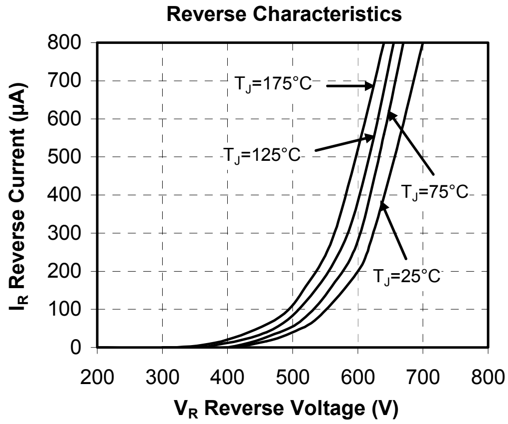
Source to Drain Diode Forward Voltage

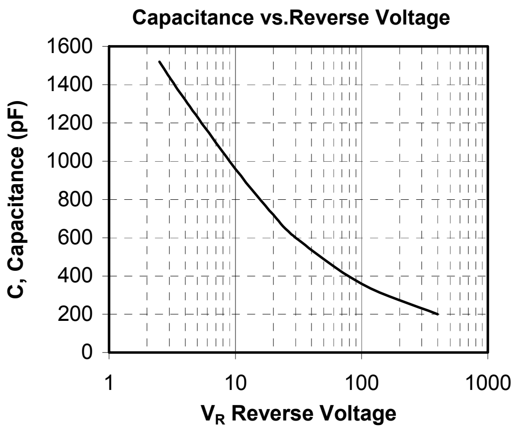


Typical CR2 SiC Diode Performance Curve









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