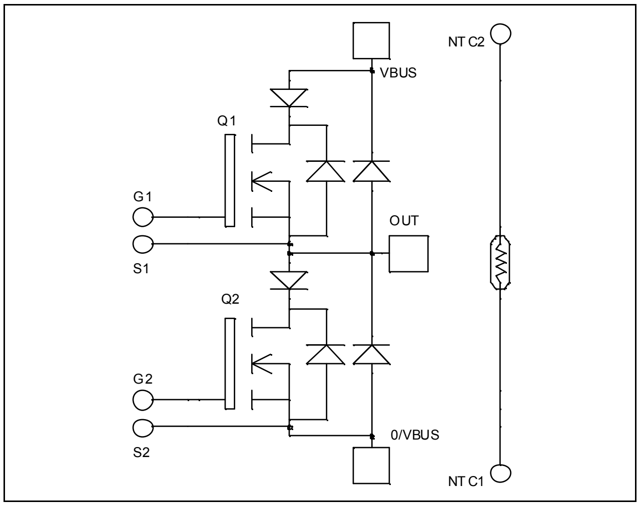
Microsemi
POWER PRODUCTS GROUP

APTC60AM35SCTG

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

V_{DSS} = 600V
R_{DSon} = 35mΩ max @ Tj = 25°C
I_D = 72A @ Tc = 25°C

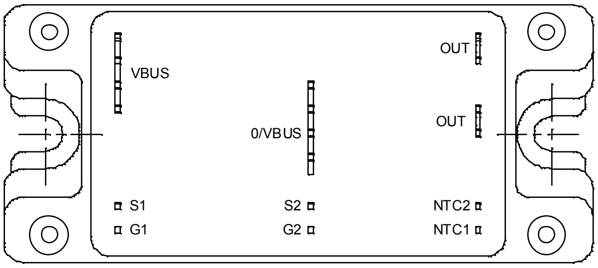


Application

- 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		600	V
I_D	Continuous Drain Current	T_c = 25°C	72	A
		T_c = 80°C	54	
I_{DM}	Pulsed Drain current		288	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		35	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	416	W
I_{AR}	Avalanche current (repetitive and non repetitive)		20	A
E_{AR}	Repetitive Avalanche Energy		1	mJ
E_{AS}	Single Pulse Avalanche Energy		1800	

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	$V_{GS} = 0V, V_{DS} = 600V$	$T_j = 25°C$			50	µA
		$V_{GS} = 0V, V_{DS} = 600V$	$T_j = 125°C$			500	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 36A$				35	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	$V_{GS} = \pm 20\ V, V_{DS} = 0V$				±150	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*	*Min*	*Typ*	*Max*	*Unit*
C_{iss}	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 25V$ f = 1MHz		14		nF
C_{oss}	Output Capacitance			5.13		
C_{rss}	Reverse Transfer Capacitance			0.42		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 300V$ $I_D = 72A$		518		nC
Q_{gs}	Gate – Source Charge			58		
Q_{gd}	Gate – Drain Charge			222		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** $V_{GS} = 15V$ $V_{Bus} = 400V$ $I_D = 72A$ $R_G = 2.5\Omega$		21		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			283		
T_f	Fall Time			84		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** $V_{GS} = 15V, V_{Bus} = 400V$ $I_D = 72A, R_G = 2.5\Omega$		804		µJ
E_{off}	Turn-off Switching Energy			1960		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** $V_{GS} = 15V, V_{Bus} = 400V$ $I_D = 72A, R_G = 2.5\Omega$		1315		µJ
E_{off}	Turn-off Switching Energy			2412		

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	$T_j = 25°C$			350	µA
			$T_j = 125°C$			600	
I_F	DC Forward Current		$T_c = 85°C$		60		A
V_F	Diode Forward Voltage	$I_F = 60A$			1.1	1.15	V
		$I_F = 120A$			1.4		
		$I_F = 60A$	$T_j = 125°C$		0.9		
t_{rr}	Reverse Recovery Time	$I_F = 60A$ $V_R = 133V$ di/dt = 400A/µs	$T_j = 25°C$		24		ns
			$T_j = 125°C$		48		
Q_{rr}	Reverse Recovery Charge		$T_j = 25°C$		66		nC
			$T_j = 125°C$		300		

Parallel 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 = 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		2.0	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			0.3	°C/W
			Series diode			0.65	
			Parallel diode			0.8	
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

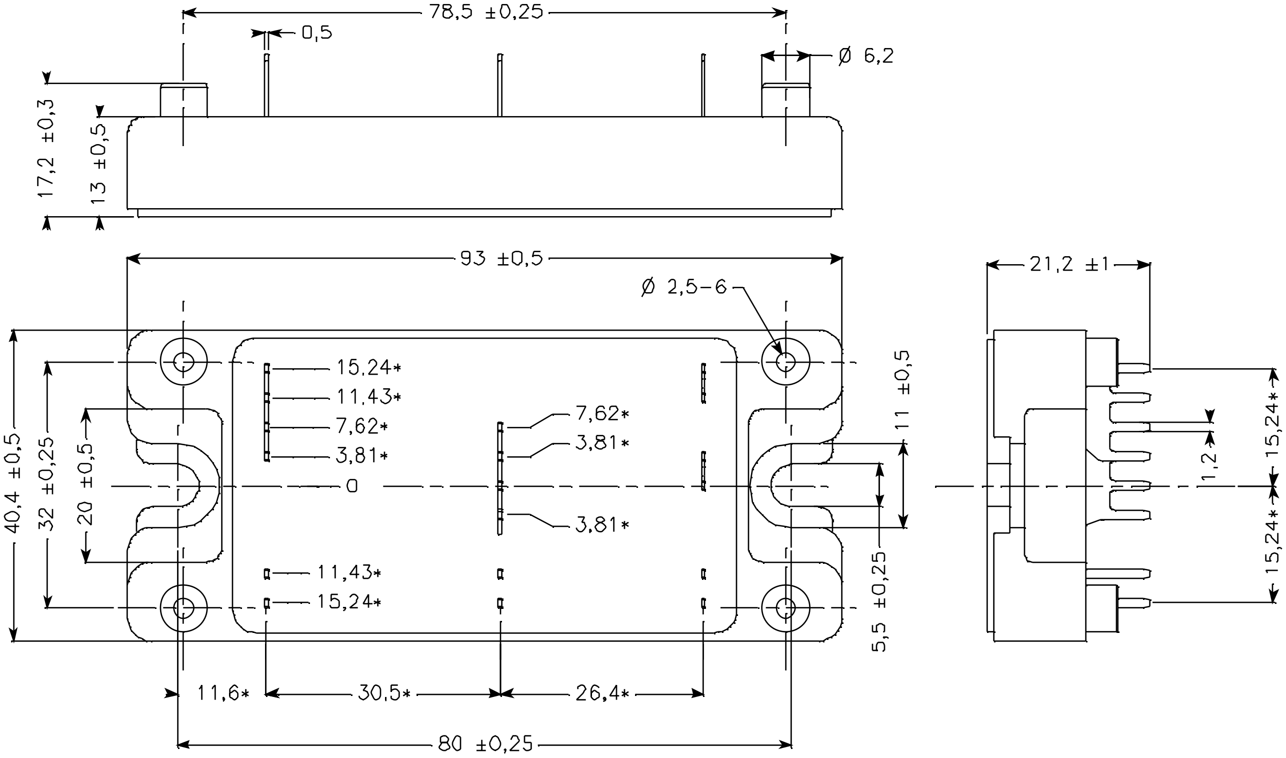
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

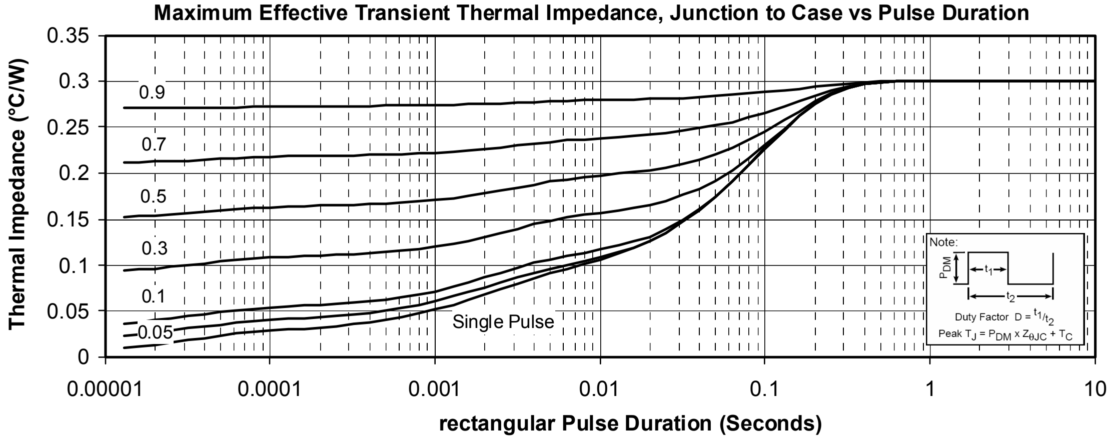
SP4 Package outline (dimensions in mm)

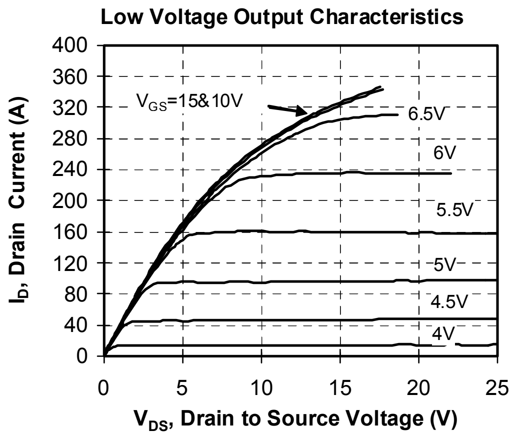


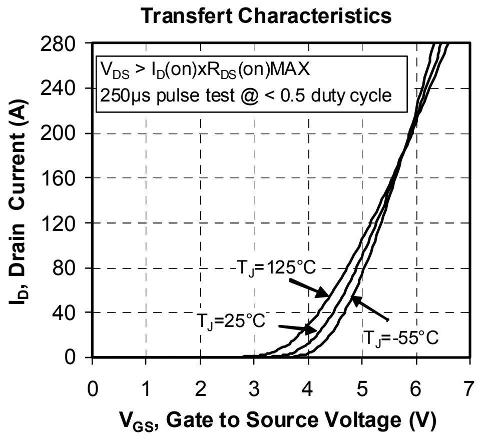
ALL DIMENSIONS MARKED " * " ARE TOLERENCED AS : ⌖ Ø1

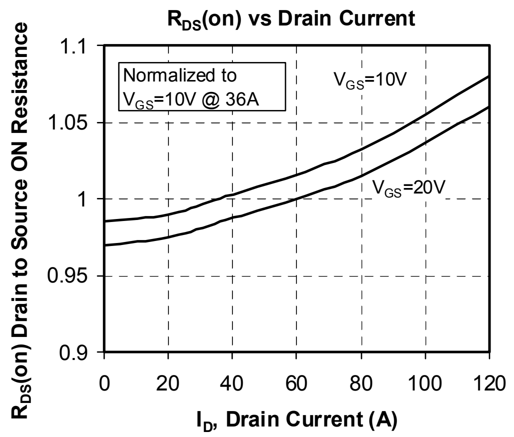
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

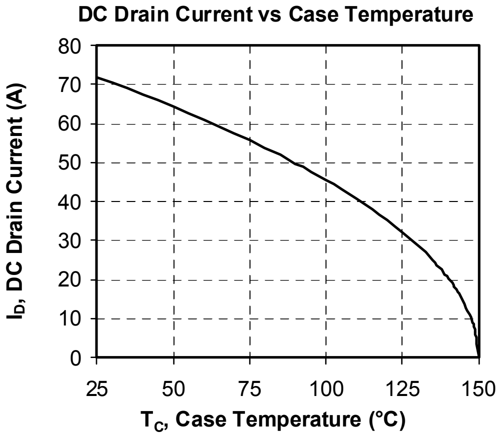
Typical CoolMOS Performance Curve

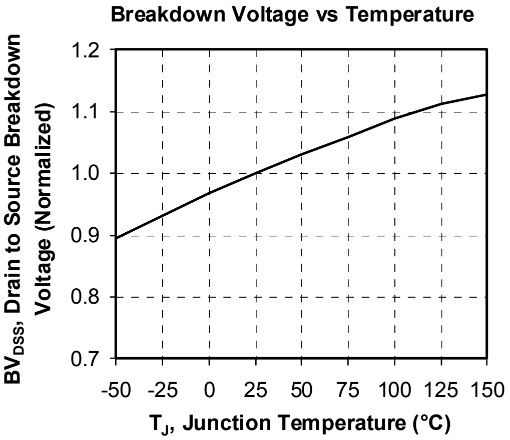


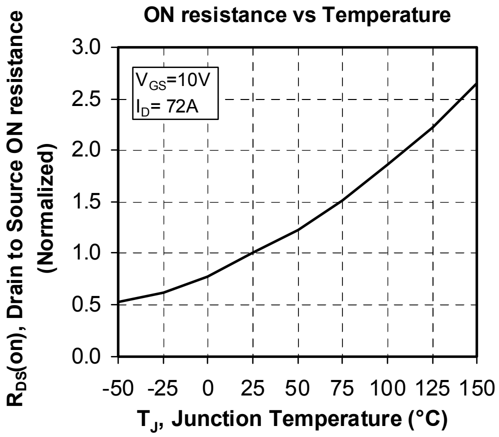


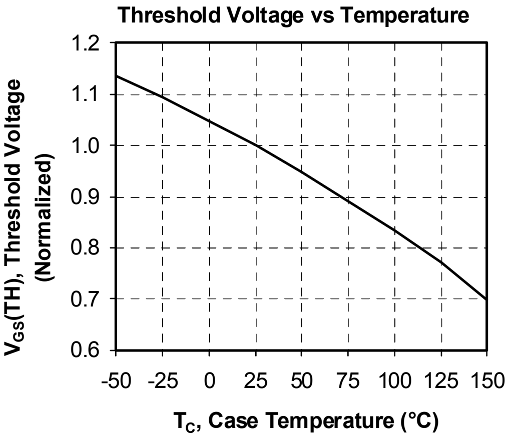


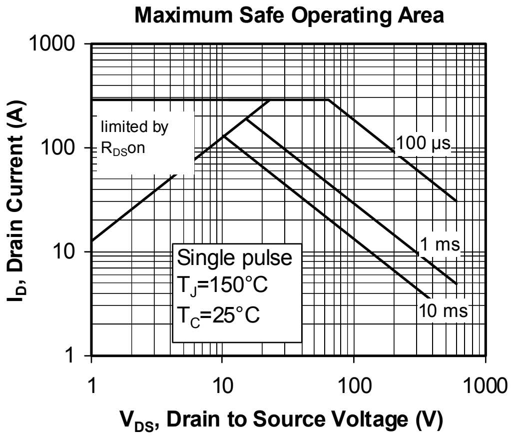


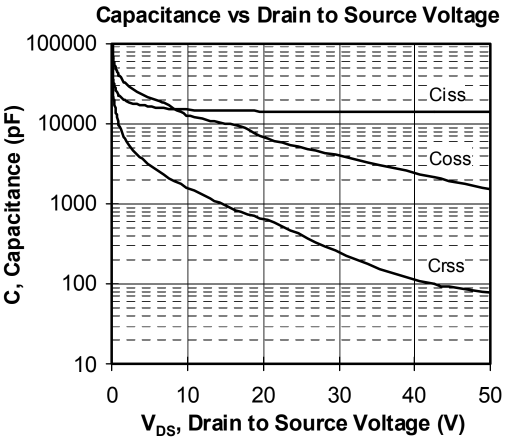


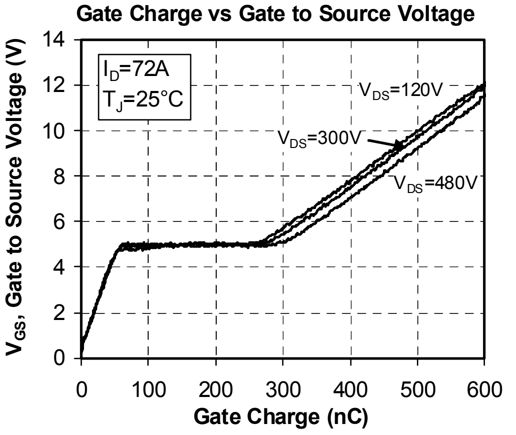

Breakdown Voltage vs Temperature

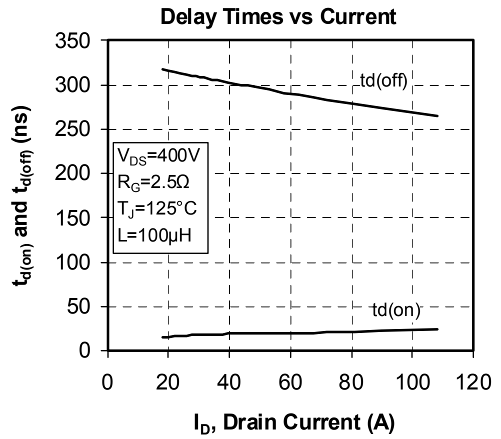

ON resistance vs Temperature

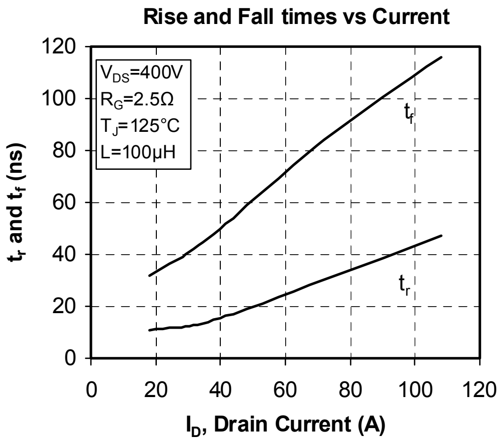

Threshold Voltage vs Temperature

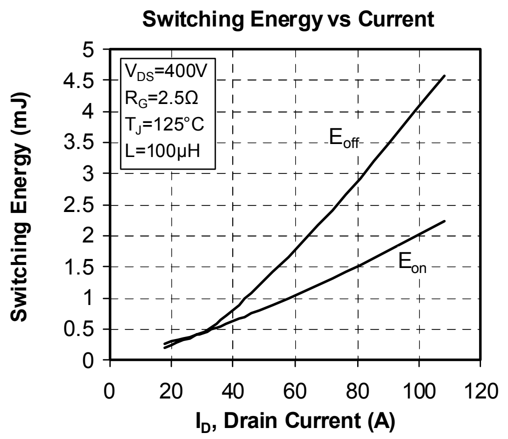

Maximum Safe Operating Area

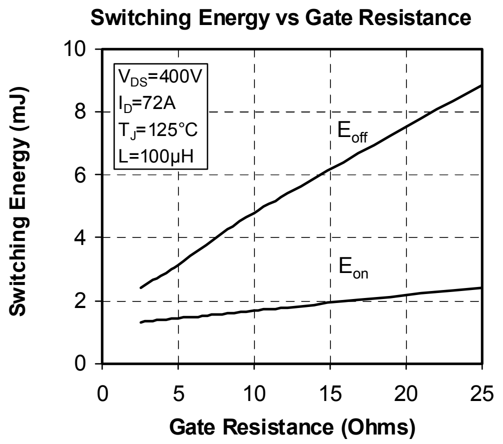

Capacitance vs Drain to Source Voltage

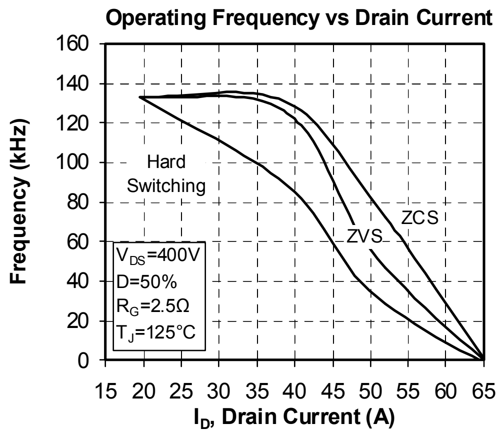

Gate Charge vs Gate to Source Voltage

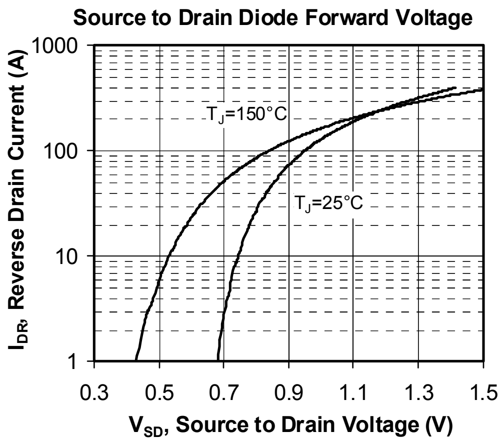

Delay Times vs Current


Rise and Fall times vs Current

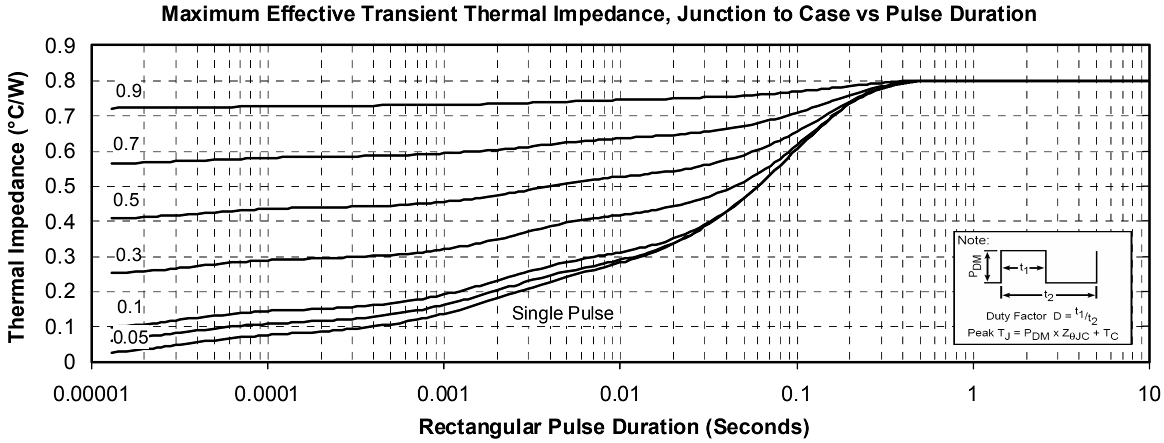

Switching Energy vs Current

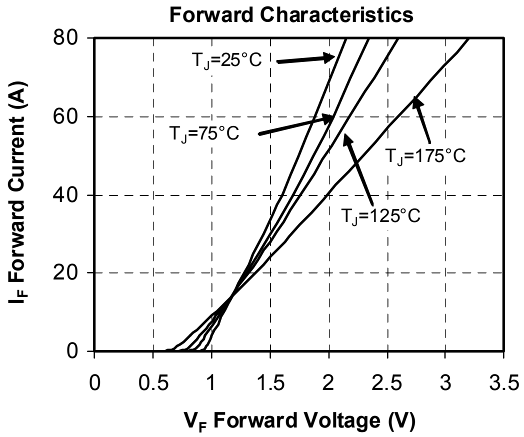

Switching Energy vs Gate Resistance

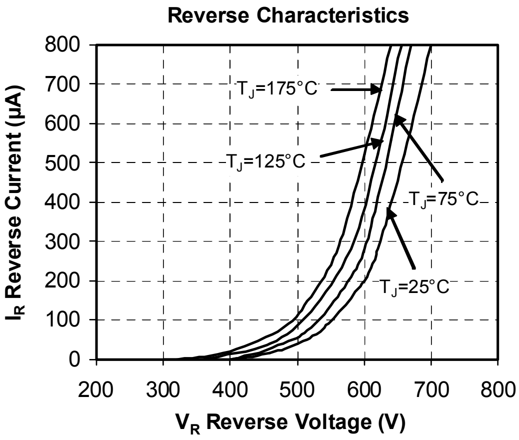

Operating Frequency vs Drain Current

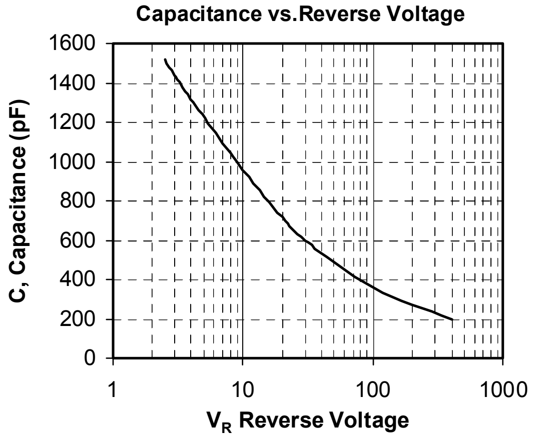

Source to Drain Diode Forward Voltage

Typical SiC Diode Performance Curve


Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration


Forward Characteristics


Reverse Characteristics


Capacitance vs.Reverse Voltage

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