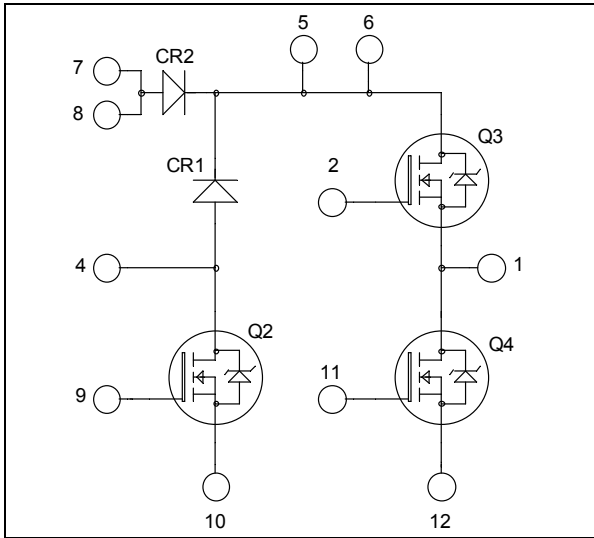


**Boost chopper & Phase Leg
Super Junction MOSFET
Power Module**

$V_{DSS} = 600V$
 $R_{DSon} = 45m\Omega \text{ max @ } T_j = 25^\circ C$
 $I_D = 49A \text{ @ } T_c = 25^\circ C$



Application

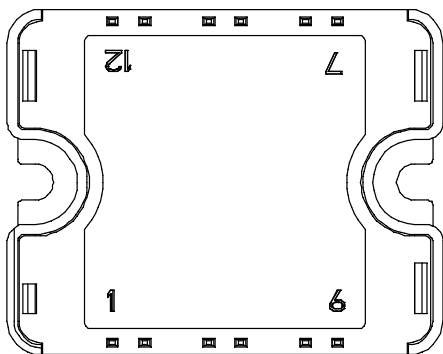
- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Solar converter

Features

- **CoolMOS™**
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
 - Very rugged
- **SiC Schottky Diode (CR1)**
 - Zero reverse recovery
 - Zero forward recovery
 - Temperature Independent switching behavior
 - Positive temperature coefficient on VF
- **By pass FRED diode (CR2)**

Benefits

- Very low stray inductance
- High level of integration
- 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



Pins 7/8 ; 5/6 must be shorted together

All ratings @ $T_j = 25^\circ C$ 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

1. Phase leg (Q3 & Q4)
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	49
		T _c = 80°C	38
I _{DM}	Pulsed Drain current	130	A
V _{GS}	Gate - Source Voltage	±20	V
R _{DS(on)}	Drain - Source ON Resistance	45	mΩ
P _D	Maximum Power Dissipation	T _c = 25°C	250
I _{AR}	Avalanche current (repetitive and non repetitive)	15	A
E _{AR}	Repetitive Avalanche Energy	3	mJ
E _{AS}	Single Pulse Avalanche Energy	1900	

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			250	μA
		V _{GS} = 0V, V _{DS} = 600V T _j = 125°C			500	
R _{DS(on)}	Drain – Source on Resistance	V _{GS} = 10V, I _D = 24.5A		40	45	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 3mA	2.1	3	3.9	V
I _{GSS}	Gate – Source Leakage Current	V _{GS} = ±20 V, V _{DS} = 0V			100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{iss}	Input Capacitance	V _{GS} = 0V ; V _{DS} = 25V f = 1MHz		7.2		nF
C _{oss}	Output Capacitance			8.5		
Q _g	Total gate Charge	V _{GS} = 10V V _{Bus} = 300V I _D = 49A		150		nC
Q _{gs}	Gate – Source Charge			34		
Q _{gd}	Gate – Drain Charge			51		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (125°C) V _{GS} = 10V V _{Bus} = 400V I _D = 49A R _G = 5Ω		21		ns
T _r	Rise Time			30		
T _{d(off)}	Turn-off Delay Time			100		
T _f	Fall Time			45		
R _{thJC}	Junction to Case Thermal Resistance				0.5	°C/W

Source - Drain diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I _S	Continuous Source current (Body diode)	T _c = 25°C		49		A
		T _c = 80°C		38		
V _{SD}	Diode Forward Voltage	V _{GS} = 0V, I _S = - 49A			1.2	V
dv/dt	Peak Diode Recovery ^①				4	V/ns
t _{rr}	Reverse Recovery Time	I _S = - 49A V _R = 350V di _S /dt = 100A/μs	T _j = 25°C	600		ns
Q _{rr}	Reverse Recovery Charge		T _j = 25°C	17		μC

^① dv/dt numbers reflect the limitations of the circuit rather than the device itself.

$$I_S \leq -49A \quad di/dt \leq 100A/\mu s \quad V_R \leq V_{DSS} \quad T_j \leq 150^\circ C$$

2. Boost chopper (CR1 & Q2)
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	49
		T _c = 80°C	38
I _{DM}	Pulsed Drain current	130	
V _{GS}	Gate - Source Voltage	±20	V
R _{DS(on)}	Drain - Source ON Resistance	45	mΩ
P _D	Maximum Power Dissipation	T _c = 25°C	250
I _{AR}	Avalanche current (repetitive and non repetitive)		15
E _{AR}	Repetitive Avalanche Energy		3
E _{AS}	Single Pulse Avalanche Energy		1900

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I _{DSS}	Zero Gate Voltage Drain Current	V _{GS} = 0V, V _{DS} = 600V			250	μA
		T _j = 25°C				
		V _{GS} = 0V, V _{DS} = 600V			500	
		T _j = 125°C				
R _{DS(on)}	Drain – Source on Resistance	V _{GS} = 10V, I _D = 24.5A		40	45	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 3mA	2.1	3	3.9	V
I _{GSS}	Gate – Source Leakage Current	V _{GS} = ±20 V, V _{DS} = 0V			100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{iss}	Input Capacitance	V _{GS} = 0V ; V _{DS} = 25V f = 1MHz		7.2		nF
C _{oss}	Output Capacitance			8.5		
Q _g	Total gate Charge	V _{GS} = 10V V _{Bus} = 300V I _D = 49A		150		nC
Q _{gs}	Gate – Source Charge			34		
Q _{gd}	Gate – Drain Charge			51		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (125°C) V _{GS} = 10V V _{Bus} = 400V I _D = 49A R _G = 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 = 49A ; R _G = 5Ω		405		μJ
E _{off}	Turn-off Switching Energy			520		
E _{on}	Turn-on Switching Energy	Inductive switching @ 125°C V _{GS} = 10V ; V _{Bus} = 400V I _D = 49A ; R _G = 5Ω		660		μJ
E _{off}	Turn-off Switching Energy			635		
R _{thJC}	Junction to Case Thermal Resistance				0.5	°C/W

SiC schottky diode ratings and characteristics (CR1)

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		10	60	μA
			T _j = 175°C		20	300	
I _{F(AV)}	Maximum Average Forward Current	50% duty cycle			10		A
V _F	Diode Forward Voltage	I _F = 10A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2	2.4	
Q _C	Total Capacitive Charge	I _F = 10A, V _R = 300V di/dt = 500A/μs			14		nC
C	Total Capacitance	f = 1MHz, V _R = 200V			65		pF
		f = 1MHz, V _R = 400V			50		
R _{thJC}	Junction to Case Thermal Resistance					2.5	°C/W

3. By pass FRED diode (CR2)
Diode ratings and characteristics

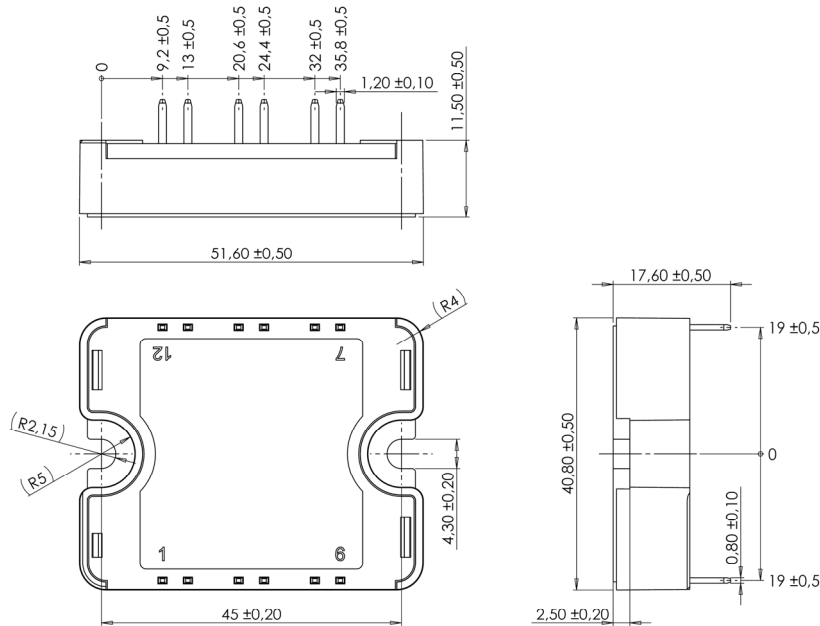
Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V _{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I _{RM}	Maximum Reverse Leakage Current	V _R =600V	T _j = 25°C			100	μA
			T _j = 150°C			350	
I _F	DC Forward Current				30		A
V _F	Diode Forward Voltage	I _F = 30A V _{GE} = 0V	T _j = 25°C		1.6	2	V
			T _j = 150°C		1.5		
t _{rr}	Reverse Recovery Time		T _j = 25°C		100		ns
			T _j = 150°C		150		
Q _{rr}	Reverse Recovery Charge	I _F = 30A V _R = 300V di/dt = 1800A/μs	T _j = 25°C		1.5		μC
			T _j = 150°C		3.1		
E _{rr}	Reverse Recovery Energy		T _j = 25°C		0.34		mJ
			T _j = 150°C		0.75		
R _{thJC}	Junction to Case Thermal Resistance					2.45	°C/W

4. Thermal & 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	M4	2	3	N.m
Wt	Package Weight				80	g

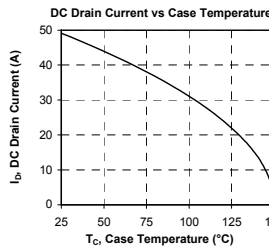
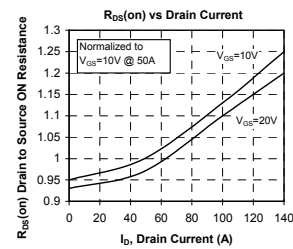
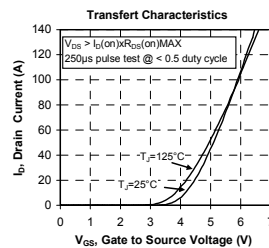
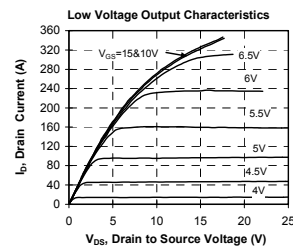
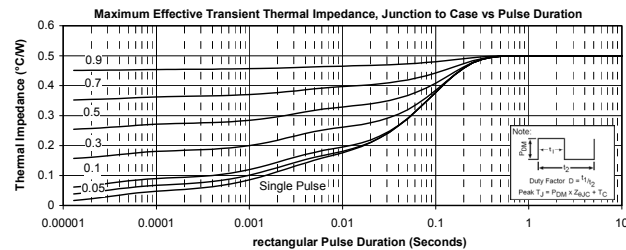
* T_{jmax} = 175°C for by pass and SiC diode

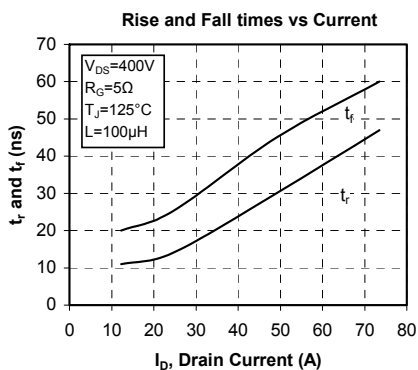
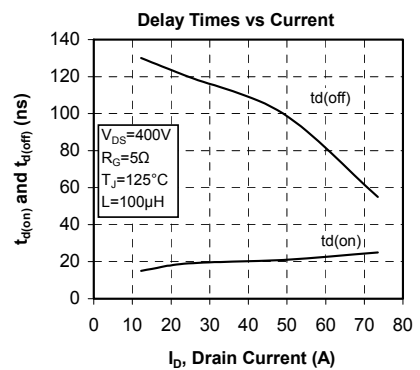
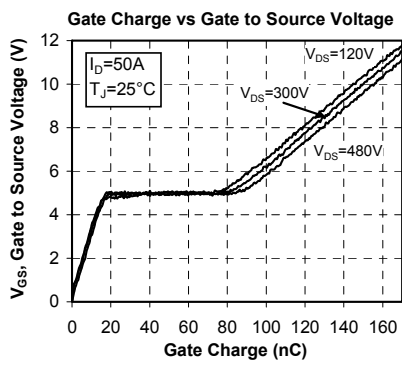
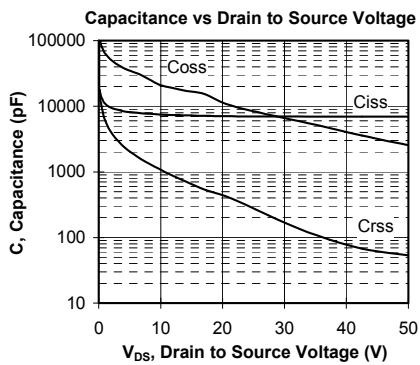
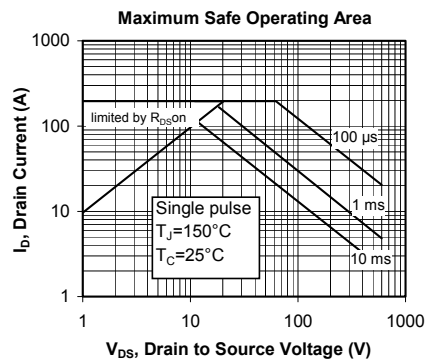
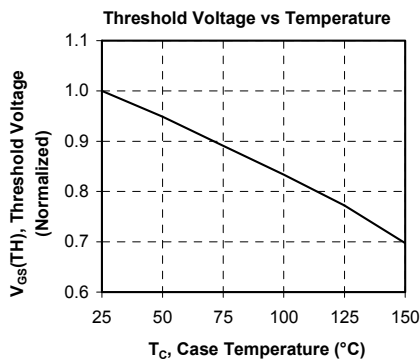
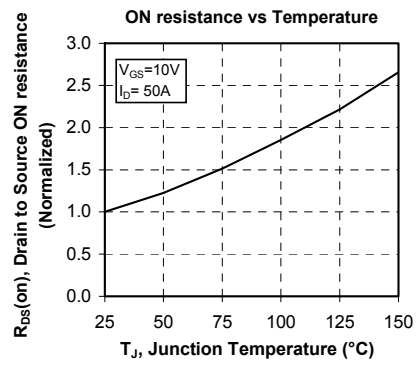
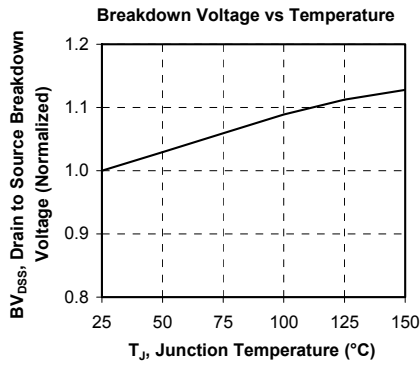
SP1 Package outline (dimensions in mm)



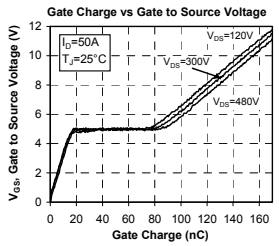
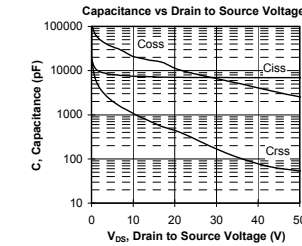
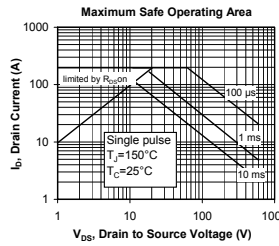
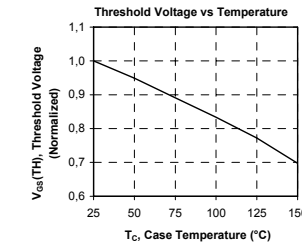
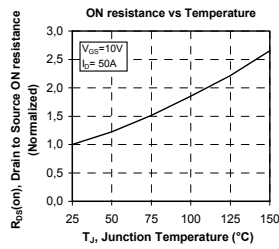
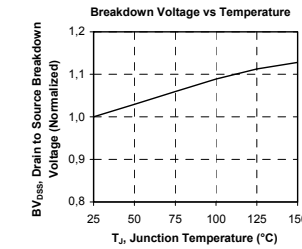
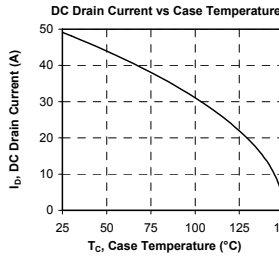
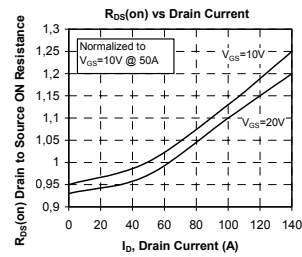
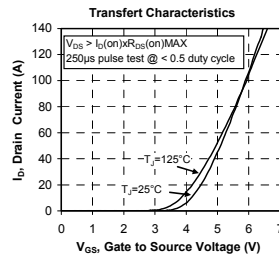
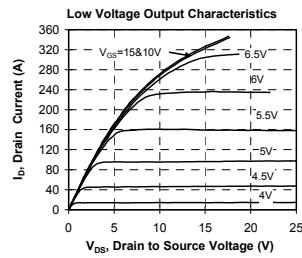
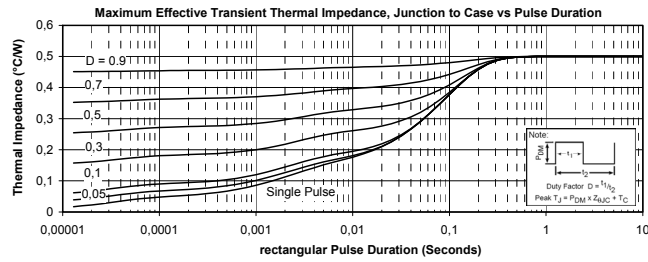
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

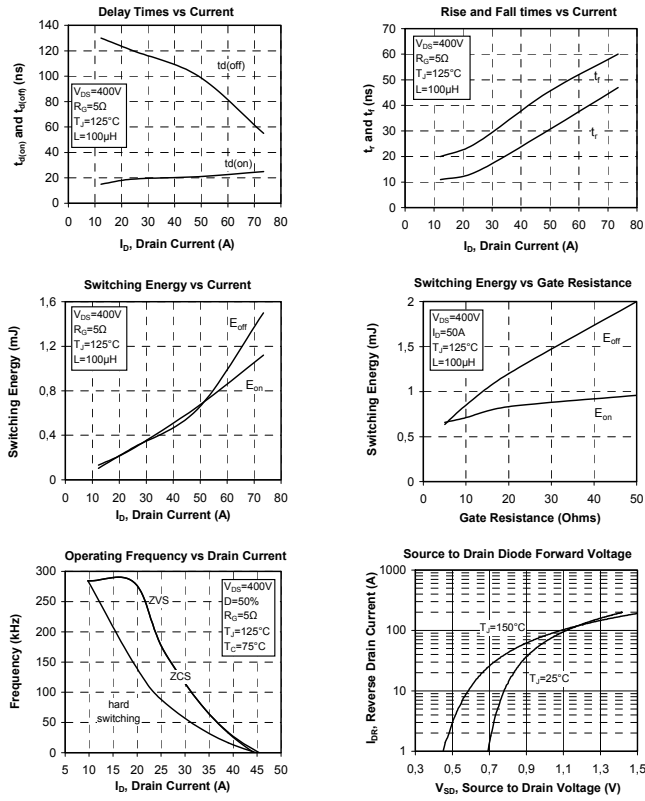
5. Typical CoolMOS Performance Curve (Phase leg)



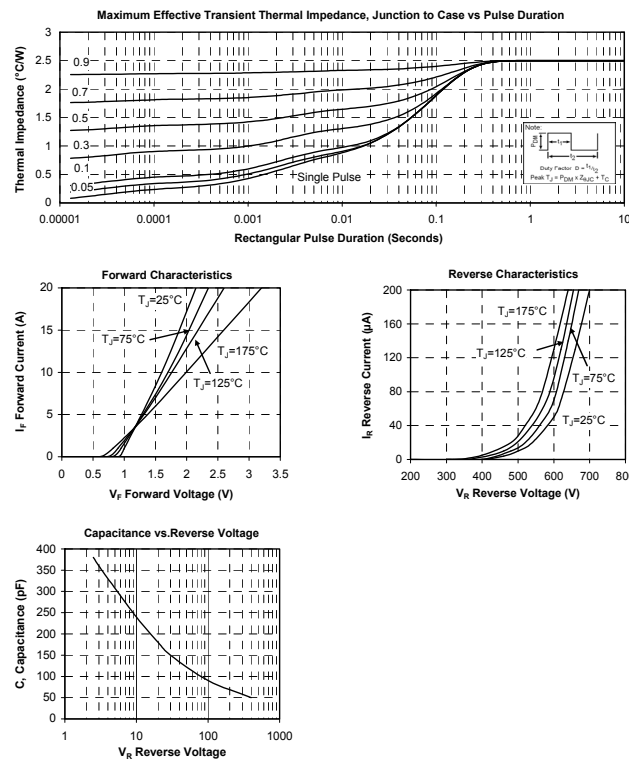


6. Typical CoolMOS Performance Curve (Boost chopper)

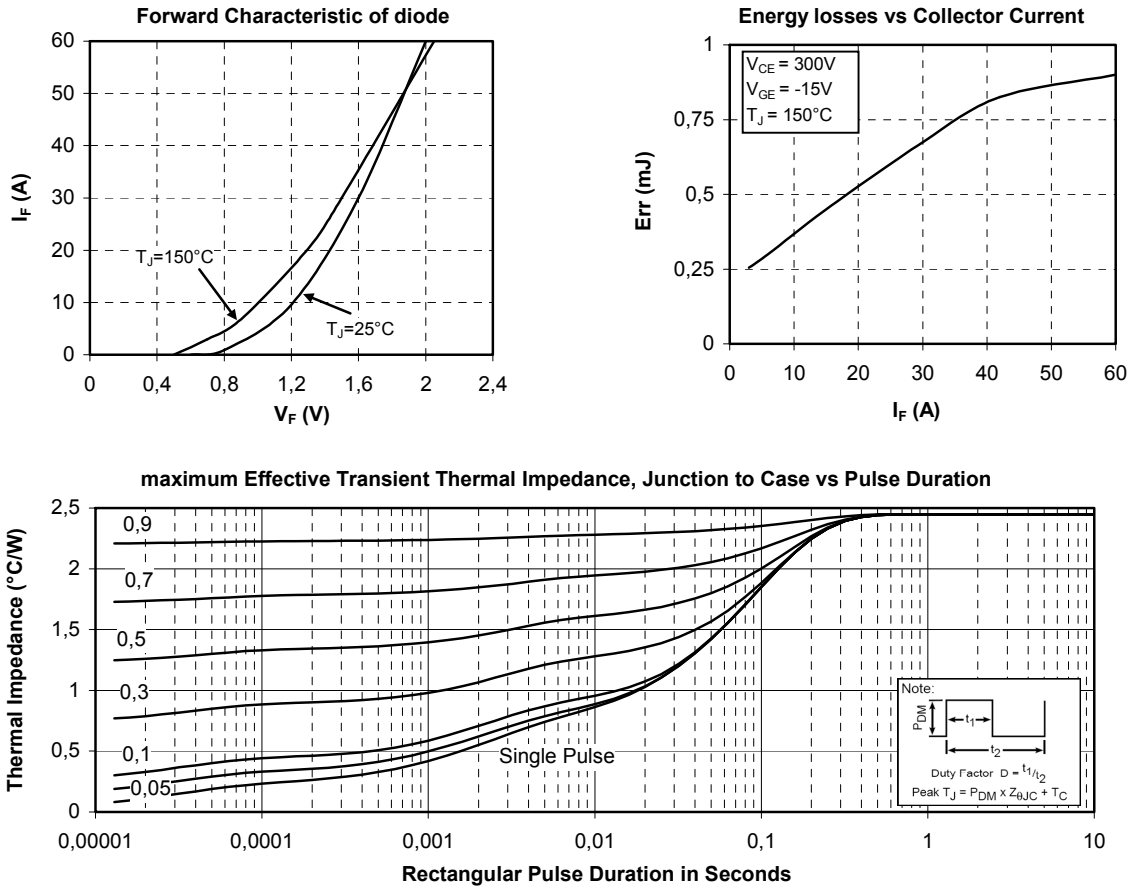




7. SiC Typical Performance Curve (CR1)



8. Typical By pass Performance Curve (CR2)



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