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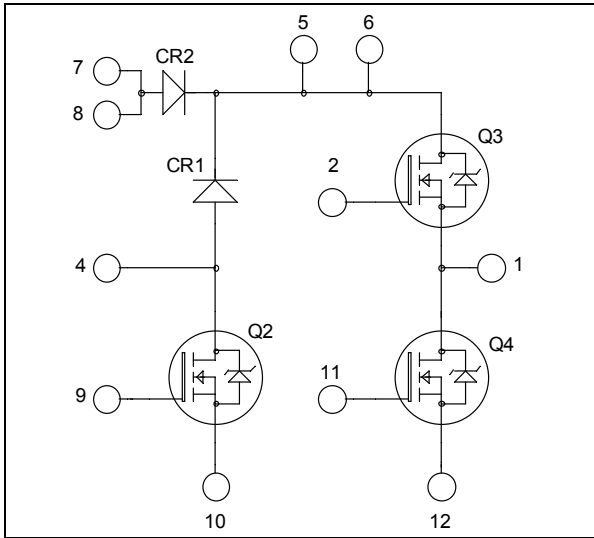


**Boost chopper & Phase Leg
Super Junction MOSFET
Power Module**

$V_{DSS} = 600V$

$R_{DSon} = 45m\Omega \text{ max @ } T_j = 25^\circ C$

$I_D = 49A \text{ @ } T_c = 25^\circ C$



Application

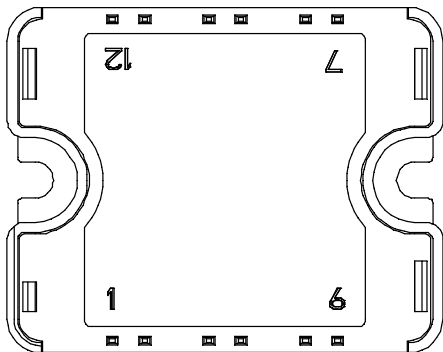
- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Solar converter

Features

- **CoolMOS™**
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
 - Very rugged
- **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	$T_c = 25^\circ\text{C}$	49
		$T_c = 80^\circ\text{C}$	38
I_{DM}	Pulsed Drain current	130	A
V_{GS}	Gate - Source Voltage	± 20	V
$R_{DS(on)}$	Drain - Source ON Resistance	45	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ\text{C}$	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	$V_{GS} = 0V, V_{DS} = 600V$ $T_j = 25^\circ\text{C}$			250	μA
		$V_{GS} = 0V, V_{DS} = 600V$ $T_j = 125^\circ\text{C}$			500	
$R_{DS(on)}$	Drain - Source on Resistance	$V_{GS} = 10V, I_D = 24.5A$		40	45	m Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 3mA$	2.1	3	3.9	V
I_{GSS}	Gate - Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			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) $V_{GS} = 10V$ $V_{Bus} = 400V$ $I_D = 49A$ $R_G = 5\Omega$		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	$^\circ\text{C/W}$

Source - Drain diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_S	Continuous Source current (Body diode)	$T_c = 25^\circ\text{C}$		49		A
		$T_c = 80^\circ\text{C}$		38		
V_{SD}	Diode Forward Voltage	$V_{GS} = 0V, I_S = -49A$			1.2	V
dv/dt	Peak Diode Recovery ^❶				4	V/ns
t_{rr}	Reverse Recovery Time	$I_S = -49A$ $V_R = 350V$ $di_S/dt = 100A/\mu s$	$T_j = 25^\circ\text{C}$		600	ns
Q_{rr}	Reverse Recovery Charge		$T_j = 25^\circ\text{C}$		17	

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

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

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		675		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		1100		μJ
E _{off}	Turn-off Switching Energy			635		
R _{thJC}	Junction to Case Thermal Resistance				0.5	°C/W

Diode ratings and characteristics (CR1)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V _{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I _{RM}	Maximum Reverse Leakage Current	V _R =600V	T _j = 25°C			25	μA
			T _j = 125°C			500	
I _F	DC Forward Current	T _c = 80°C			60		A
V _F	Diode Forward Voltage	I _F = 60A			1.7	2.3	V
		I _F = 120A			2		
		I _F = 60A	T _j = 125°C		1.4		
t _{rr}	Reverse Recovery Time	I _F = 600A V _R = 400V di/dt = 200A/μs	T _j = 25°C		70		ns
			T _j = 125°C		140		
Q _{rr}	Reverse Recovery Charge	I _F = 600A V _R = 400V di/dt = 200A/μs	T _j = 25°C		100		nC
			T _j = 125°C		690		
R _{thJC}	Junction to Case Thermal Resistance					0.85	°C/W

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

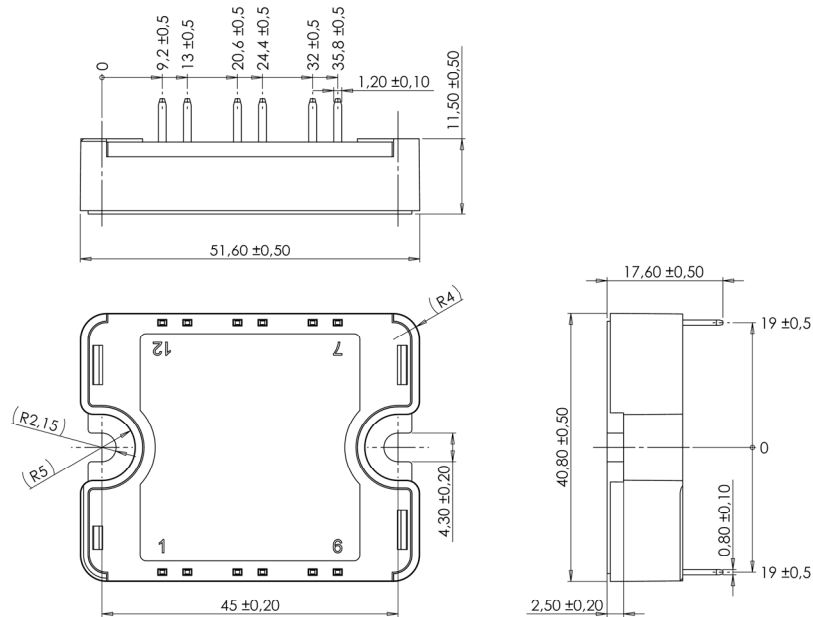
<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V _{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I _{RM}	Maximum Reverse Leakage Current	V _R =600V	T _j = 25°C			100	μA
			T _j = 150°C			350	
I _F	DC Forward Current	T _c = 80°C			30		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	I _F = 30A V _R = 300V di/dt = 1800A/μs	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	I _F = 30A V _R = 300V di/dt = 1800A/μs	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

<i>Symbol</i>	<i>Characteristic</i>			<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
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

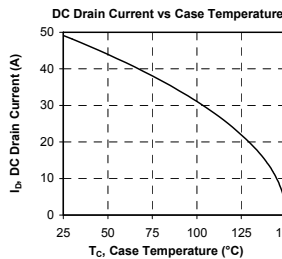
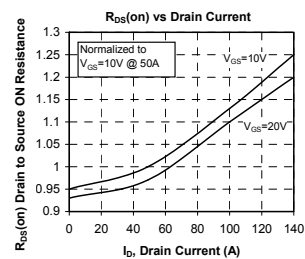
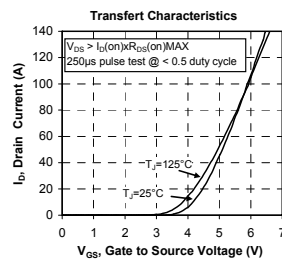
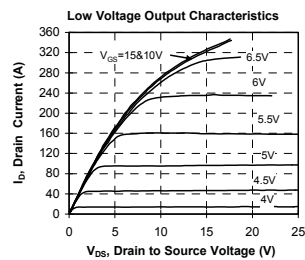
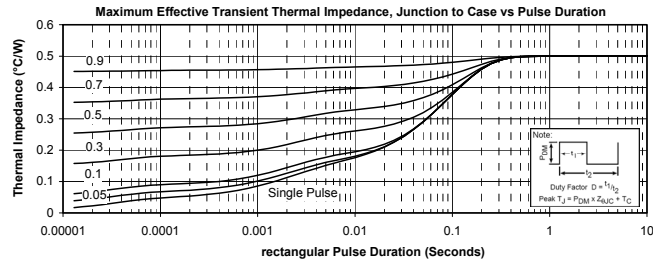
* T_{jmax} = 175°C for by pass diode

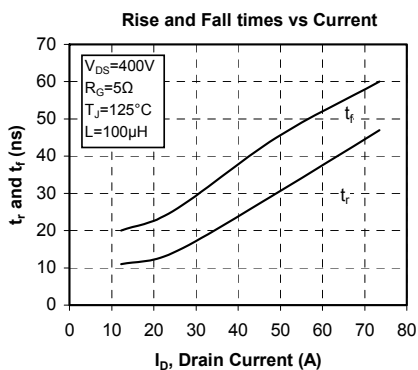
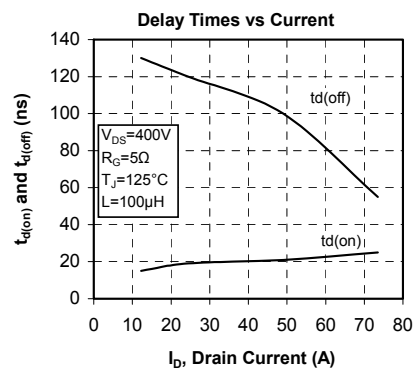
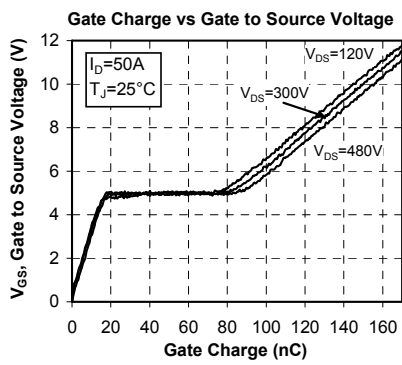
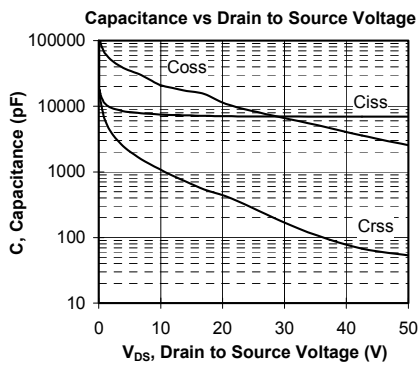
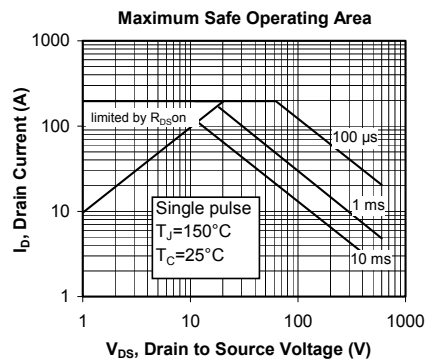
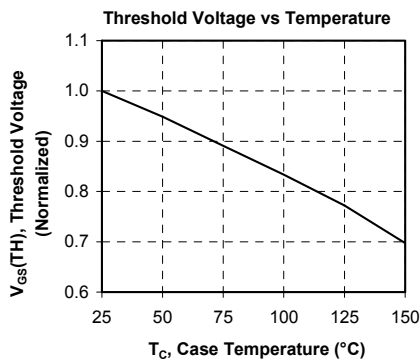
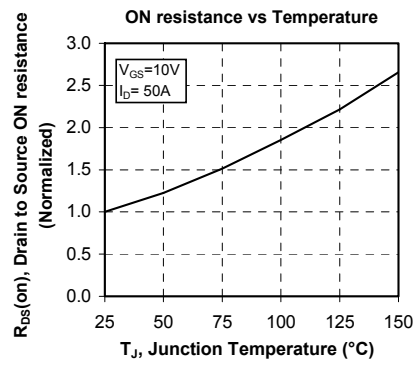
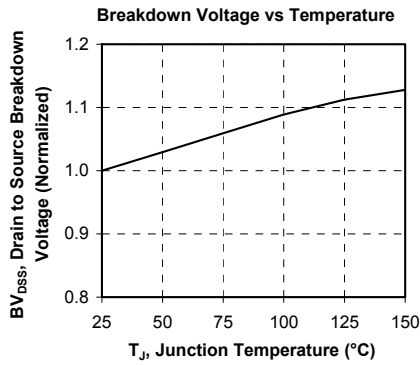
SP1 Package outline (dimensions in mm)



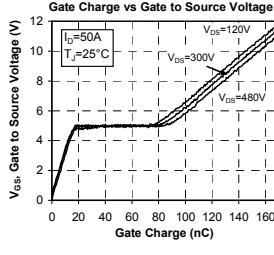
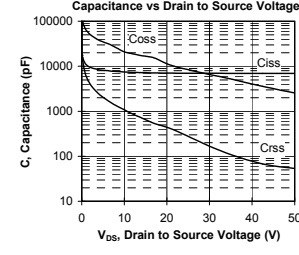
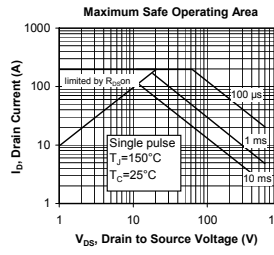
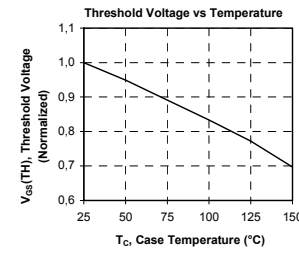
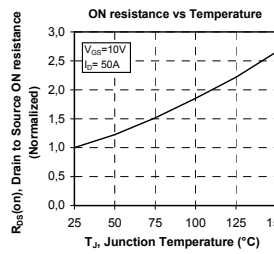
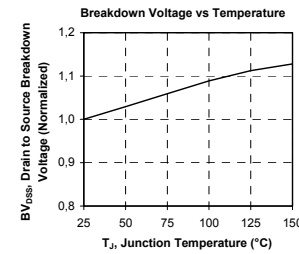
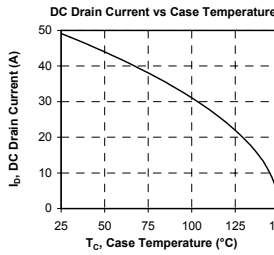
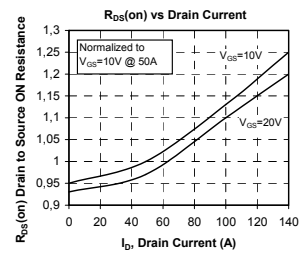
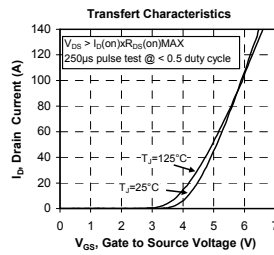
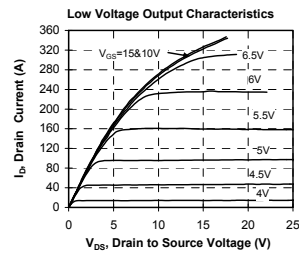
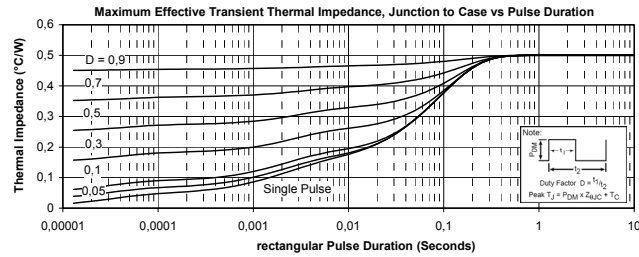
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

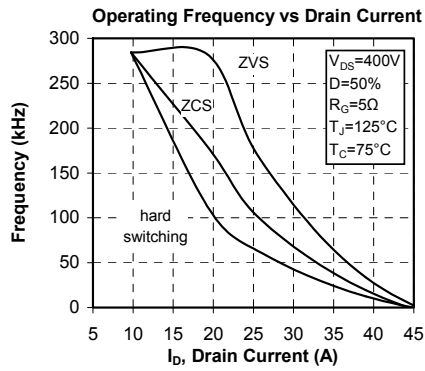
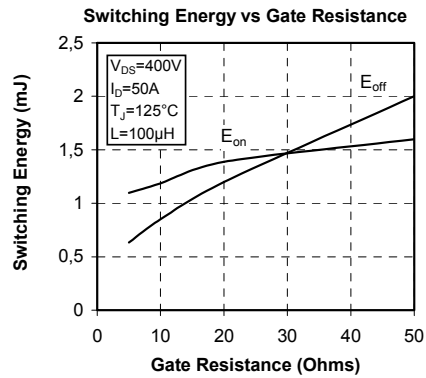
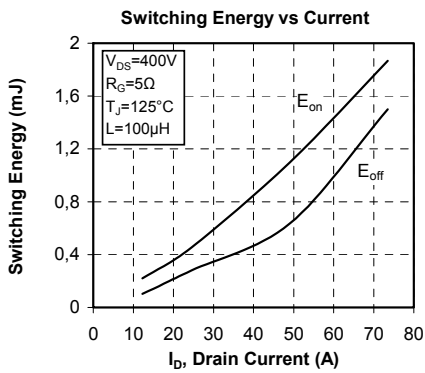
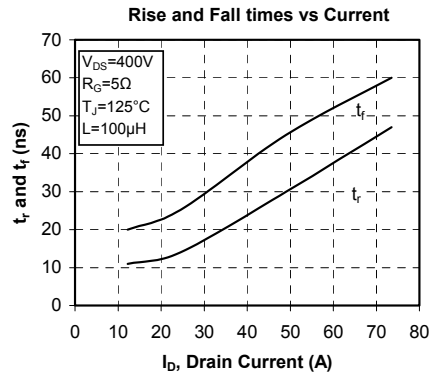
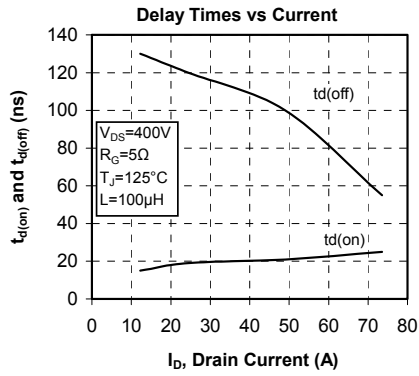
5. Typical CoolMOS Performance Curve (Phase leg)



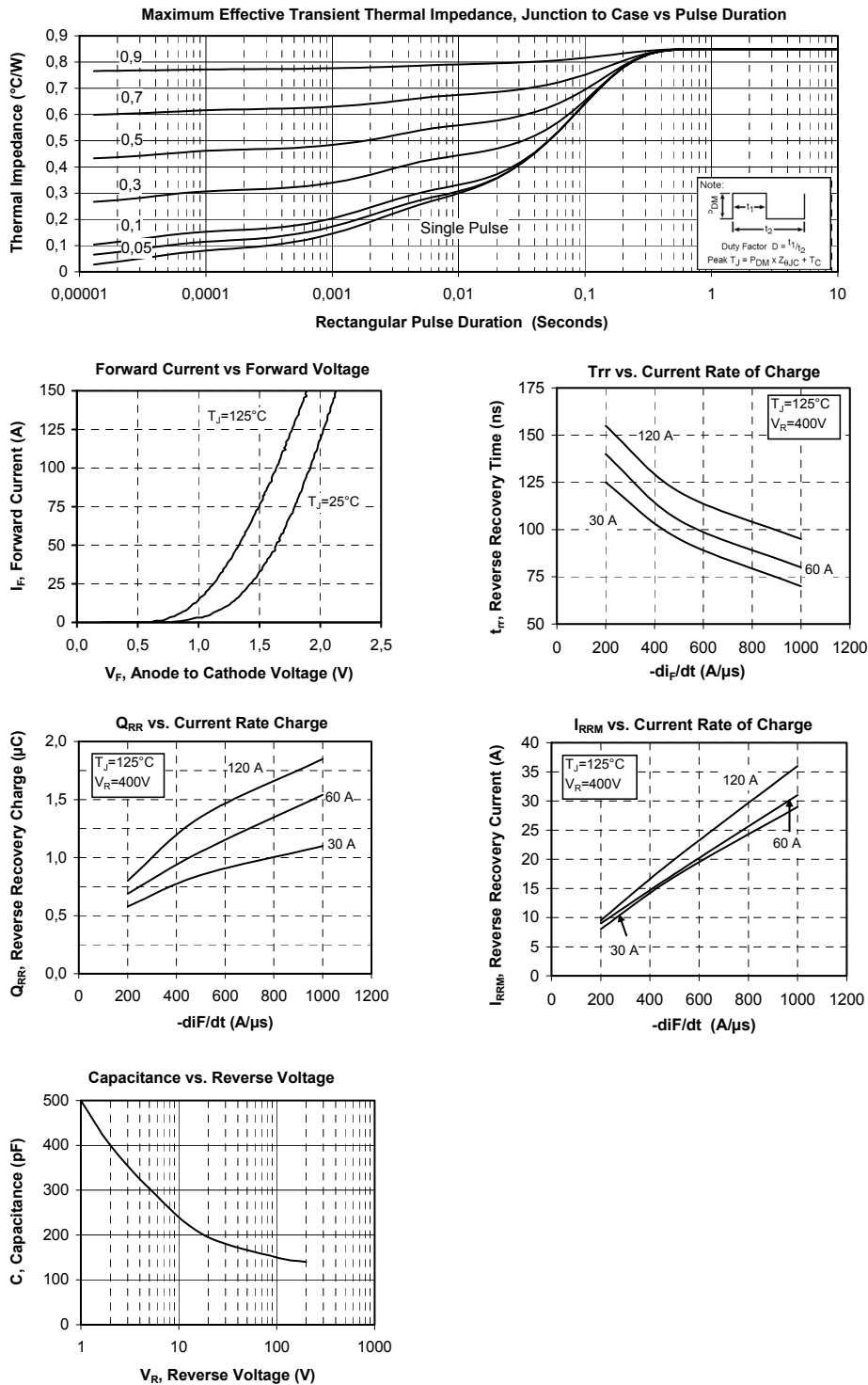


6. Typical CoolMOS Performance Curve (Boost chopper)

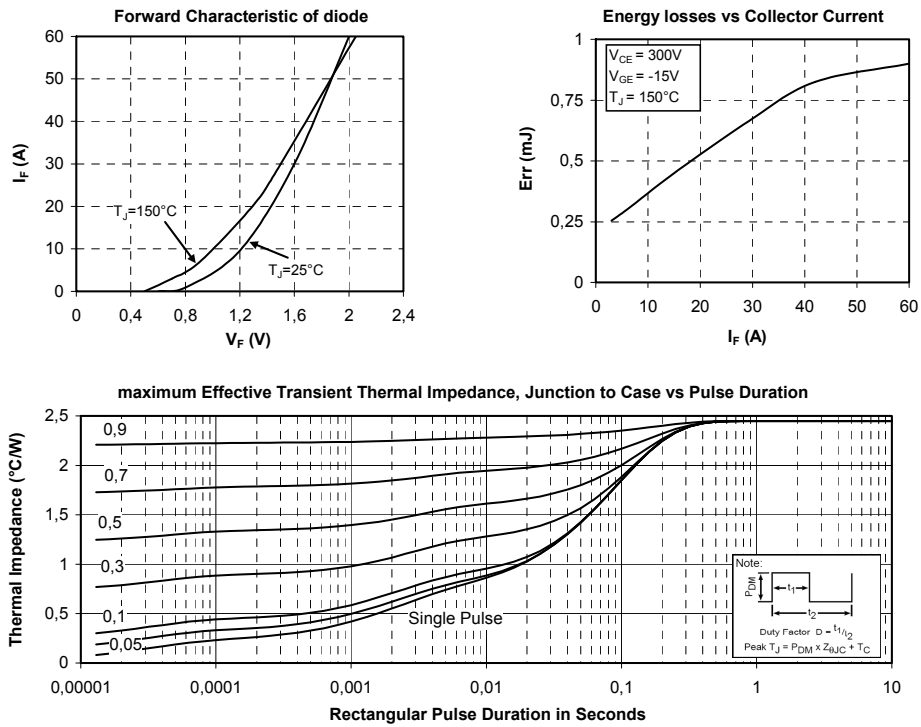




7. Typical Performance Curve (CRI)



8. Typical By pass Performance Curve (CR2)



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