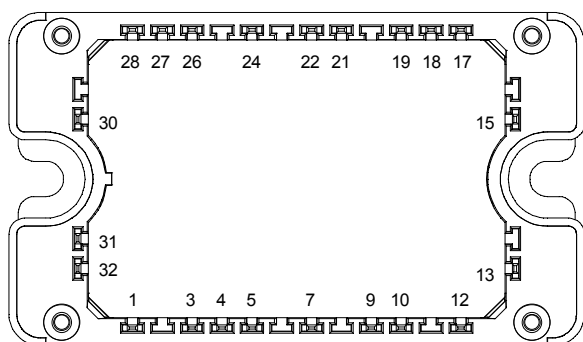
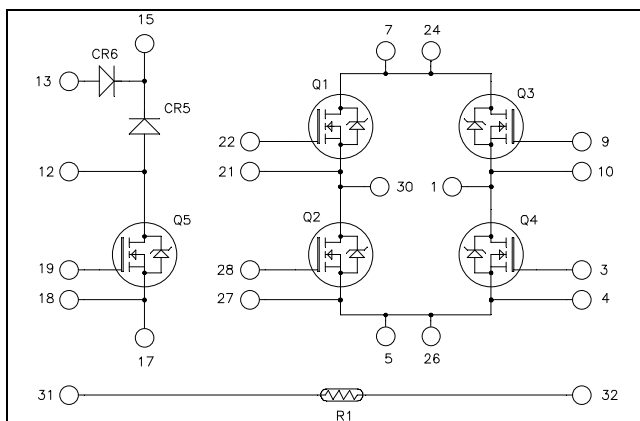


**Full – Bridge + boost chopper
CoolMOS Power module**



All multiple inputs and outputs must be shorted together
7/24 ; 5/26

All ratings @ $T_j = 25^\circ\text{C}$ unless otherwise specified

1. Full bridge switches

1.1 CoolMOS™ characteristics (Per CoolMOS™)

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	600	V
I_D	Continuous Drain Current	$T_c = 25^\circ\text{C}$ 39 $T_c = 80^\circ\text{C}$ 29	A
I_{DM}	Pulsed Drain current	160	
V_{GS}	Gate - Source Voltage	± 20	V
R_{DSon}	Drain - Source ON Resistance	70	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ\text{C}$ 250	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 Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

CoolMOS™ Q1 to Q4:

$V_{DSS} = 600\text{V}$

$R_{DSon} = 70\text{m}\Omega$ max @ $T_j = 25^\circ\text{C}$

CoolMOS™ Q5:

$V_{DSS} = 600\text{V}$

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

Application

- Solar converter

Features

- CoolMOS™**
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated

- Very low stray inductance
- Kelvin source for easy drive
- Internal thermistor for temperature monitoring
- High level of integration

Benefits

- Optimized conduction & switching losses
- 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
- Easy paralleling due to positive T_C of V_{CEsat}
- RoHS Compliant

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			25	μA
		V _{GS} = 0V, V _{DS} = 600V, T _j = 125°C			250	
R _{DS(on)}	Drain – Source on Resistance	V _{GS} = 10V, I _D = 39A			70	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 2.7mA	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		7		nF
C _{oss}	Output Capacitance	V _{DS} = 25V		2.56		
C _{rss}	Reverse Transfer Capacitance	f = 1MHz		0.21		
Q _g	Total gate Charge	V _{GS} = 10V		259		nC
Q _{gs}	Gate – Source Charge	V _{Bus} = 300V		29		
Q _{gd}	Gate – Drain Charge	I _D = 39A		111		
T _{d(on)}	Turn-on Delay Time	Inductive Switching @ 125°C V _{GS} = 15V V _{Bus} = 400V I _D = 39A R _G = 5Ω		21		ns
T _r	Rise Time			30		
T _{d(off)}	Turn-off Delay Time			283		
T _f	Fall Time			84		
E _{off}	Turn-off Switching Energy	V _{GS} = 15V V _{Bus} = 400V I _D = 39A	T _j = 25°C	980		μJ
E _{off}	Turn-off Switching Energy	R _G = 5Ω	T _j = 125°C	1206		
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		39		A
		T _C = 80°C		29		
V _{SD}	Diode Forward Voltage	V _{GS} = 0V, I _S = - 39A			1.2	V
dv/dt	Peak Diode Recovery ❶				6	V/ns
t _{rr}	Reverse Recovery Time	I _S = - 39A V _R = 350V	T _j = 25°C	580		ns
Q _{rr}	Reverse Recovery Charge	di/dt = 100A/μs	T _j = 25°C	23		μC

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

I_S ≤ - 39A di/dt ≤ 100A/μs V_R ≤ V_{DSS} T_j ≤ 150°C

2. Boost chopper Q5, CR5

2.1 Q5 CoolMOS™ characteristics

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage	600	V
I_D	Continuous Drain Current	$T_c = 25^\circ\text{C}$	A
		$T_c = 80^\circ\text{C}$	
I_{DM}	Pulsed Drain current	130	
V_{GS}	Gate - Source Voltage	± 20	V
$R_{DS(on)}$	Drain - Source ON Resistance	45	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ\text{C}$	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	

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	$V_{GS} = 0V; V_{DS} = 25V$		7.2		nF
C_{oss}	Output Capacitance	$f = 1MHz$		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		
E_{on}	Turn-on Switching Energy	Inductive switching @ 25°C $V_{GS} = 10V; V_{Bus} = 400V$ $I_D = 49A; R_G = 5\Omega$		675		μJ
E_{off}	Turn-off Switching Energy			520		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125°C $V_{GS} = 10V; V_{Bus} = 400V$ $I_D = 49A; R_G = 5\Omega$		1096		μJ
E_{off}	Turn-off Switching Energy			635		
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°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 ❶					4	V/ns
t _{rr}	Reverse Recovery Time	I _S = - 49A V _R = 350V	T _j = 25°C		600		ns
Q _{rr}	Reverse Recovery Charge	di _S /dt = 100A/μs	T _j = 25°C		17		μC

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

I_S ≤ - 49A di/dt ≤ 100A/μs V_R ≤ V_{DSS} T_j ≤ 150°C

2.2 Chopper diode characteristics (CR5)

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			25	μA
			T _j = 125°C			500	
I _F	DC Forward Current		T _c = 80°C		30		A
V _F	Diode Forward Voltage	I _F = 30A			1.8	2.2	V
		I _F = 60A			2.2		
		I _F = 30A	T _j = 125°C		1.5		
t _{rr}	Reverse Recovery Time	I _F = 30A V _R = 400V	T _j = 25°C		25		ns
			T _j = 125°C		160		
Q _{rr}	Reverse Recovery Charge	di/dt = 200A/μs	T _j = 25°C		35		nC
			T _j = 125°C		480		
R _{thJC}	Junction to Case Thermal resistance					1.2	°C/W

3. By pass diode (CR6)
Absolute maximum ratings

Absolute Maximum Ratings					
Symbol	Parameter			Max ratings	Unit
V _R	Maximum DC reverse Voltage			1600	V
V _{RRM}	Maximum Peak Repetitive Reverse Voltage				
I _F	DC Forward Current		T _C = 80°C	40	A
I _{FSM}	Non-Repetitive Forward Surge Current	t=10ms	T _J = 45°C	400	

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I _R	Reverse Current	V _R = 1600V	T _j = 25°C		20		μA
			T _j = 125°C		2		mA
V _F	Forward Voltage	I _F = 40A	T _j = 25°C		1.3		V
			T _j = 125°C		1.1		
V _T	On – state Voltage				0.8		V
r _T	On – state Slope resistance				10.5		mΩ
R _{thJC}	Junction to Case Thermal resistance					1.5	°C/W

4. Temperature sensor

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
ΔR ₂₅ /R ₂₅			5		%
B _{25/85}	T ₂₅ = 298.15 K		3952		K
ΔB/B	T _C = 100°C		4		%

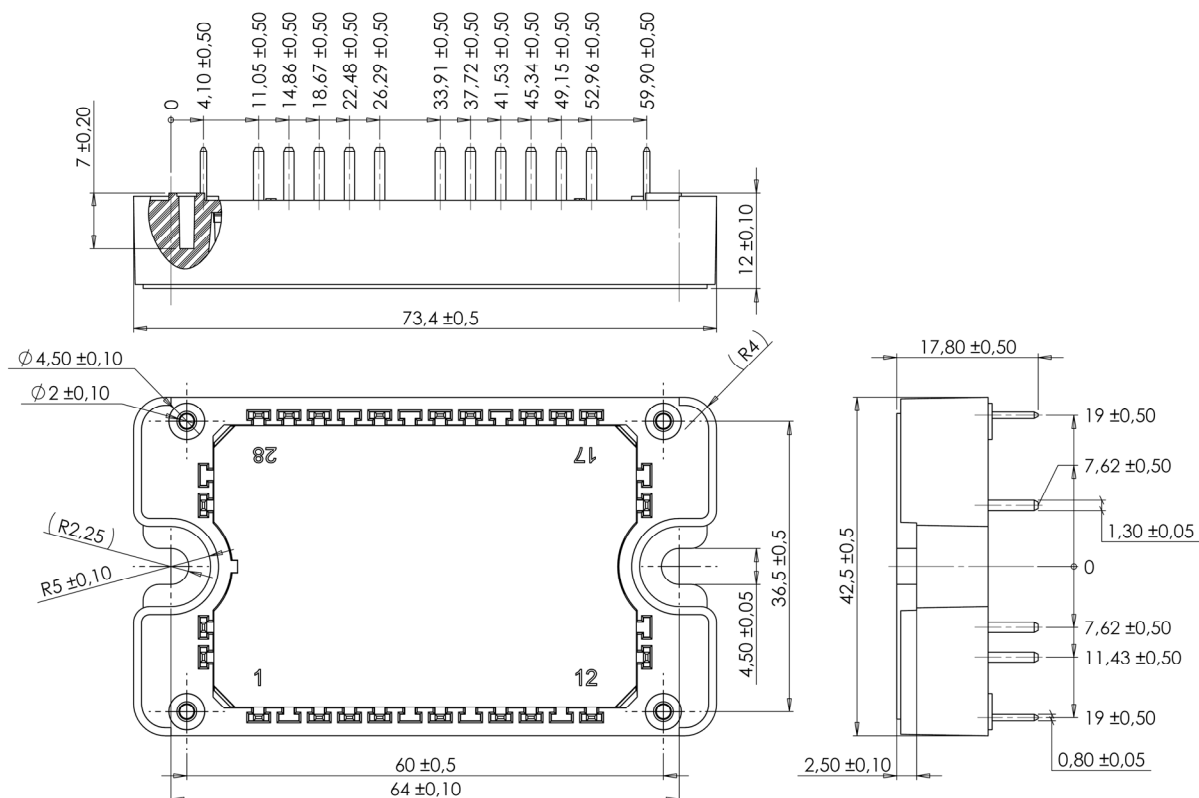
$$R_T = \frac{R_{25}}{\exp \left[B_{25/85} \left(\frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

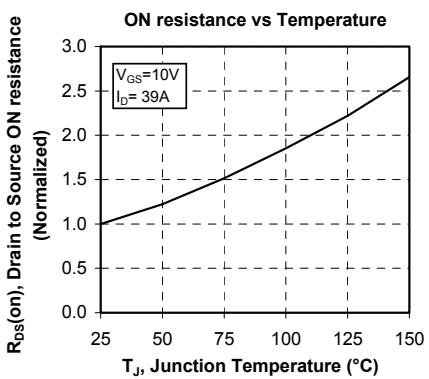
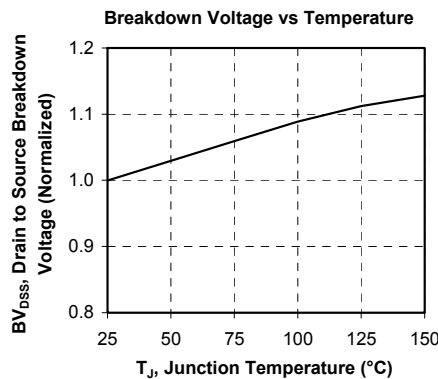
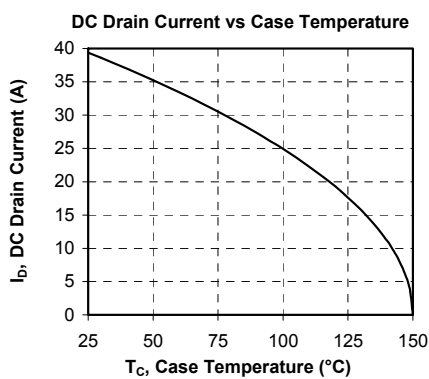
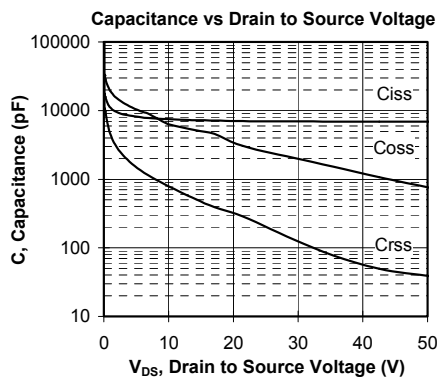
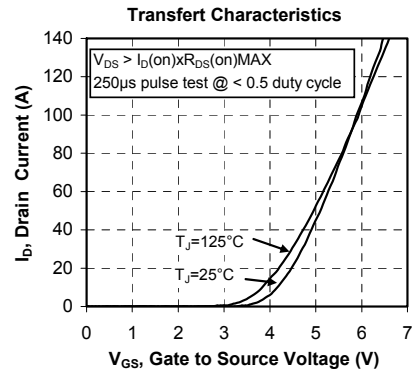
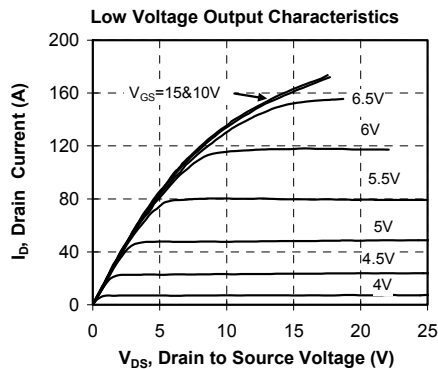
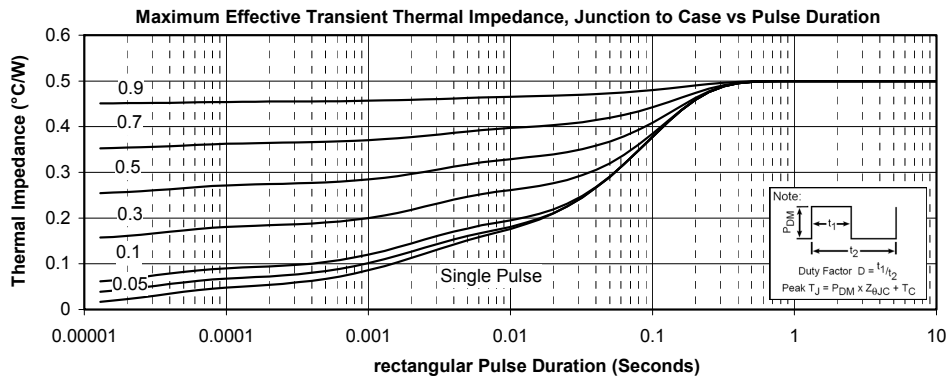
5. Package characteristics

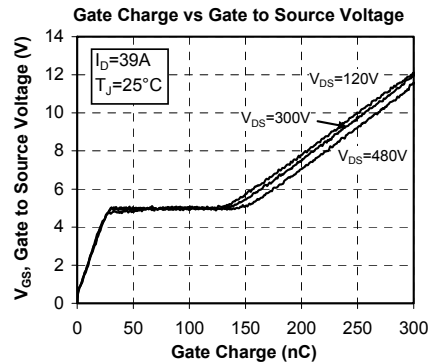
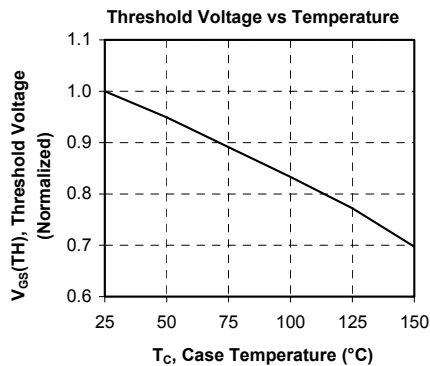
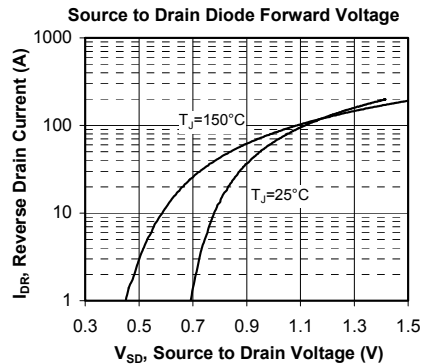
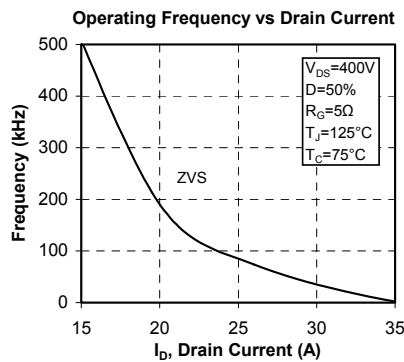
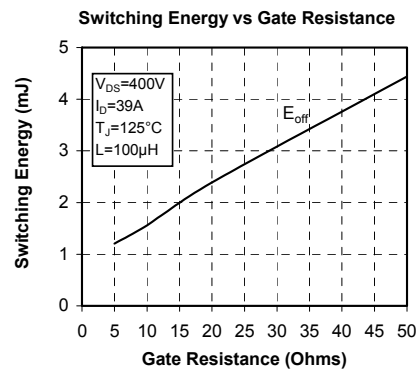
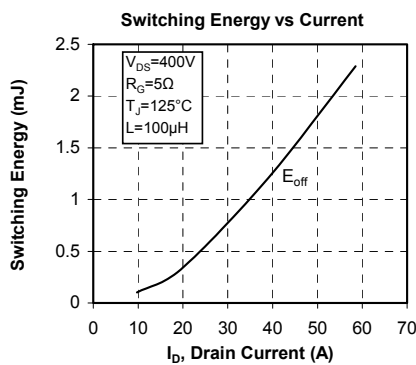
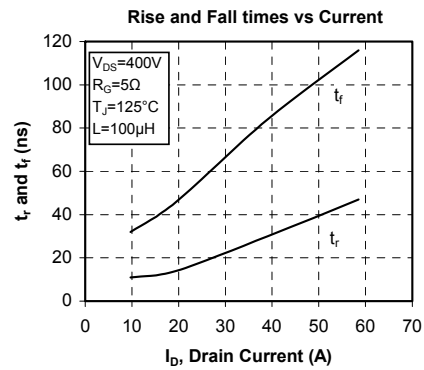
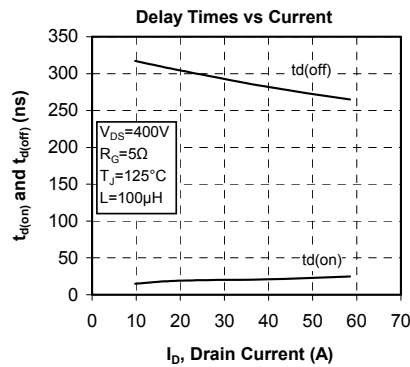
Symbol	Characteristic			Min	Typ	Max	Unit
V _{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T _J	Operating junction temperature range			-40		150	°C
T _{STG}	Storage Temperature Range			-40		125	
T _C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M4	2		3	N.m
Wt	Package Weight					110	g

6. SP3F Package outline (dimensions in mm)

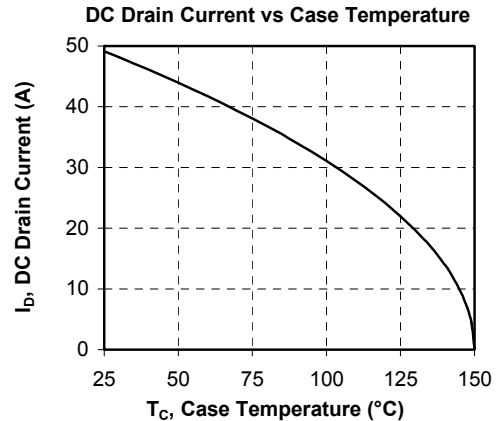
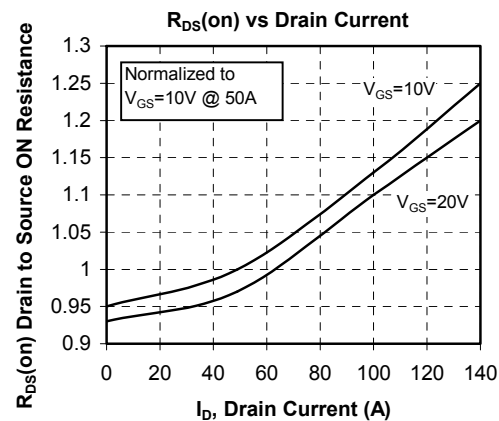
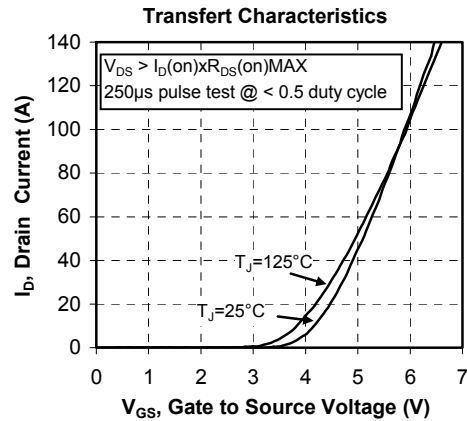
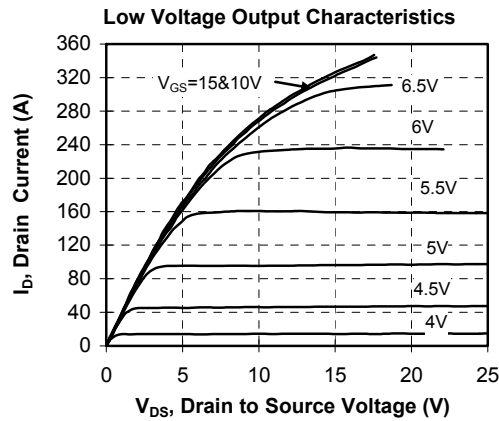
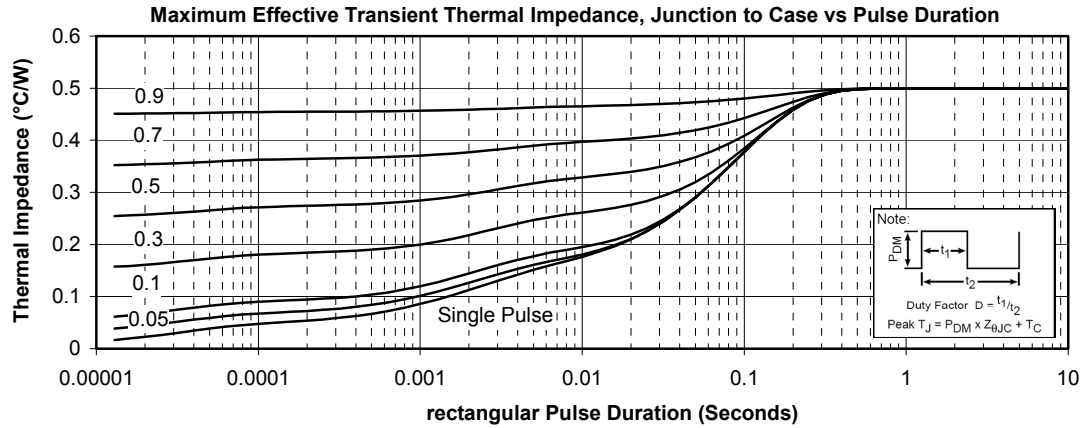


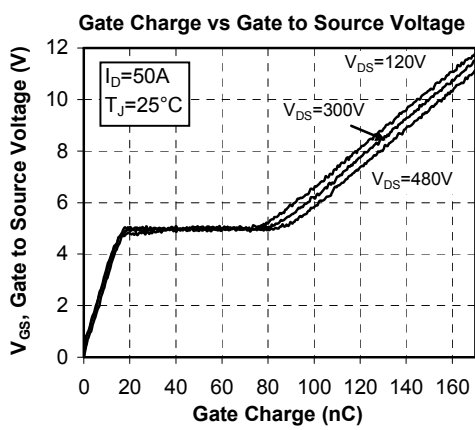
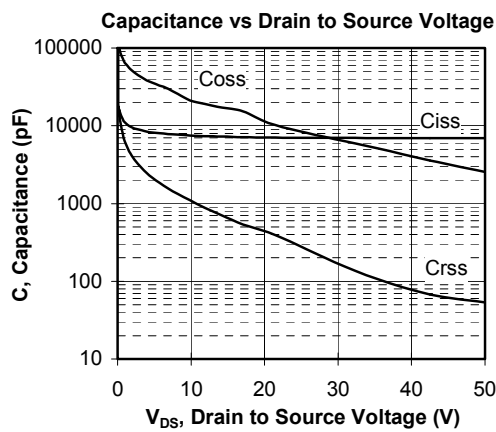
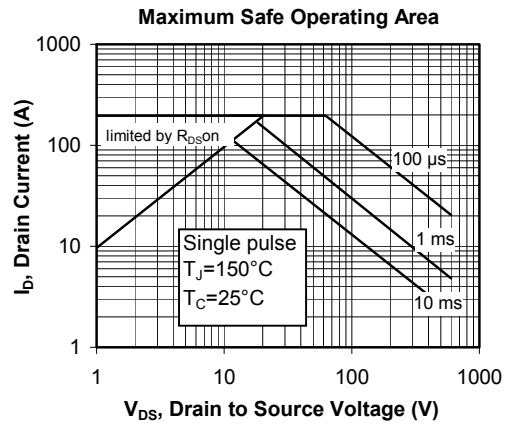
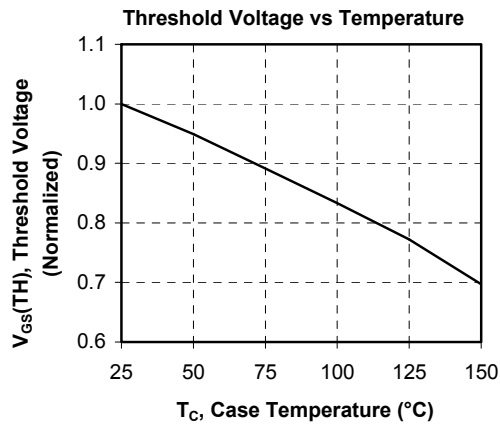
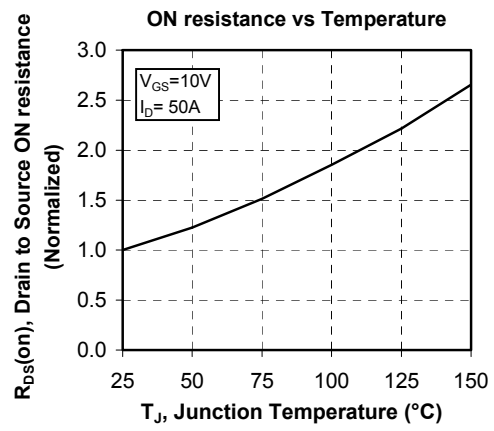
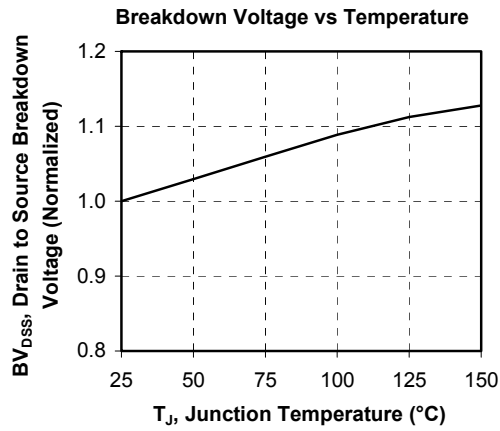
7. Full bridge switches curves (Per CoolMOST™)

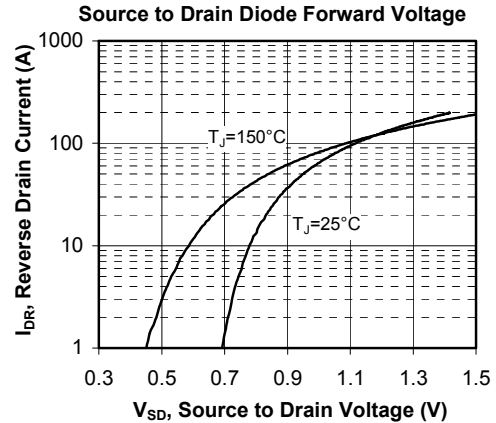
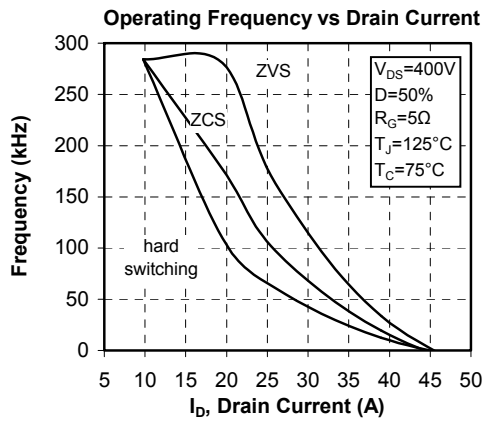
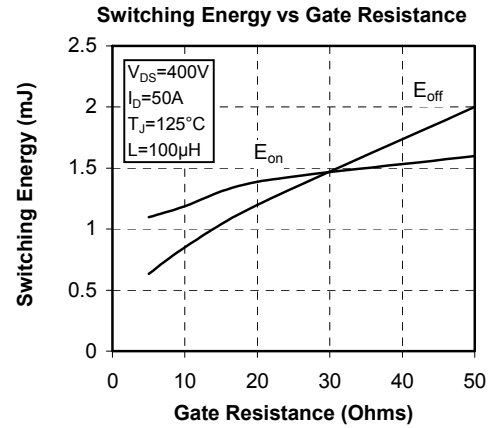
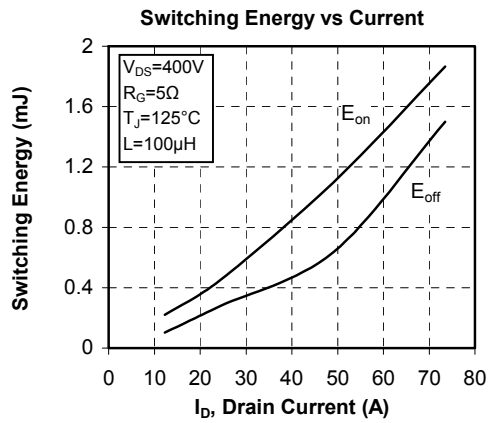
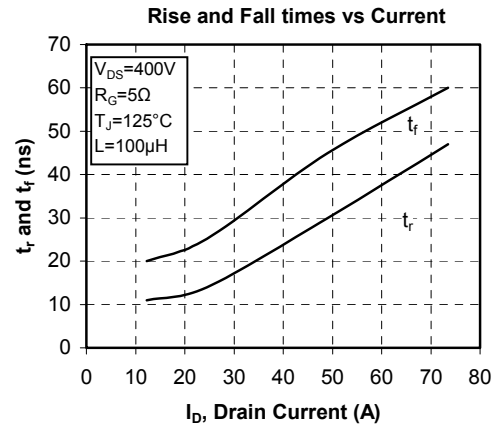
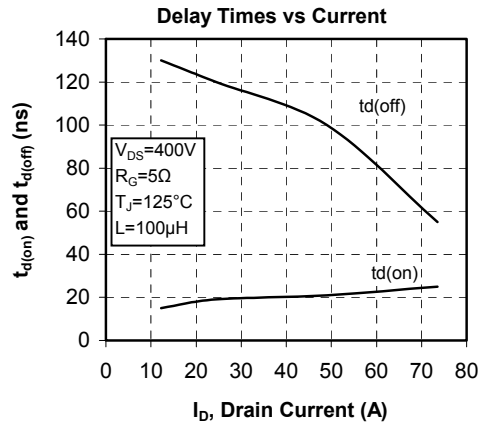




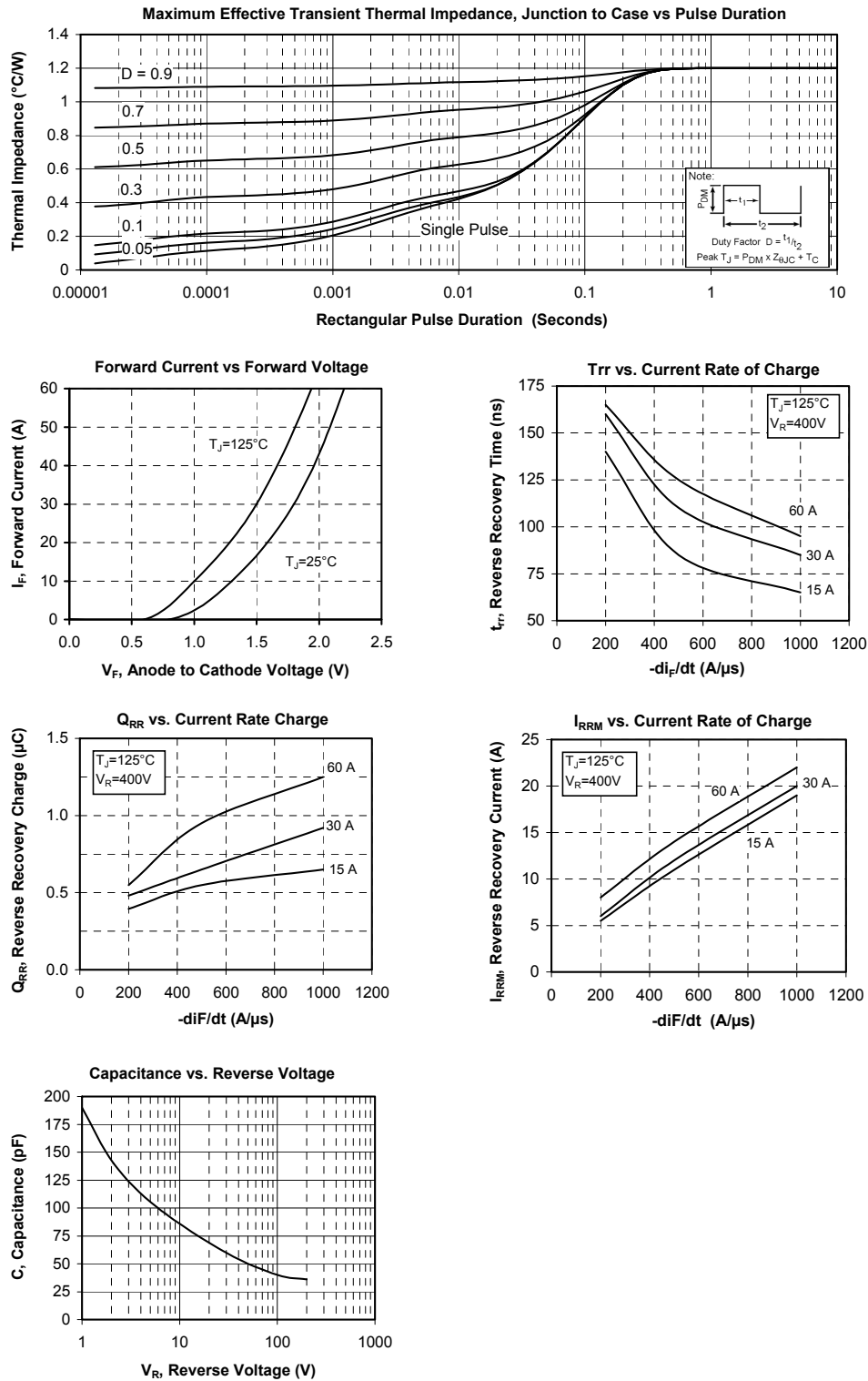
8. Chopper CoolMOS™



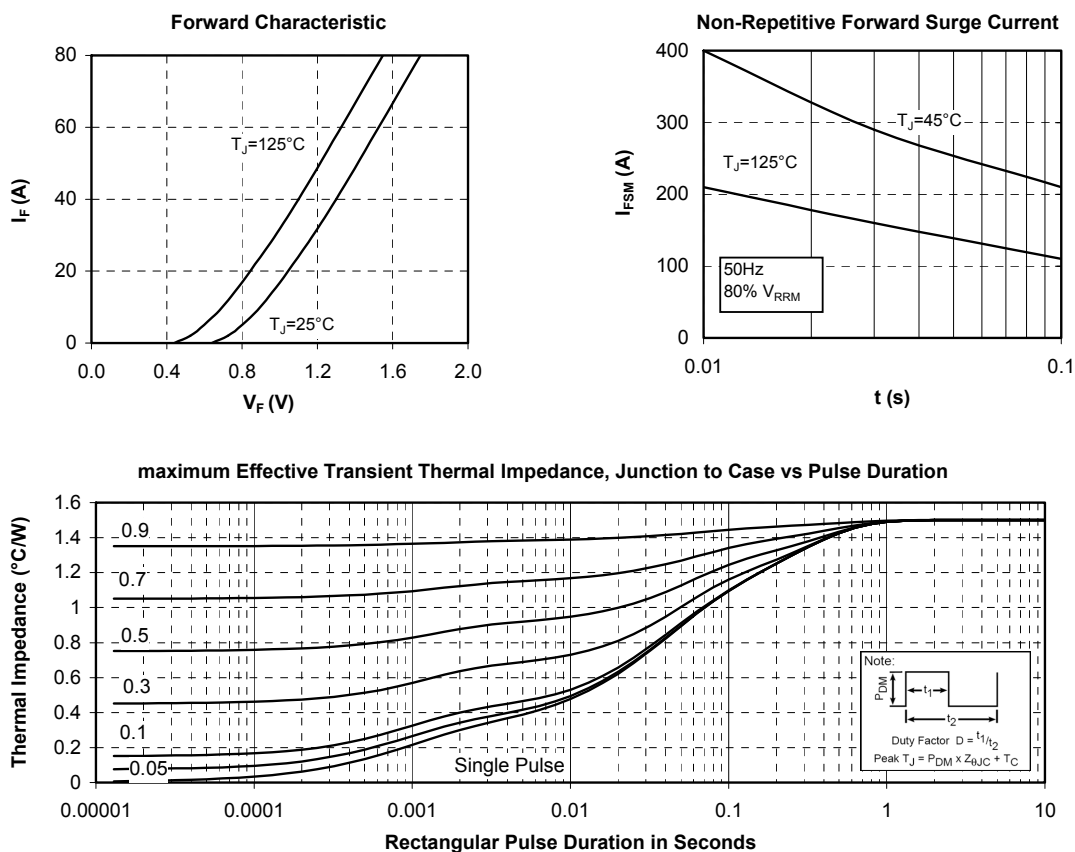




9. Chopper diode curves



10. Typical by pass CR6 diode curves



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