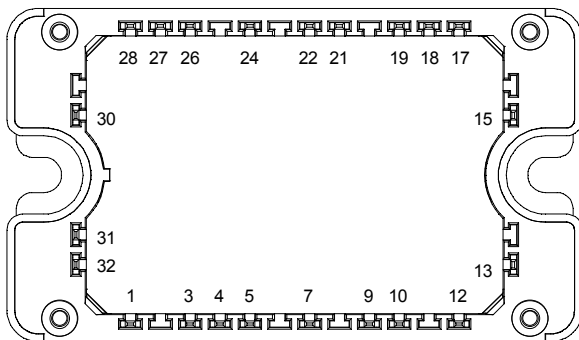
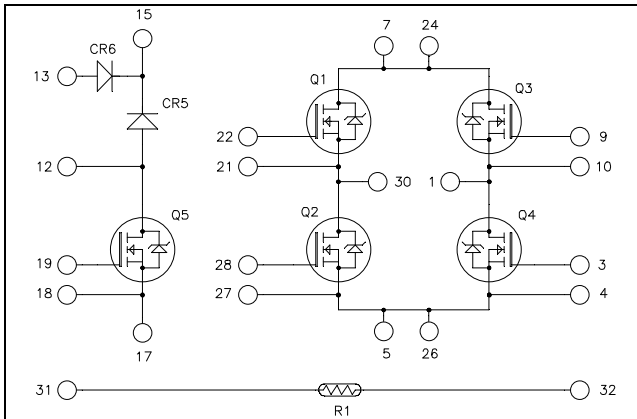


**Full – Bridge + boost chopper  
CoolMOS Power module**



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
$I_{DM}$	Pulsed Drain current	160	A
$V_{GS}$	Gate - Source Voltage	$\pm 20$	V
$R_{DSon}$	Drain - Source ON Resistance	70	$m\Omega$
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ\text{C}$	250
$I_{AR}$	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](http://www.microsemi.com)

#### CoolMOS™ Q1 to Q4:

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

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

#### CoolMOS™ Q5:

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

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

#### 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 <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 600V	T <sub>j</sub> = 25°C			25	μA
		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 600V	T <sub>j</sub> = 125°C			250	
R <sub>DS(on)</sub>	Drain – Source on Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 39A				70	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 2.7mA		2.1	3	3.9	V
I <sub>GSS</sub>	Gate – Source Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0V				±100	nA

**Dynamic Characteristics**

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V			7		nF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> = 25V			2.56		
C <sub>rss</sub>	Reverse Transfer Capacitance	f = 1MHz			0.21		
Q <sub>g</sub>	Total gate Charge	V <sub>GS</sub> = 10V			259		nC
Q <sub>gs</sub>	Gate – Source Charge	V <sub>Bus</sub> = 300V			29		
Q <sub>gd</sub>	Gate – Drain Charge	I <sub>D</sub> = 39A			111		
T <sub>d(on)</sub>	Turn-on Delay Time	<b>Inductive Switching @ 125°C</b>			21		ns
T <sub>r</sub>	Rise Time	V <sub>GS</sub> = 15V			30		
T <sub>d(off)</sub>	Turn-off Delay Time	V <sub>Bus</sub> = 400V			283		
T <sub>f</sub>	Fall Time	I <sub>D</sub> = 39A R <sub>G</sub> = 5Ω			84		
E <sub>off</sub>	Turn-off Switching Energy	V <sub>GS</sub> = 15V V <sub>Bus</sub> = 400V	T <sub>j</sub> = 25°C		980		μJ
E <sub>off</sub>	Turn-off Switching Energy	I <sub>D</sub> = 39A R <sub>G</sub> = 5Ω	T <sub>j</sub> = 125°C		1206		
R <sub>thJC</sub>	Junction to Case Thermal resistance					0.5	°C/W

**Source - Drain diode ratings and characteristics**

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I <sub>S</sub>	Continuous Source current (Body diode)	T <sub>c</sub> = 25°C			39		A
		T <sub>c</sub> = 80°C			29		
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = - 39A				1.2	V
dv/dt	Peak Diode Recovery ❶					6	V/ns
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> = - 39A V <sub>R</sub> = 350V	T <sub>j</sub> = 25°C		580		ns
Q <sub>rr</sub>	Reverse Recovery Charge	di <sub>S</sub> /dt = 100A/μs	T <sub>j</sub> = 25°C		23		μC

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

$$I_S \leq -39A \quad di/dt \leq 100A/\mu s \quad V_R \leq V_{DSS} \quad T_j \leq 150^\circ C$$

**2. Boost chopper Q5, CR5**
**2.1 Q5 CoolMOS™ characteristics**
**Absolute maximum ratings**

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>
V <sub>DSS</sub>	Drain - Source Breakdown Voltage	600	V
I <sub>D</sub>	Continuous Drain Current	T <sub>c</sub> = 25°C	49
		T <sub>c</sub> = 80°C	38
I <sub>DM</sub>	Pulsed Drain current	130	A
V <sub>GS</sub>	Gate - Source Voltage	±20	V
R <sub>DS(on)</sub>	Drain - Source ON Resistance	45	mΩ
P <sub>D</sub>	Maximum Power Dissipation	T <sub>c</sub> = 25°C	250
I <sub>AR</sub>	Avalanche current (repetitive and non repetitive)	15	A
E <sub>AR</sub>	Repetitive Avalanche Energy	3	mJ
E <sub>AS</sub>	Single Pulse Avalanche Energy	1900	

**Electrical Characteristics**

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

**Dynamic Characteristics**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V ; V <sub>DS</sub> = 25V f = 1MHz		7.2		nF
C <sub>oss</sub>	Output Capacitance			8.5		
Q <sub>g</sub>	Total gate Charge	V <sub>GS</sub> = 10V V <sub>Bus</sub> = 300V I <sub>D</sub> = 49A		150		nC
Q <sub>gs</sub>	Gate – Source Charge			34		
Q <sub>gd</sub>	Gate – Drain Charge			51		
T <sub>d(on)</sub>	Turn-on Delay Time	<b>Inductive Switching (125°C)</b> V <sub>GS</sub> = 10V V <sub>Bus</sub> = 400V I <sub>D</sub> = 49A R <sub>G</sub> = 5Ω		21		ns
T <sub>r</sub>	Rise Time			30		
T <sub>d(off)</sub>	Turn-off Delay Time			100		
T <sub>f</sub>	Fall Time			45		
E <sub>on</sub>	Turn-on Switching Energy	<b>Inductive switching @ 25°C</b> V <sub>GS</sub> = 10V ; V <sub>Bus</sub> = 400V I <sub>D</sub> = 49A ; R <sub>G</sub> = 5Ω		675		μJ
E <sub>off</sub>	Turn-off Switching Energy			520		
E <sub>on</sub>	Turn-on Switching Energy	<b>Inductive switching @ 125°C</b> V <sub>GS</sub> = 10V ; V <sub>Bus</sub> = 400V I <sub>D</sub> = 49A ; R <sub>G</sub> = 5Ω		1096		μJ
E <sub>off</sub>	Turn-off Switching Energy			635		
R <sub>thJC</sub>	Junction to Case Thermal resistance				0.5	°C/W

**Source - Drain diode ratings and characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I <sub>S</sub>	Continuous Source current (Body diode)		T <sub>c</sub> = 25°C		49	A
			T <sub>c</sub> = 80°C		38	
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = - 49A			1.2	V
dv/dt	Peak Diode Recovery ❶				4	V/ns
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> = - 49A V <sub>R</sub> = 350V di <sub>S</sub> /dt = 100A/μs	T <sub>j</sub> = 25°C		600	ns
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>j</sub> = 25°C		17	μC

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.  
 I<sub>S</sub> ≤ - 49A    di/dt ≤ 100A/μs    V<sub>R</sub> ≤ V<sub>DSS</sub>    T<sub>j</sub> ≤ 150°C

**2.2 Chopper diode characteristics (CR5)**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage		600			V
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> = 600V	T <sub>j</sub> = 25°C		25	μA
			T <sub>j</sub> = 125°C		500	
I <sub>F</sub>	DC Forward Current			30		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 30A		1.8	2.2	V
		I <sub>F</sub> = 60A		2.2		
		I <sub>F</sub> = 30A	T <sub>j</sub> = 125°C	1.5		
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 30A V <sub>R</sub> = 400V di/dt = 200A/μs	T <sub>j</sub> = 25°C		25	ns
			T <sub>j</sub> = 125°C		160	
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>j</sub> = 25°C		35	nC
			T <sub>j</sub> = 125°C		480	
R <sub>thJC</sub>	Junction to Case Thermal resistance				1.2	°C/W

**3. By pass diode (CR6)**
**Absolute maximum ratings**

Symbol	Parameter	Max ratings	Unit
V <sub>R</sub>	Maximum DC reverse Voltage	1600	V
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage		
I <sub>F</sub>	DC Forward Current	T <sub>C</sub> = 80°C	40
I <sub>FSM</sub>	Non-Repetitive Forward Surge Current	t = 10ms T <sub>J</sub> = 45°C	400

**Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I <sub>R</sub>	Reverse Current	V <sub>R</sub> = 1600V	T <sub>j</sub> = 25°C		20	μA
			T <sub>j</sub> = 125°C		2	mA
V <sub>F</sub>	Forward Voltage	I <sub>F</sub> = 40A	T <sub>j</sub> = 25°C		1.3	V
			T <sub>j</sub> = 125°C		1.1	
V <sub>T</sub>	On – state Voltage			0.8		V
r <sub>T</sub>	On – state Slope resistance			10.5		mΩ
R <sub>thJC</sub>	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 <sub>25</sub>	Resistance @ 25°C		50		kΩ
ΔR <sub>25</sub> /R <sub>25</sub>			5		%
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K
ΔB/B			4		%

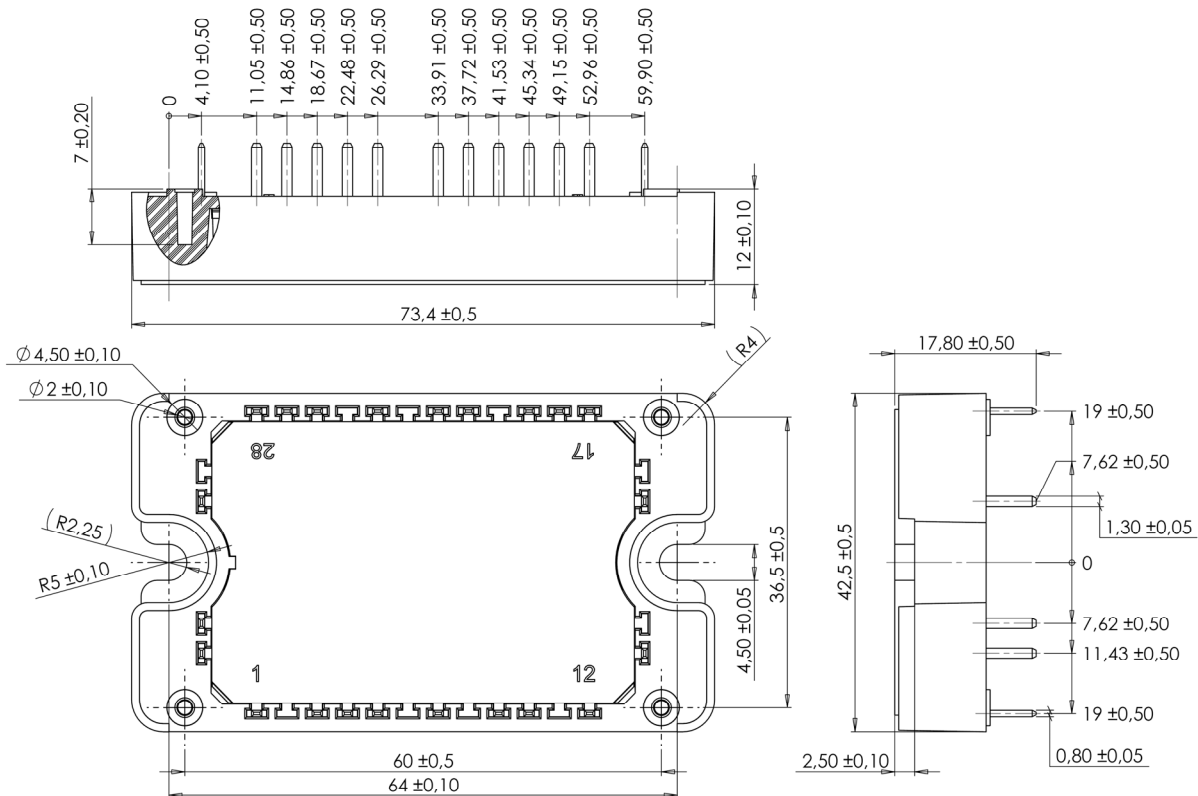
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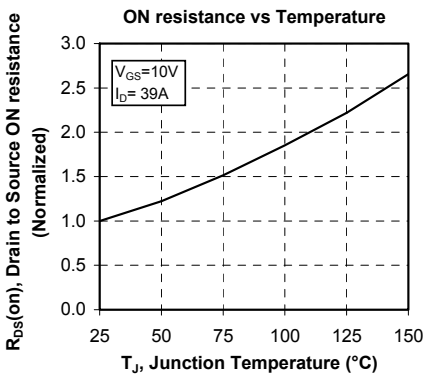
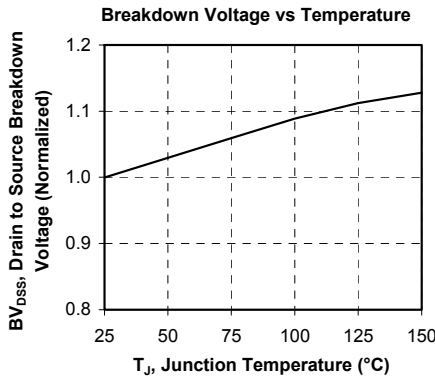
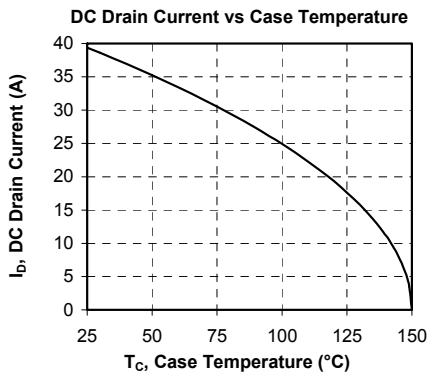
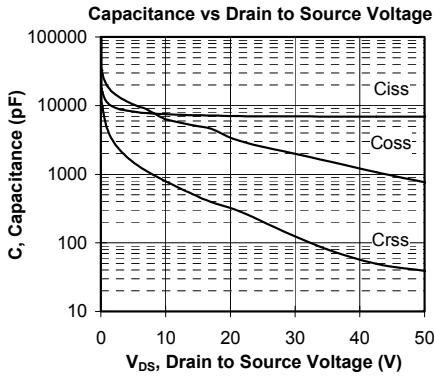
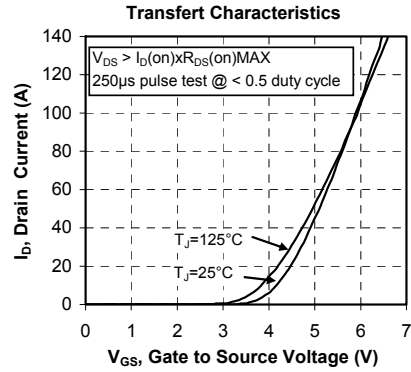
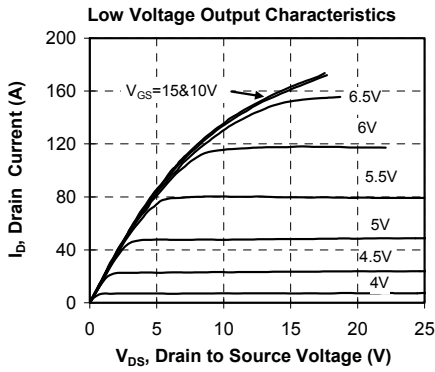
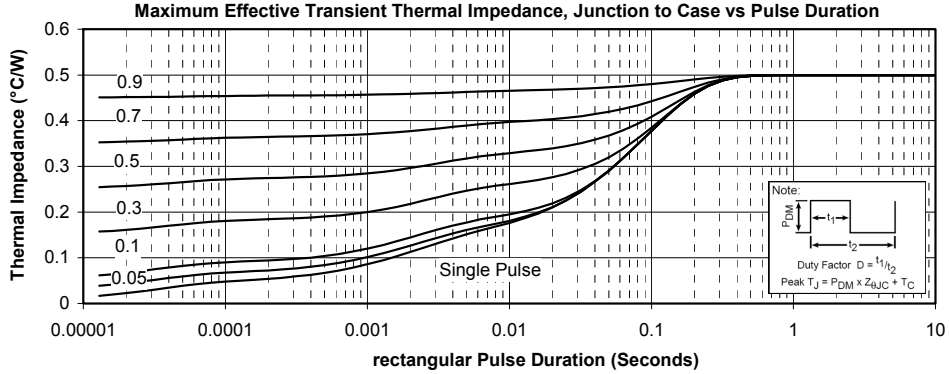
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

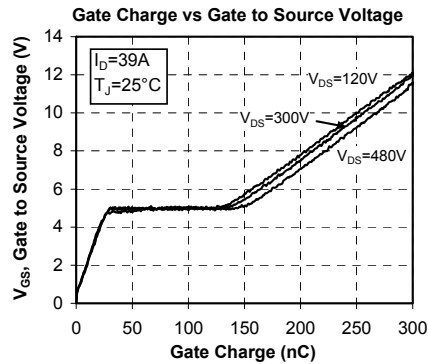
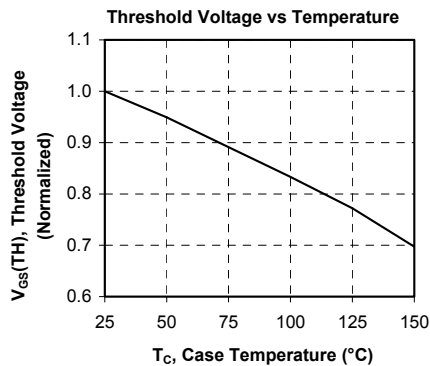
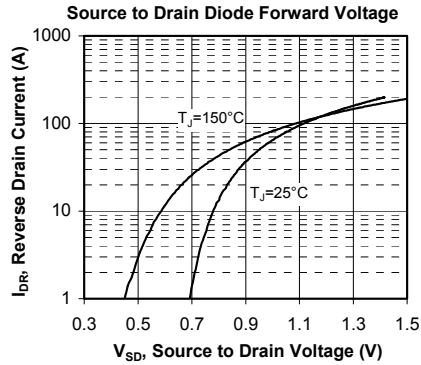
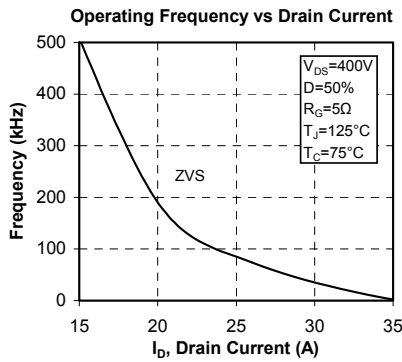
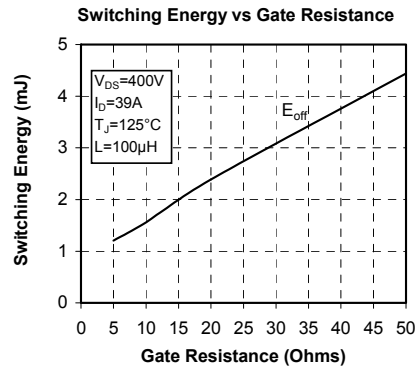
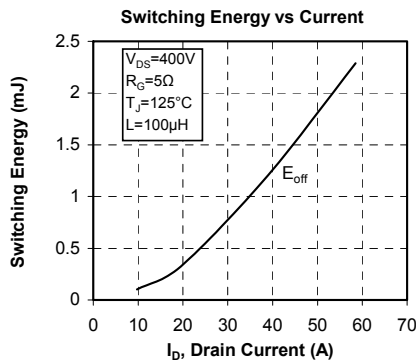
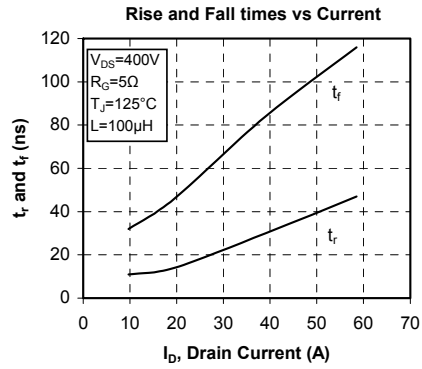
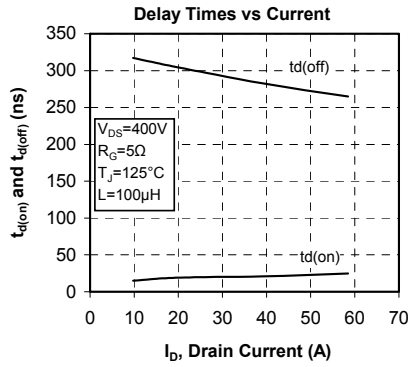
#### 5. Package characteristics

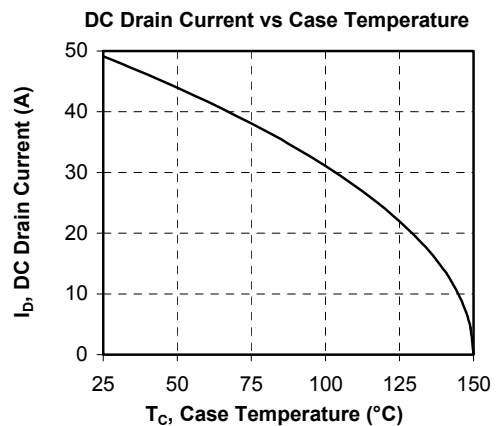
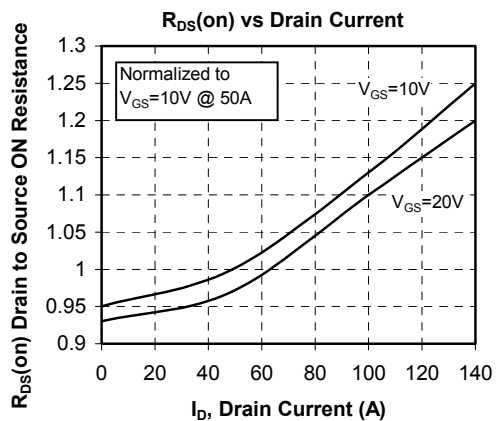
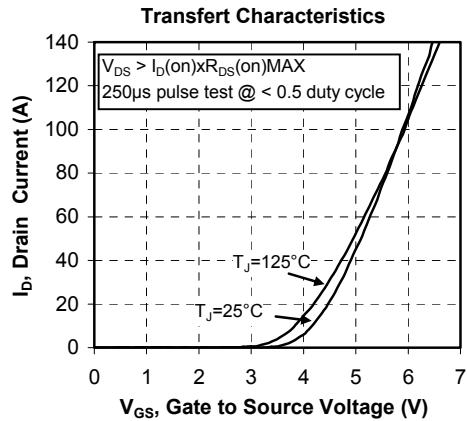
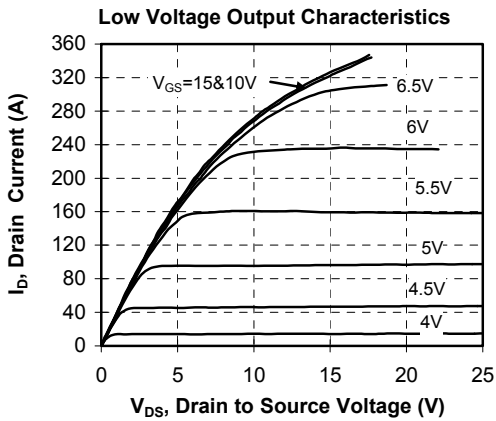
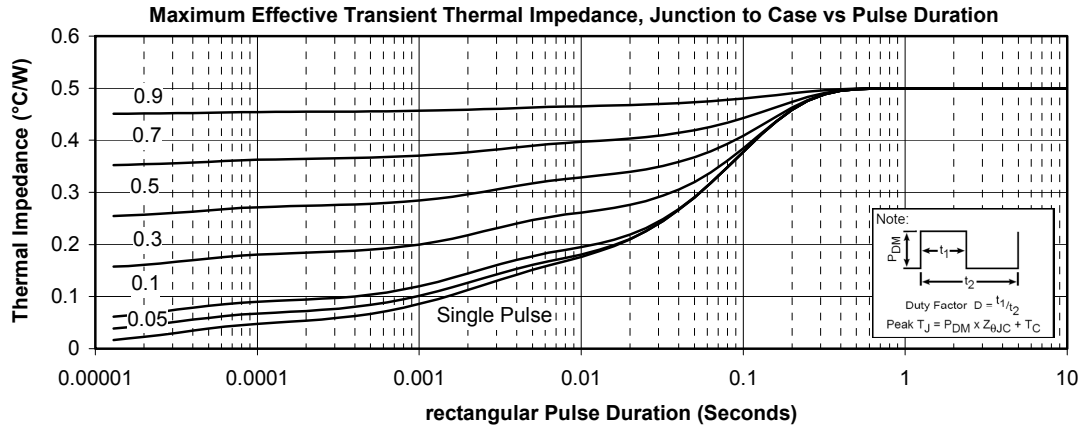
Symbol	Characteristic	Min	Typ	Max	Unit	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz	4000			V	
T <sub>J</sub>	Operating junction temperature range	-40		150	°C	
T <sub>STG</sub>	Storage Temperature Range	-40		125		
T <sub>C</sub>	Operating Case Temperature	-40		100		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

#### 6. SP3F Package outline (dimensions in mm)

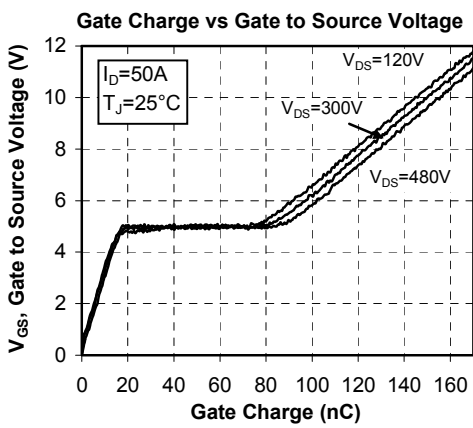
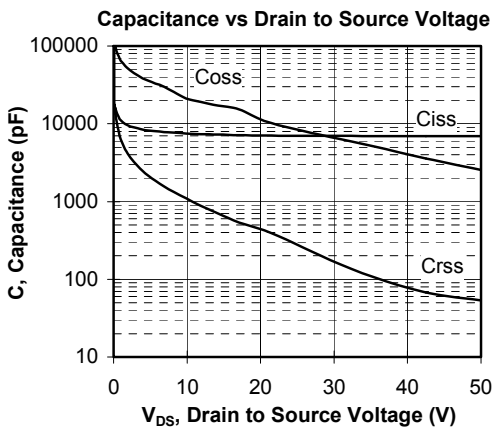
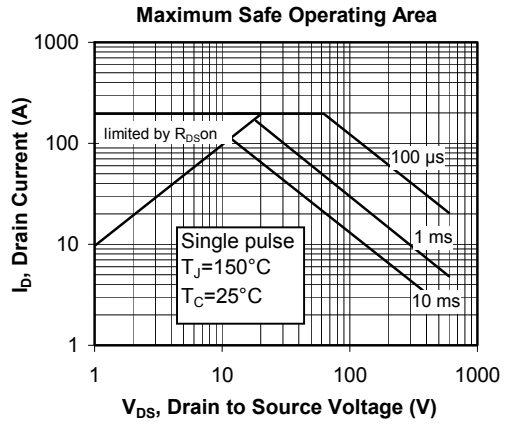
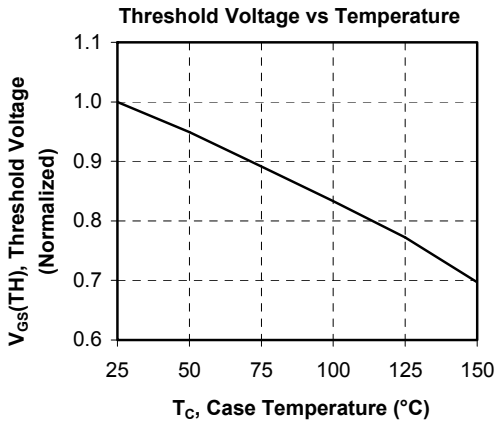
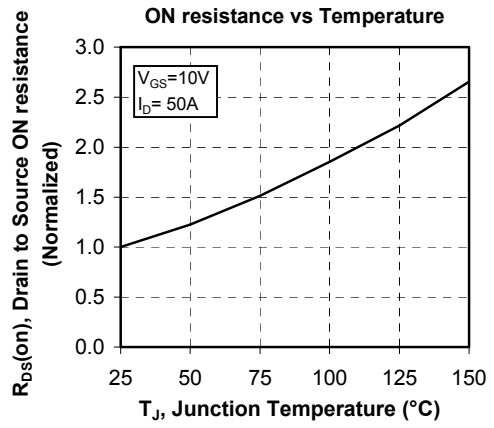
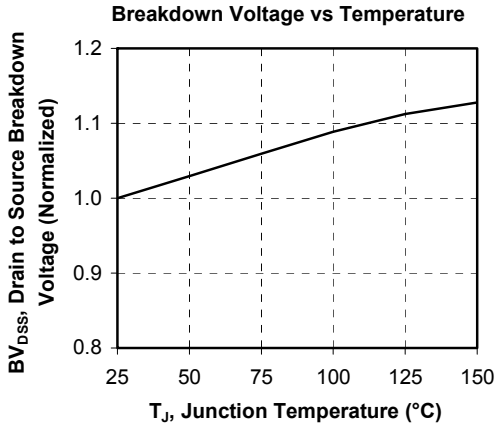


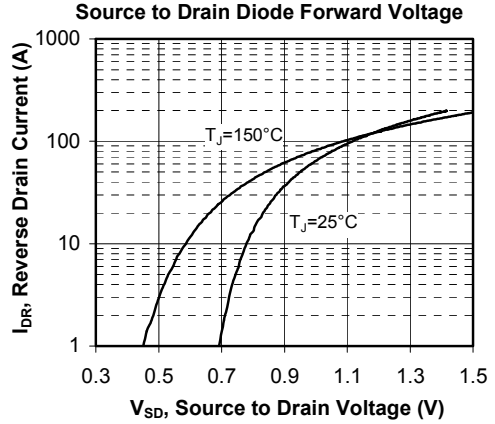
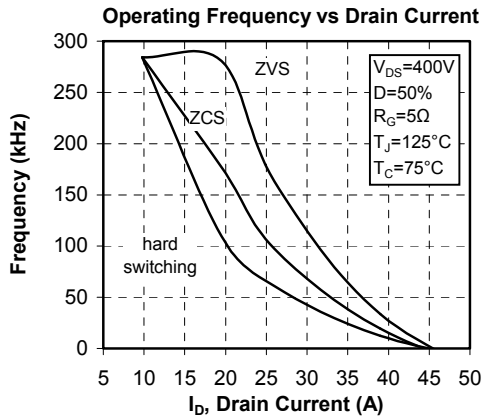
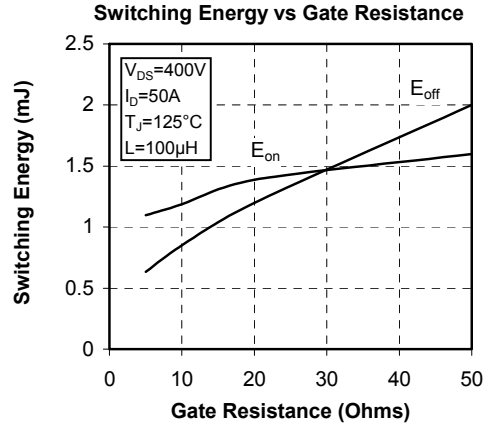
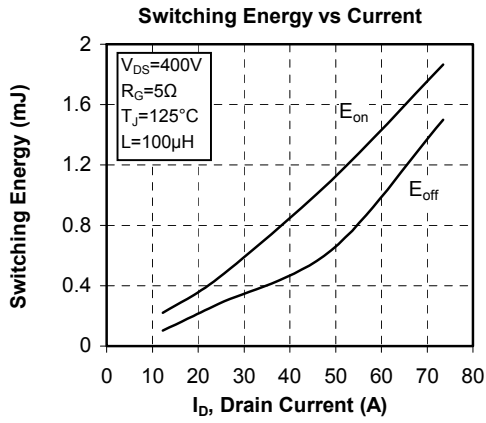
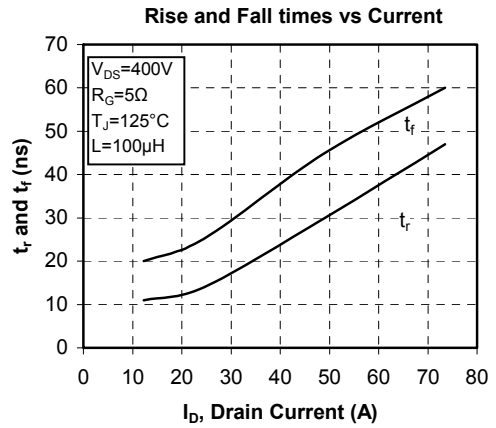
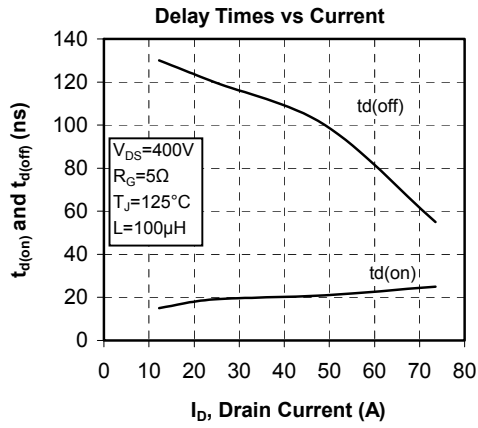
**7. Full bridge switches curves (Per CoolMOS™)**


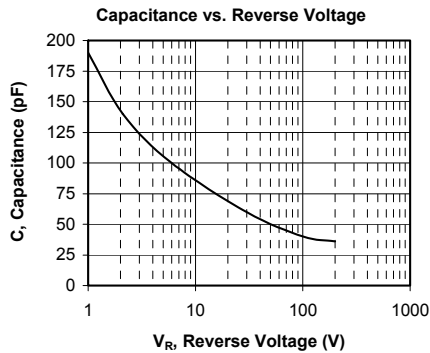
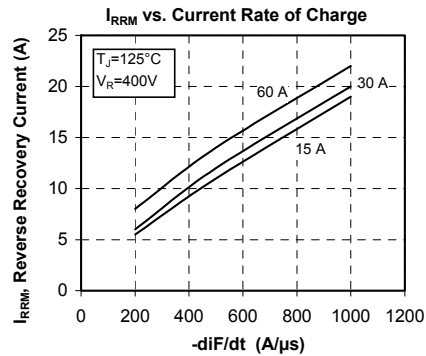
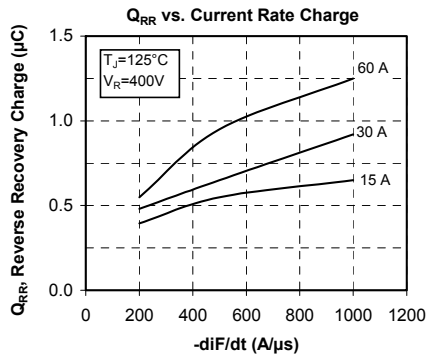
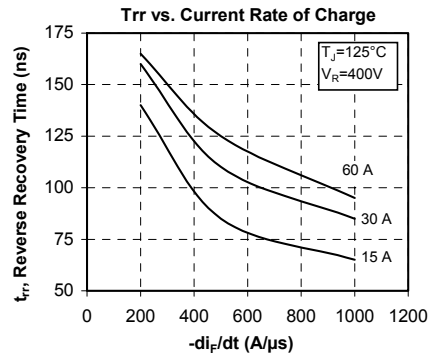
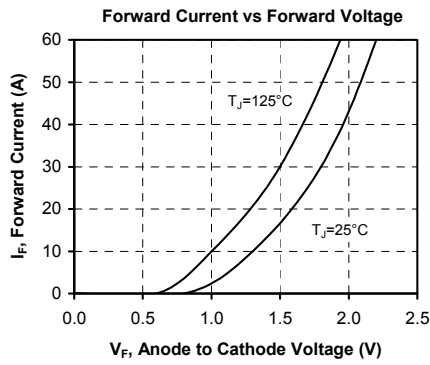
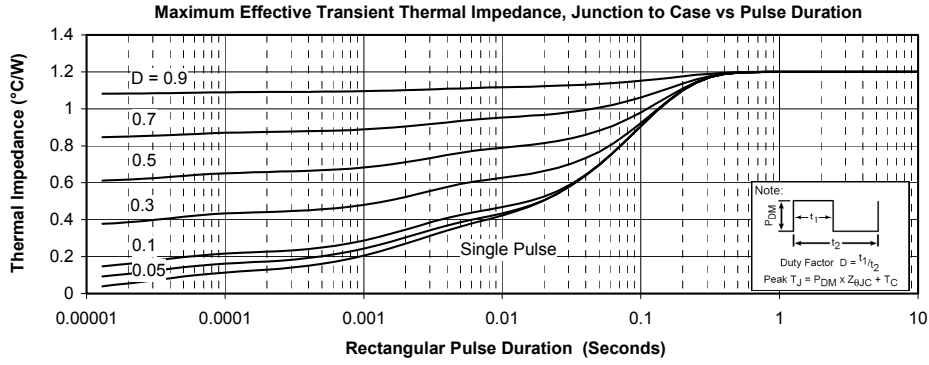


**8. Chopper CoolMOS™**


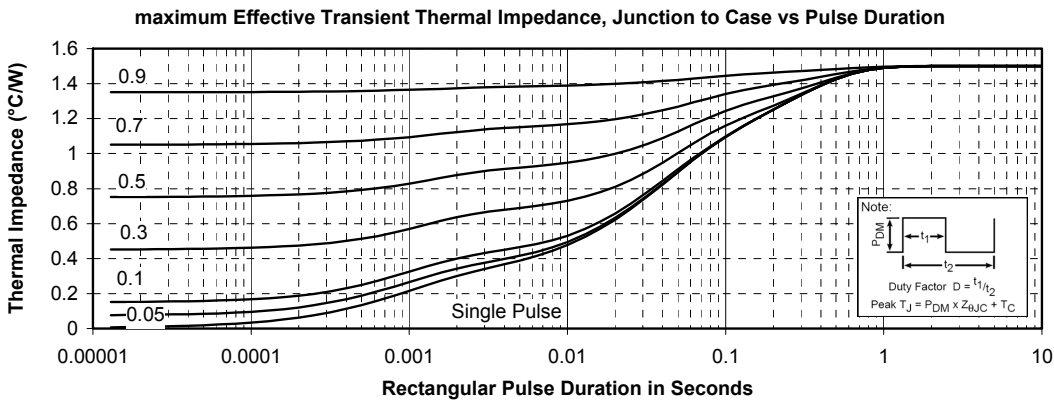
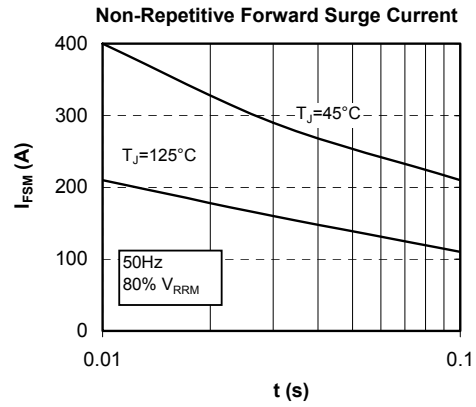
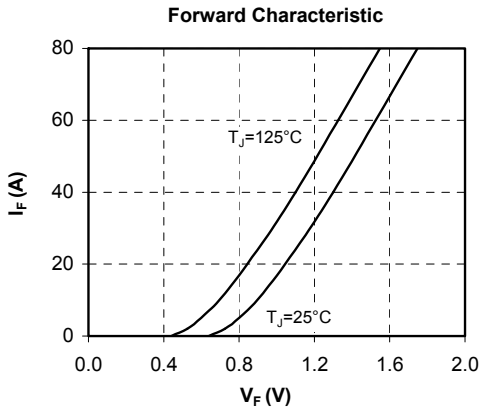






**9. Chopper diode curves**


**10. Typical by pass CR6 diode curves**



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