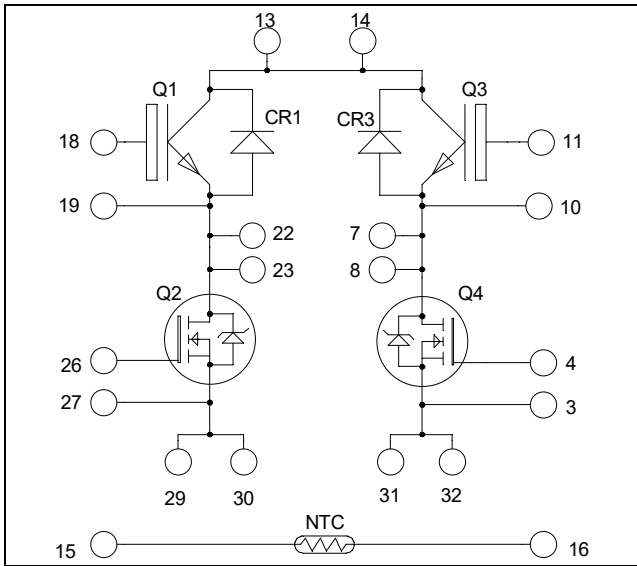


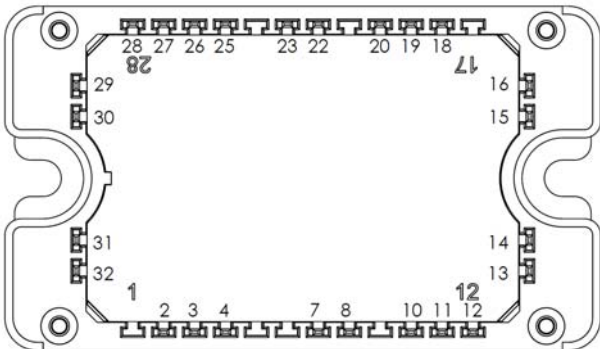
Full – Bridge Power module

Trench & Field Stop IGBT3 Q1, Q3:
 $V_{CES} = 600V$; $I_C = 50A @ T_c = 80^\circ C$

Super Junction MOSFET Q2, Q4:
 $V_{DSS} = 600V$; $I_D = 49A @ T_c = 25^\circ C$



Top switches : Trench + Field Stop IGBT3
 Bottom switches : Super junction MOSFET



All multiple inputs and outputs must be shorted together
 13/14 ; 22/23 ; 29/30 ; 31/32

Application

- Solar converter

Features

- **Q2, Q4 Super junction MOSFET**
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
- **Q1, Q3 Trench & Field Stop IGBT3**
 - Low voltage drop
 - Switching frequency up to 20 kHz
 - RBSOA & SCSOA rated
 - Low tail current

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

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
- RoHS Compliant

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

 **CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

1. Top switches

1.1 Top Trench + Field Stop IGBT3 characteristics

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V _{CES}	Collector - Emitter Voltage	600	V
I _C	Continuous Collector Current	T _C = 25°C	80
		T _C = 80°C	50
I _{CM}	Pulsed Collector Current	T _C = 25°C	100
V _{GE}	Gate - Emitter Voltage	±20	V
P _D	Power Dissipation	T _C = 25°C	176
RBSOA	Reverse Bias Safe Operating Area	T _J = 150°C	100A @ 550V

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I _{CES}	Zero Gate Voltage Collector Current	V _{GE} = 0V, V _{CE} = 600V			250	μA
V _{CE(sat)}	Collector Emitter Saturation Voltage	V _{GE} = 15V	T _J = 25°C	1.5	1.9	V
		I _C = 50A		1.7		
V _{GE(th)}	Gate Threshold Voltage	V _{GE} = V _{CE} , I _C = 600μA	5.0	5.8	6.5	V
I _{GES}	Gate - Emitter Leakage Current	V _{GE} = 20V, V _{CE} = 0V			600	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{ies}	Input Capacitance	V _{GE} = 0V V _{CE} = 25V f = 1MHz		3150		pF
C _{oes}	Output Capacitance			200		
C _{res}	Reverse Transfer Capacitance			95		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (25°C) V _{GE} = ±15V V _{Bus} = 300V I _C = 50A R _G = 8.2Ω		110		ns
T _r	Rise Time			45		
T _{d(off)}	Turn-off Delay Time			200		
T _f	Fall Time			40		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (150°C) V _{GE} = ±15V V _{Bus} = 300V I _C = 50A R _G = 8.2Ω		120		ns
T _r	Rise Time			50		
T _{d(off)}	Turn-off Delay Time			250		
T _f	Fall Time			60		
E _{on}	Turn-on Switching Energy	V _{GE} = ±15V V _{Bus} = 300V I _C = 50A R _G = 8.2Ω	T _J = 25°C	0.3		mJ
			T _J = 150°C	0.43		
E _{off}	Turn-off Switching Energy	I _C = 50A R _G = 8.2Ω	T _J = 25°C	1.35		mJ
			T _J = 150°C	1.75		
R _{thJC}	Junction to Case Thermal resistance				0.85	°C/W

1.2 Top fast diode characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V _{RRM}	Peak Repetitive Reverse Voltage					600	V
I _{RM}	Reverse Leakage Current	V _R =600V				25	μA
I _F	DC Forward Current		T _c = 80°C		30		A
V _F	Diode Forward Voltage	I _F = 30A			1.8	2.3	V
		I _F = 60A			2.1		
		I _F = 30A	T _j = 125°C		1.5		
t _{rr}	Reverse Recovery Time	I _F = 30A V _R = 400V di/dt = 200A/μs	T _j = 25°C		25		ns
Q _{rr}	Reverse Recovery Charge		T _j = 125°C		160		
			T _j = 25°C		35		
			T _j = 125°C		480		
R _{thJC}	Junction to Case Thermal resistance					1.2	°C/W

2. Bottom switches

2.1 Bottom Super junction MOSFET characteristics

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V _{DSS}	Drain - Source 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	Power Dissipation	T _c = 25°C	290
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			250	μA
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 _{rss}	Reverse Transfer Capacitance			0.29		
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 = 4.7Ω		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 = 4.7Ω		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 = 4.7Ω		1100		μJ
E _{off}	Turn-off Switching Energy			635		
R _{thJC}	Junction to Case Thermal resistance				0.5	°C/W

3. Temperature sensor (see application note APT0406 on www.microsemi.com).

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			4		%

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

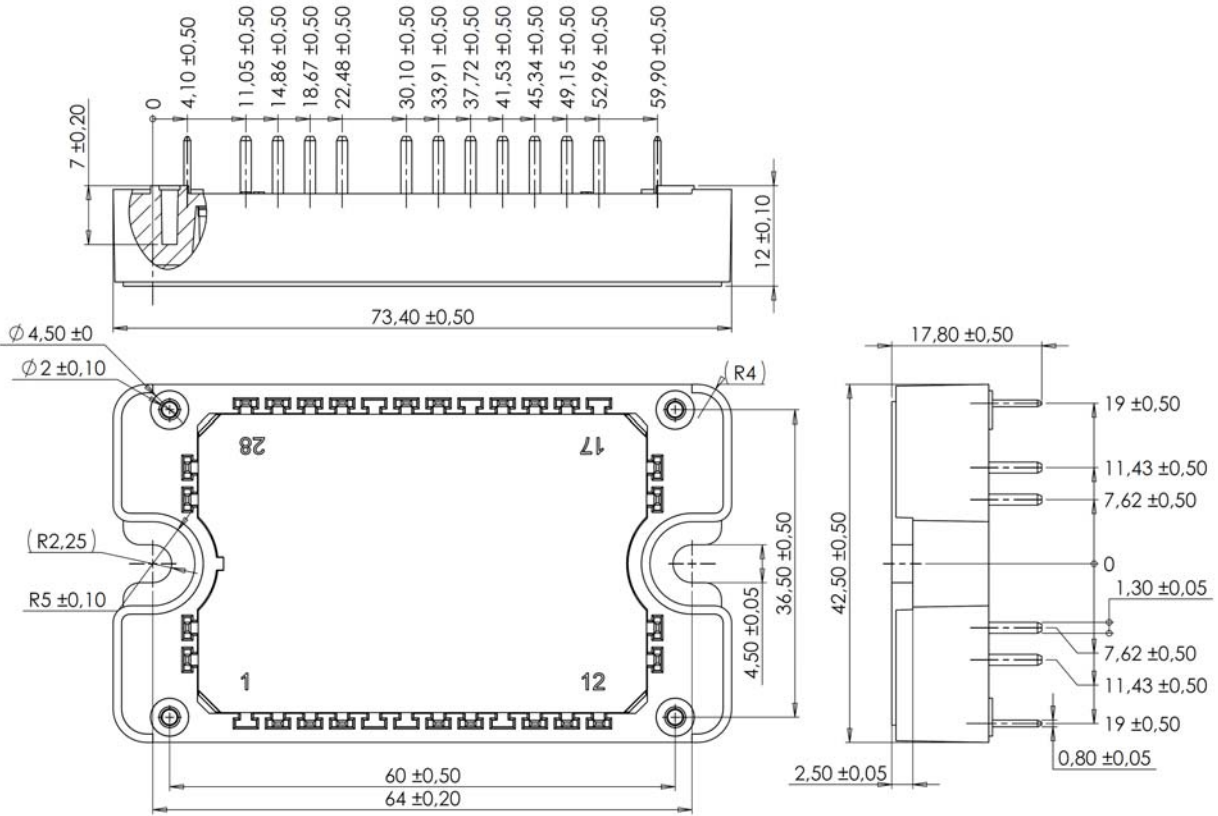
T: Thermistor temperature
R_T: Thermistor value at T

4. Package characteristics

Symbol	Characteristic	Min	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 _{JOP}	Recommended junction temperature under switching conditions	-40	T _{Jmax} -25			
T _{STG}	Storage Temperature Range	-40	125			
T _C	Operating Case Temperature	-40	125			
Torque	Mounting torque	To heatsink	M4	2	3	N.m
Wt	Package Weight				110	g

T_j=175°C for IGBT

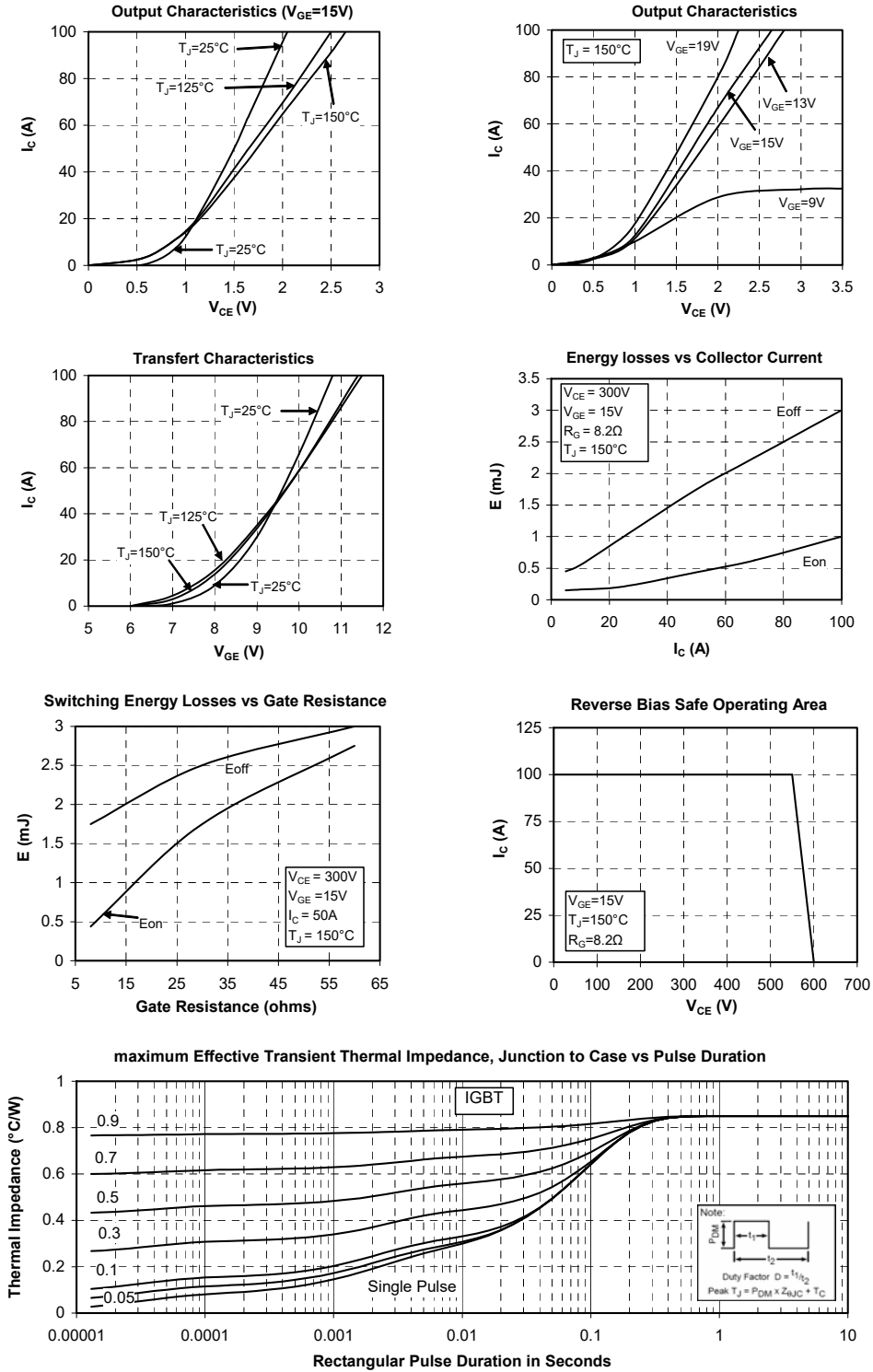
5. Package outline (dimensions in mm)



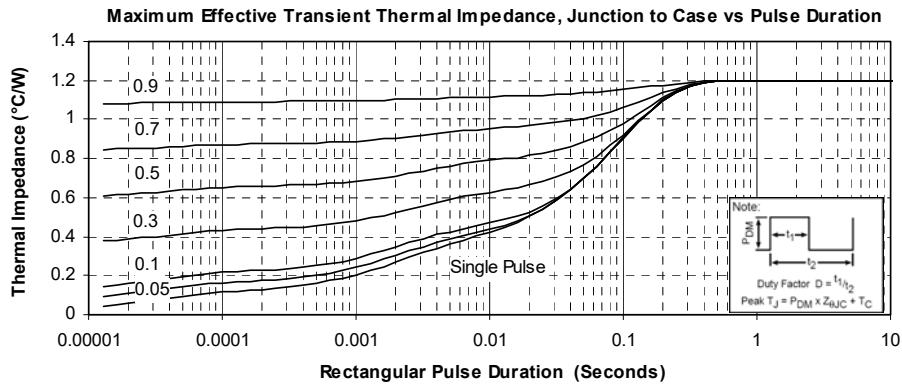
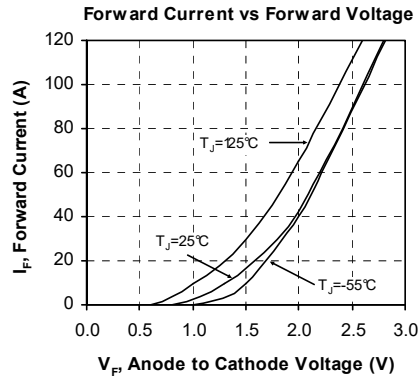
See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

6. Top switches curves

6.1 Top Trench + Field Stop IGBT3 typical performance curves

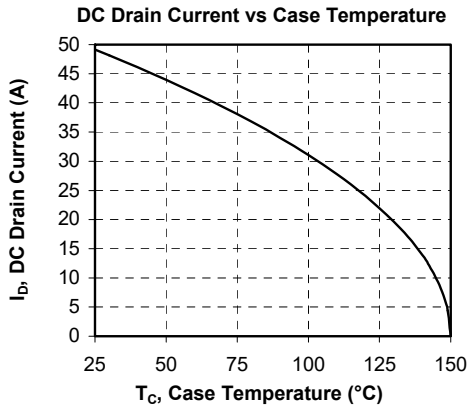
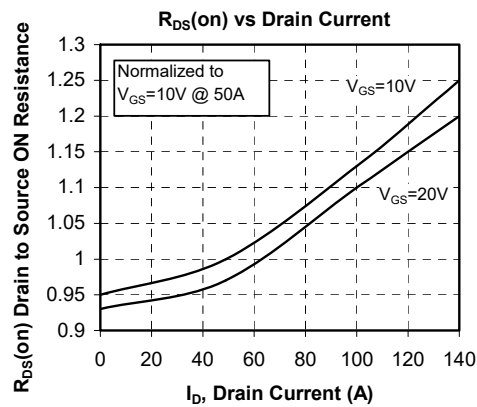
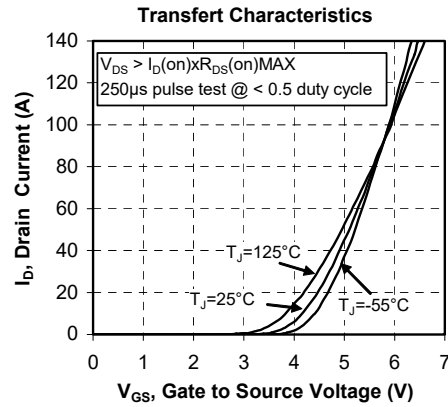
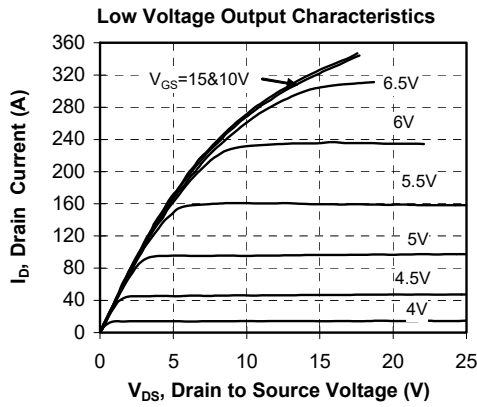
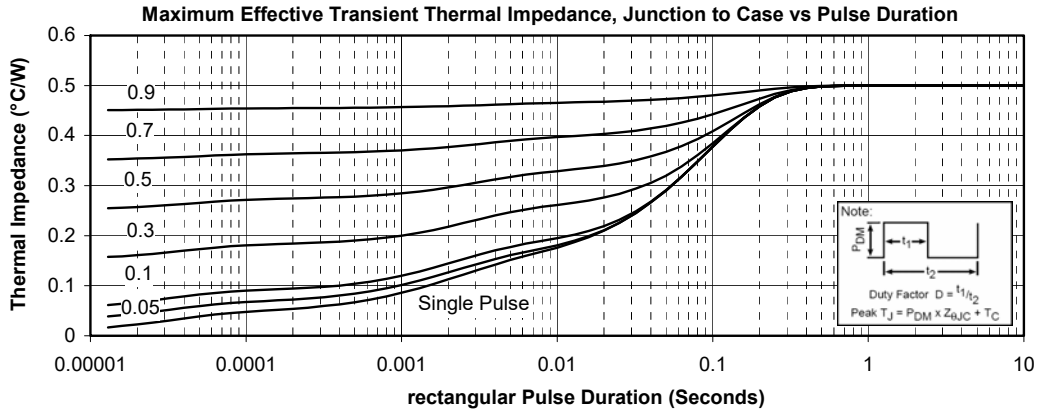


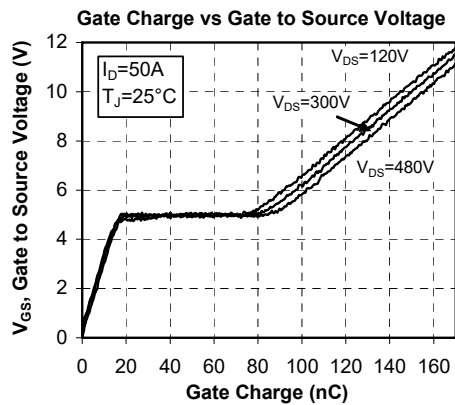
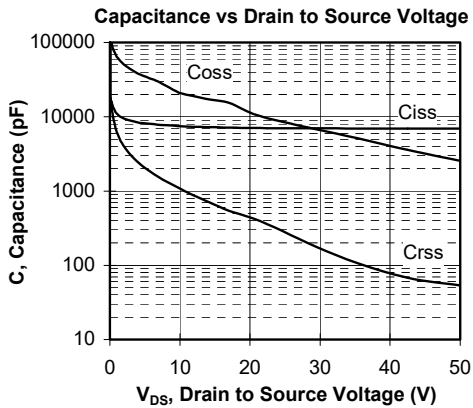
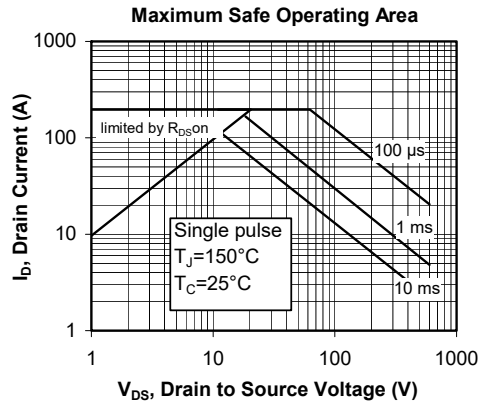
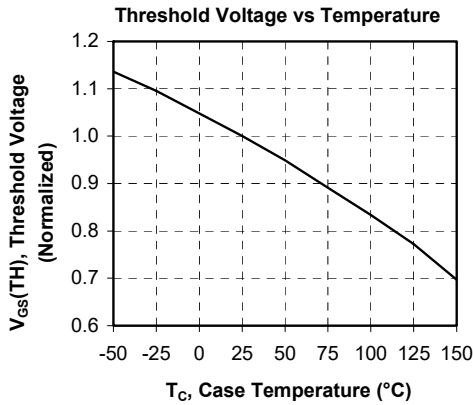
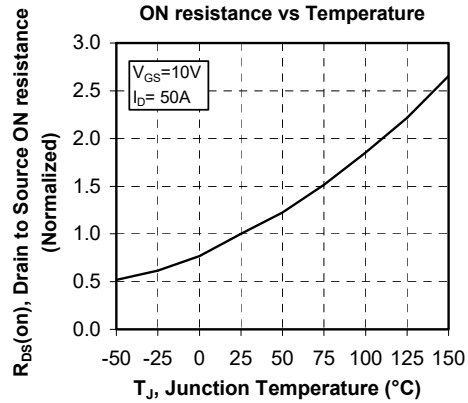
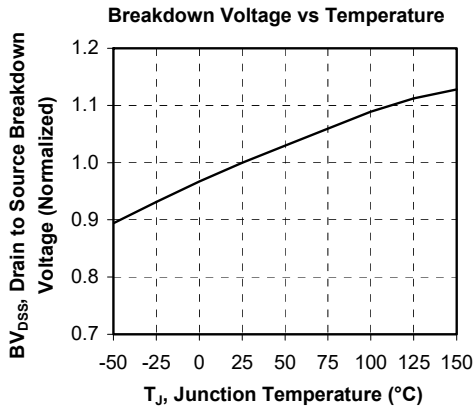
6.2 Top Fast diode typical performance curves

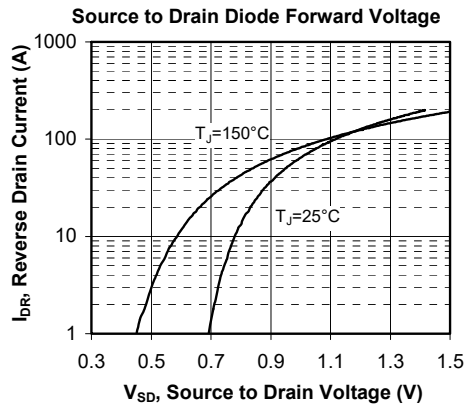
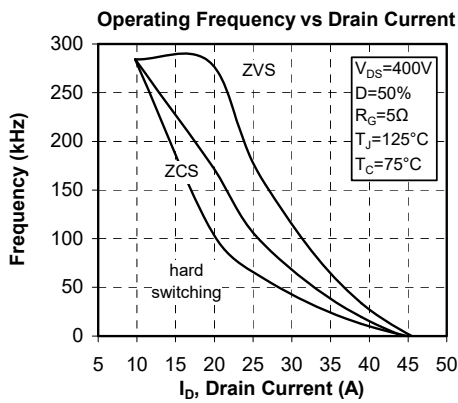
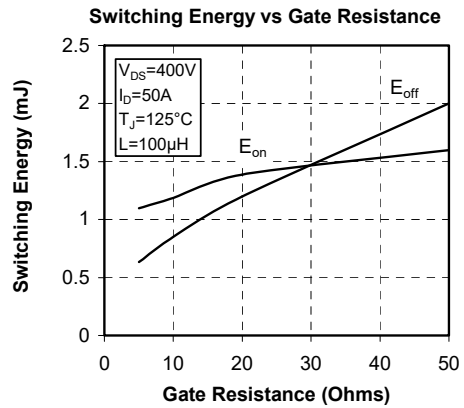
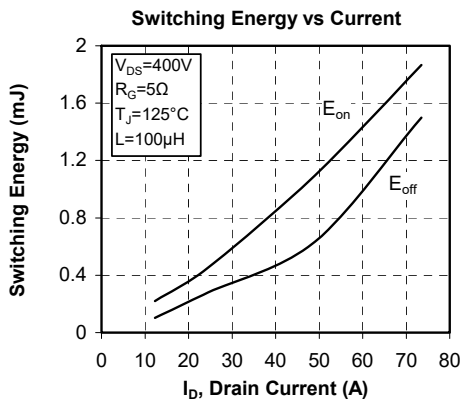
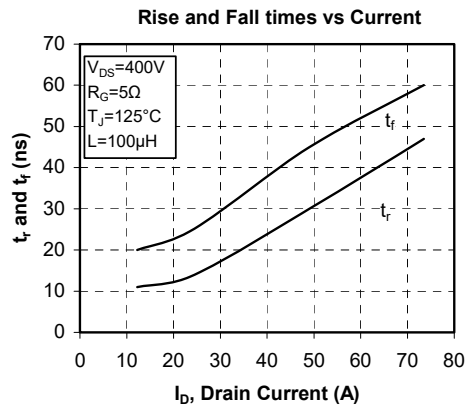
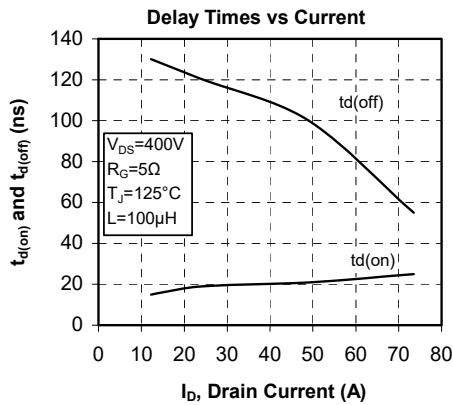


7. Bottom switches curves

7.1 Bottom Super junction MOSFET typical performance curves







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