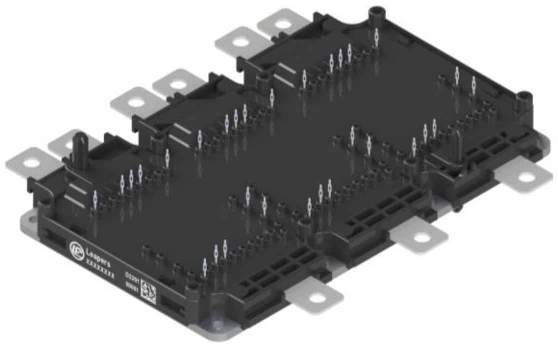
DFS01FB08HDB1

750V/800A 3 Phase SiC MOSFET Module

Description

The DFS01FB08HDB1 is a 3 Phase SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips for xEV or motor drives application.



Features

- Blocking voltage 750V
- $R_{DS(on)}$ =1.5mΩ (T_f =25°C)
- Arcbonding™ technology
- 175°C maximum junction temperature
- Si_3N_4 AMB substrate
- Direct Cooled Pin Fin Base Plate
- Thermistor inside
- Press FIT Contact Technology

Applications

- xEV Applications
- Motor Drives

Circuit diagram

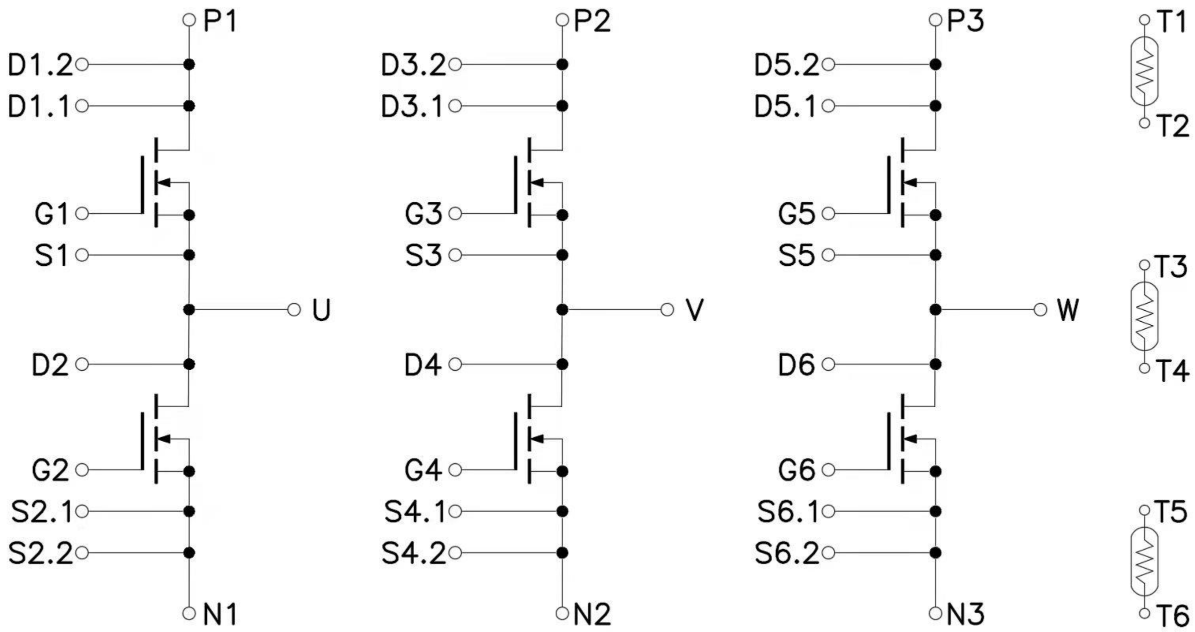


Figure 1. Out drawing & circuit diagram for DFS01FB08HDB1

Physical Dimensions

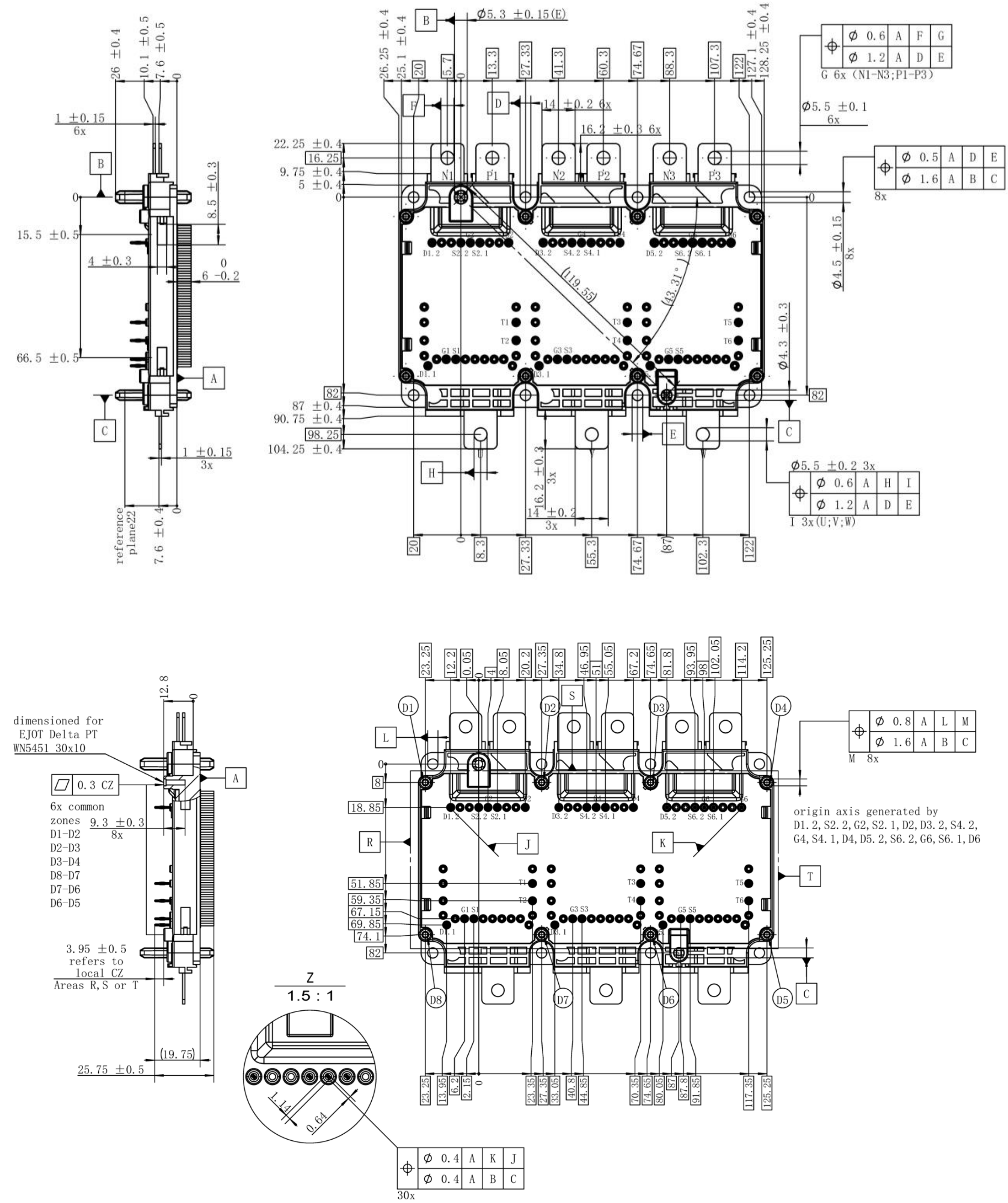


Figure2. Physical Dimensions

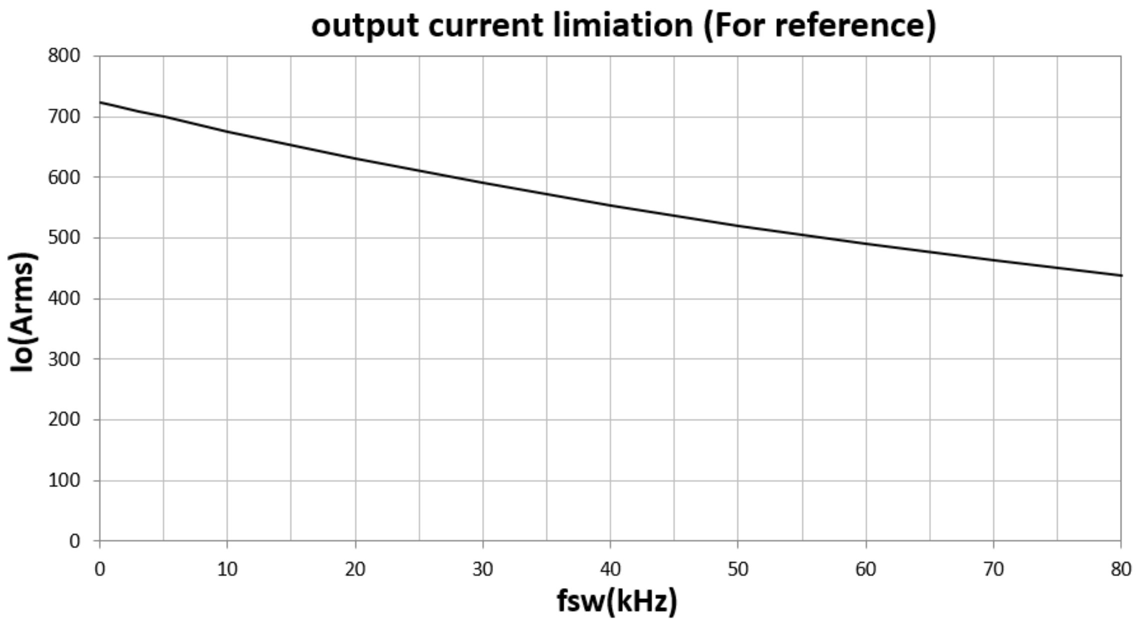
Maximum Ratings (T_j =25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	750	V
V_{GSS}	Maximum transient，gate-source Voltage	t < 10 hours over lifetime, t pulse < 1µs	-11/+23	V
	Continuous gate-source Voltage	-	-5/18	V
I_{DS}	DC Continuous Drain Current	T_f =65°C	520	A
I_{SD}	Source (Body Diode) Current	T_f =65°C, with ON signal	520	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note1	1600	A
P_D	Maximum Power Dissipation	T_f =25°C	1042	W
T_j	junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature.

Typical current output ability

Condition: SPWM control, V_{CC} =400V, R_g =5.1/3.3Ω, T_f =65°C, T_{jmax} =175°C, PF =0.8, Modulation rate =1



Note2: This graph is calculated value for reference based on the limitation of T_{jmax} =175°C. The actual current out ability depends on inverter electrical, thermal and mechanic design. Please confirm it in actual application system.

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =0Hz, t =1sec	4.2	kV
Material of module baseplate	-	Cu+Ni	-
Creepage distance	terminal to heatsink terminal to terminal	9	mm
Clearance	terminal to heatsink terminal to terminal	4.5	mm
Stray inductance module	T_f =65°C	8	nH
Module lead resistance, terminals – chip	T_f =65°C	0.2	mΩ
Mounting torque for module mounting	Screw M4 baseplate to heatsink	1.8 to 2.2	Nm
Weight	-	798	g

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_c =25°C	-	5	-	kΩ
ΔR/R	Deviation of R100	T_c =100°C, R_{100} =493Ω	-5	-	5	%
P_{25}	Power dissipation	T_c =25°C	-	-	20	mW
$B_{25/50}$	B-value	R2 =R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))]	-	3375	-	K
$B_{25/80}$	B-value	R2 =R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))]	-	3411	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3433	-	K

MOSFET Electrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =4mA		750	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS} =750V, V_{GS} =0V		-	-	100	μA
$V_{GS(th)}$	Gate-source threshold voltage	I_D =40mA,V_{DS} =V_{GS}		2.1	3.4	5.8	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V, T_j =25°C		-	-	10	μA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =800A V_{GS} =18V	T_j =25°C	1.0	1.5	2.0	mΩ
			T_j =175°C	1.8	2.8	3.8	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state voltage	I_D =800A V_{GS} =18V	T_j =25°C	0.8	1.2	1.6	V
			T_j =175°C	1.44	2.24	3.04	V
C_{iss}	Input capacitance	V_{DS} =500V V_{GS} =0V f =100KHz		-	24.9	-	nF
C_{oss}	Output capacitance			-	1.9	-	nF
C_{rss}	Reverse transfer capacitance			-	0.14	-	nF
Q_G	Total gate charge	V_{DD} =500V, I_D =500A, V_{GS} =+18/-5V		-	960	-	nC
$t_{d(on)}$	Turn-on delay time		T_j =25°C	-	219	-	ns
			T_j =150°C	-	187	-	ns

t_r	Rise time	V_{DD} =500V I_D =800A V_{GS} =-+18/-5V $R_{G(ON)}$ =5.1Ω $R_{G(OFF)}$ =3.3Ω Inductive load switching operation	T_j =25°C	-	78	-	ns
			T_j =150°C	-	68	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	135	-	ns
			T_j =150°C	-	155	-	
t_f	Fall time		T_j =25°C	-	25	-	ns
			T_j =150°C	-	48	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	18.5	-	mJ
			T_j =150°C	-	23.21	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	8.97	-	mJ
			T_j =150°C	-	9.92	-	
$R_{th(j-f)}$	FET Thermal Resistance	Junction to cooling fluid ΔV/Δt =10dm³/min, T_f =65°C		-	0.144	-	K/W

Body Diode Electrical characteristics (Tj =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-5V I_{SD} =800A	T_j =25°C	4.5	5.5	6.5	V
			T_j =175°C	4.0	4.9	5.8	
T_{rr}	Reverse recovery time	V_{DD} =500V I_D =800A V_{GS} = +18/-5V R_{Gon}/R_{Goff} =5.1/3.3Ω Inductive load switching operation	T_j =25°C	-	34	-	ns
			T_j =150°C	-	46	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	1.17	-	uC
			T_j =150°C	-	3.13	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.41	-	mJ
			T_j =150°C	-	1.24	-	

Test Conditions

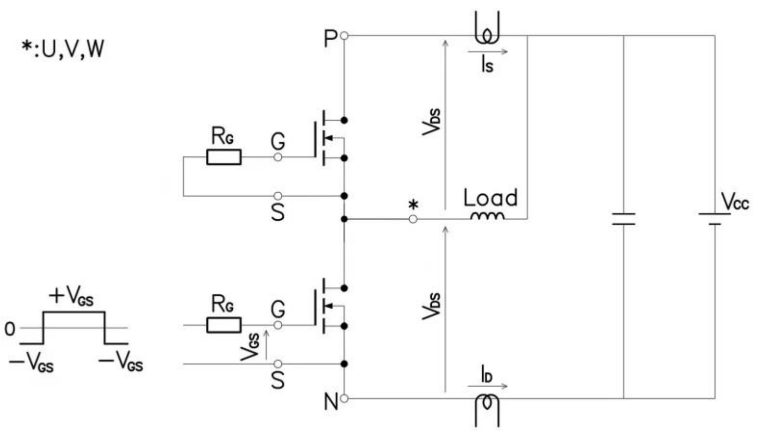


Figure 3. Switching time measure circuit

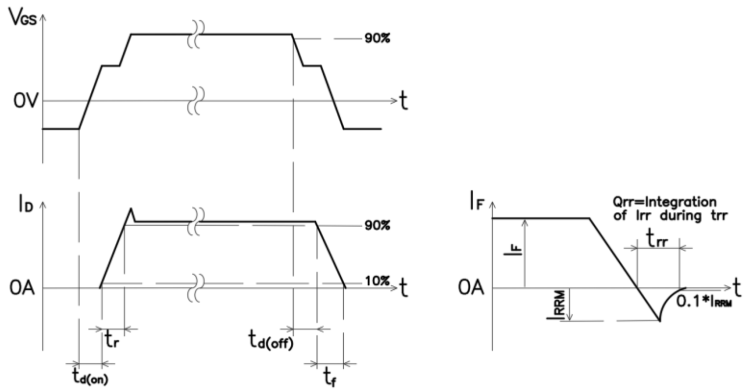


Figure 4. Switching time definition

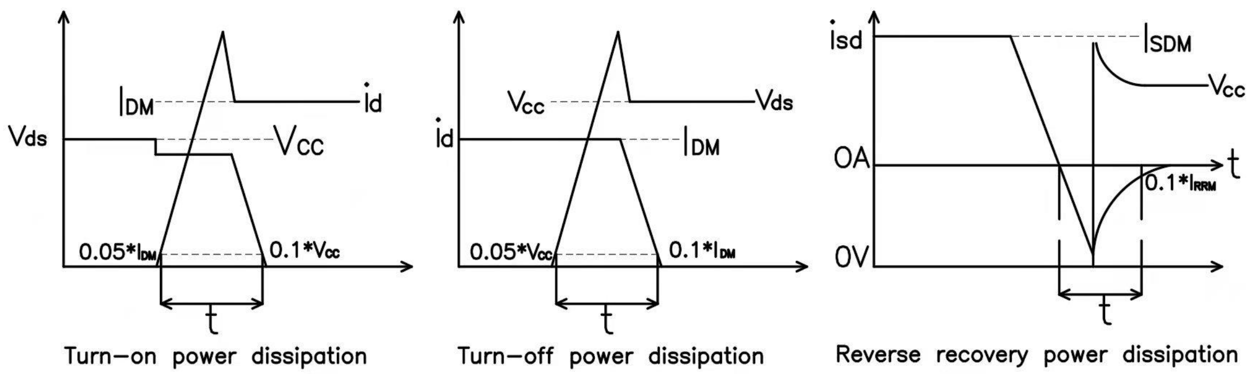


Figure 5. Switching power dissipation definition

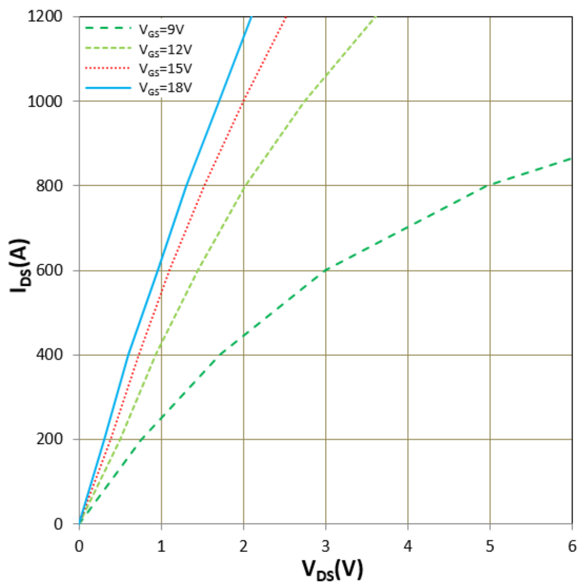
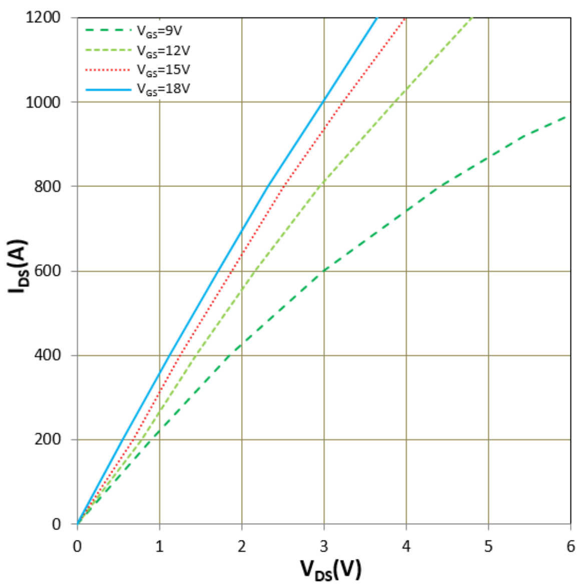
 	

Figure 6. I_{DS} vs V_{DS} T_j =25℃, V_{GS} parameter	Figure 7. I_{DS} vs V_{DS} T_j =175℃, V_{GS} parameter

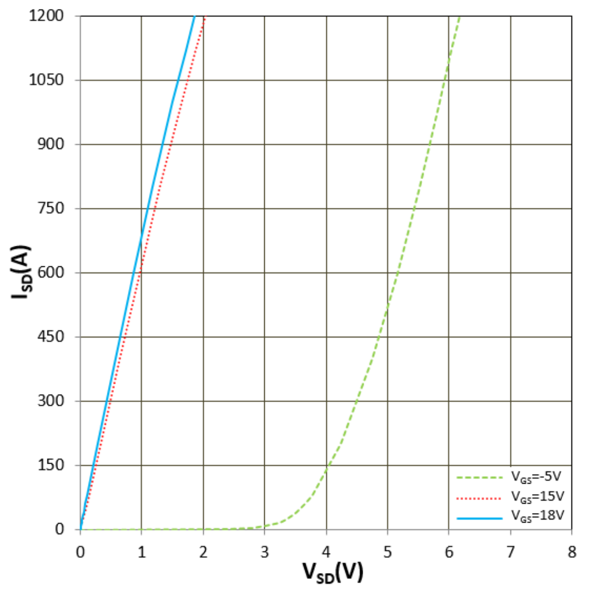


Figure 8. I_{SD} vs V_{SD}

T_j =25℃, V_{GS} parameter

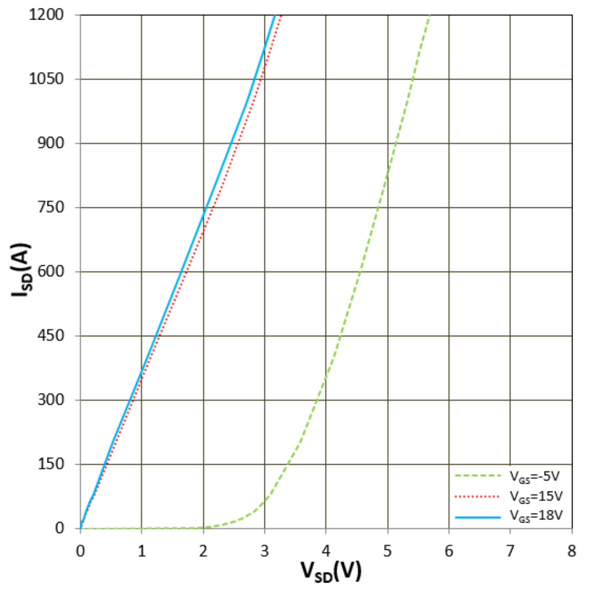


Figure 9. I_{SD} vs V_{SD}

T_j =175℃, V_{GS} parameter

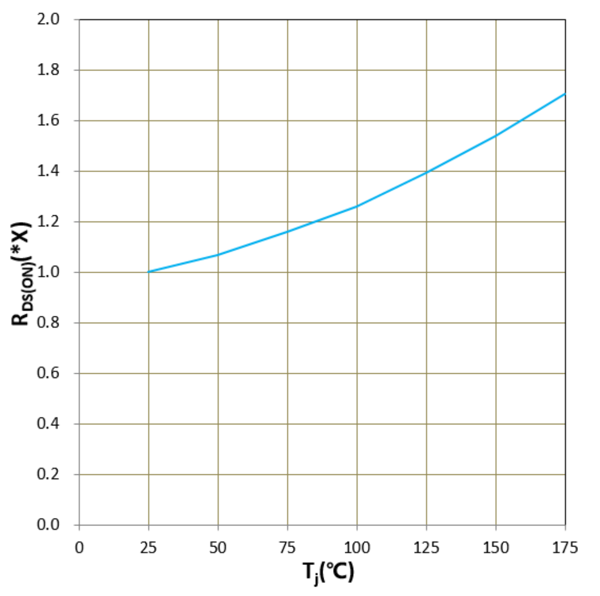


Figure 10. $R_{DS(ON)}$ vs T_j

V_{GS} =+15V, I_D =800A, 1.0x =1.73mΩ

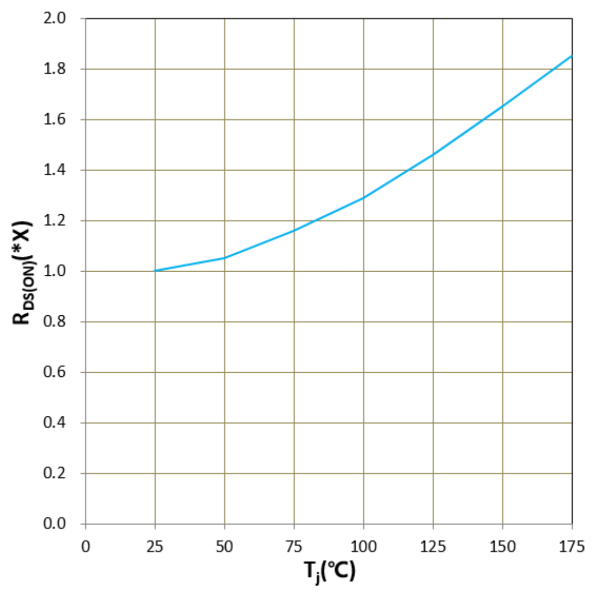


Figure 11. $R_{DS(ON)}$ vs T_j

V_{GS} =+18V, I_D =800A, 1.0x =1.5mΩ

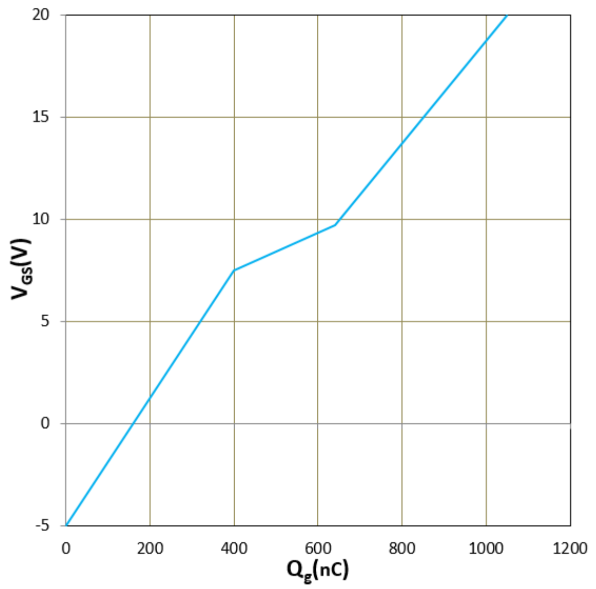


Figure 12. V_{GS} vs Q_g

T_j =25°C, V_{DS} =500V

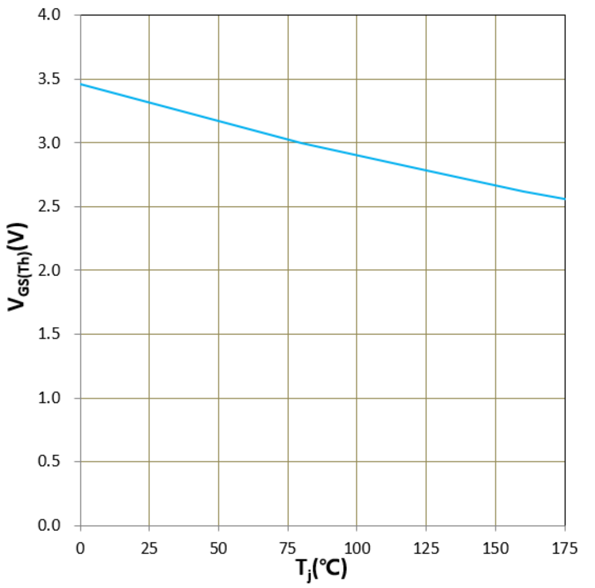


Figure 13. $V_{GS(TH)}$ vs T_j

V_{GS} =V_{DS}, I_D =40mA

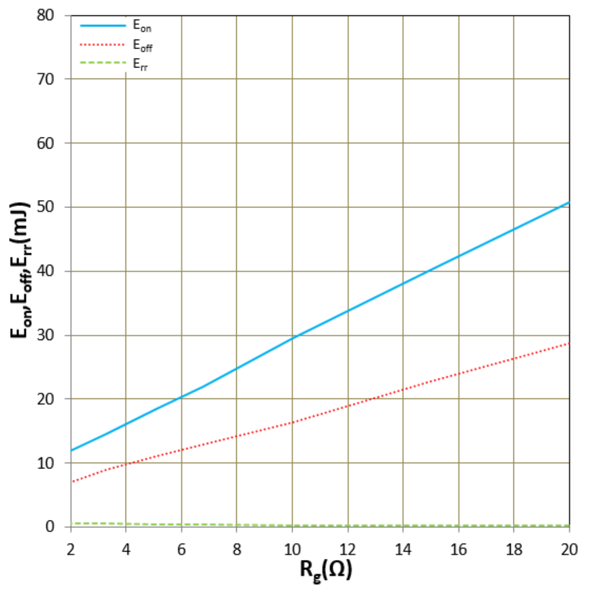


Figure 14. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{CC} =500V, I_D =800A, V_{GS} =+18V/-5V

Inductive Load

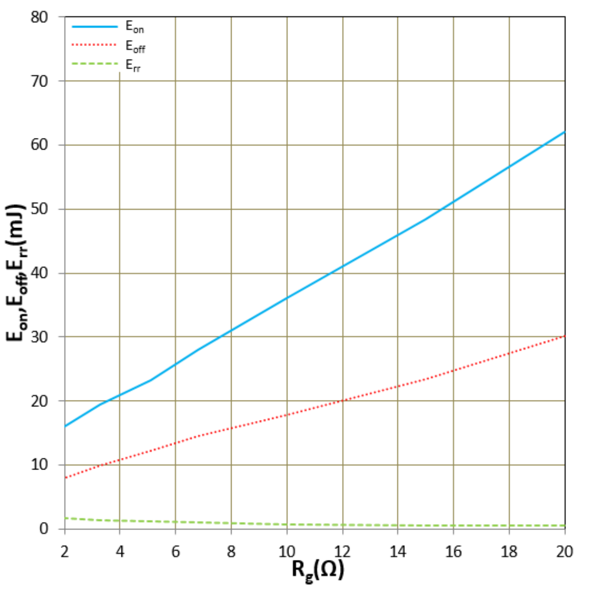


Figure 15. E_{on}, E_{off} , E_{rr} vs R_g

T_j =150°C, V_{CC} =500V, I_D =800A, V_{GS} =+18V/-5V

Inductive Load

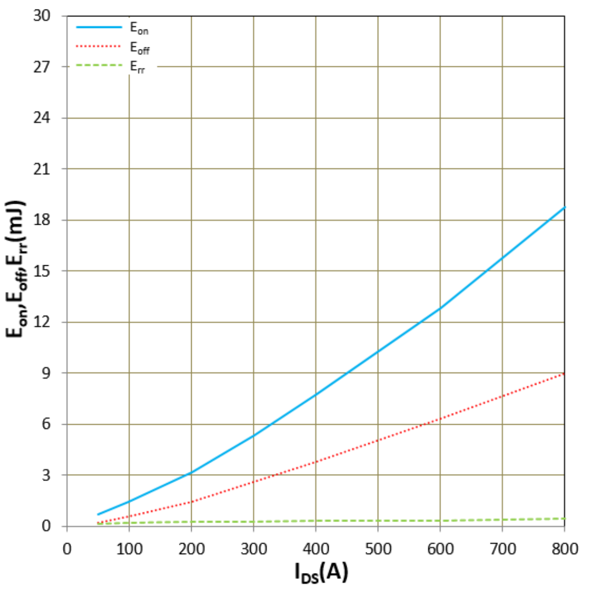


Figure 16. E_{on}, E_{off} , E_{rr} vs I_{DS}
T_j =25℃, V_{CC} =500V, R_G =5.1/3.3Ω
V_{GS} =+18V/-5V, Inductive Load

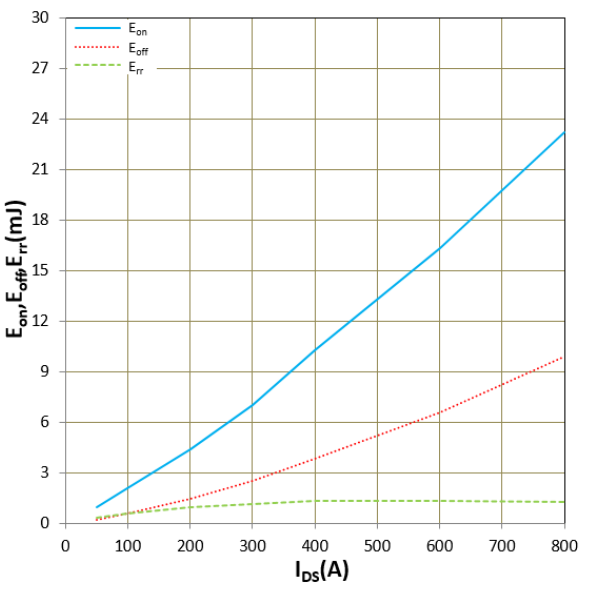


Figure 17. E_{on}, E_{off} , E_{rr} vs I_{DS}
T_j =150℃, V_{CC} =500V, R_G =5.1/3.3Ω
V_{GS} =+18V/-5V, Inductive Load

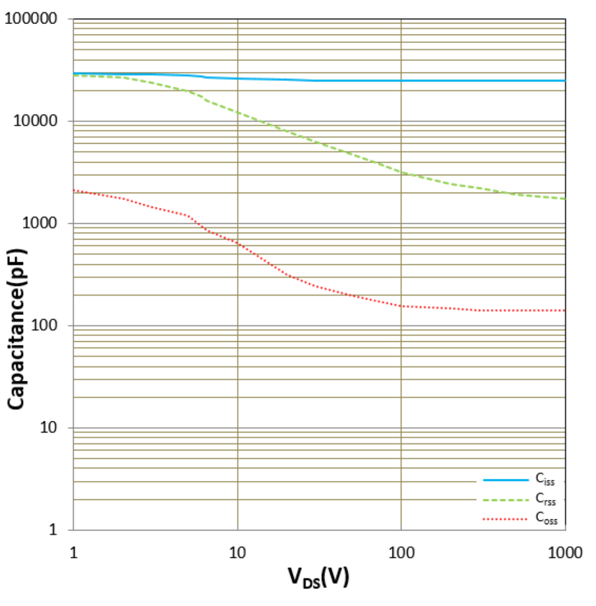


Figure 18. C_{iss},C_{oss},C_{rss} vs V_{DS}
T_j =25℃

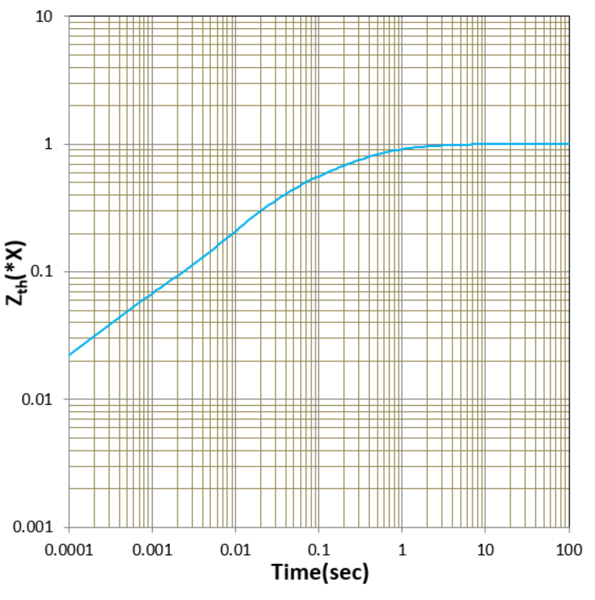


Figure 19. Transient themal impedance
1.0x =0.144K/W

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