DFS600HF12I5B3

1200V/600A Half Bridge SiC MOSFET Module

Description

The DFS600HF12I5B3 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Motor drives and Renewable energy.

Features

- 1200V/2.2mΩ
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside
- Pressfit terminal

Applications

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Smart-Grid / Grid-Tied Distributed Generation

Circuit diagram

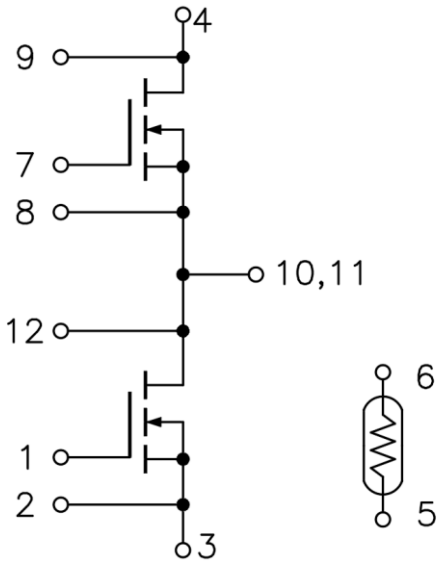

Figure 1. Out drawing & circuit diagram for DFS600HF12I5B3

Pin Configuration and Marking Information

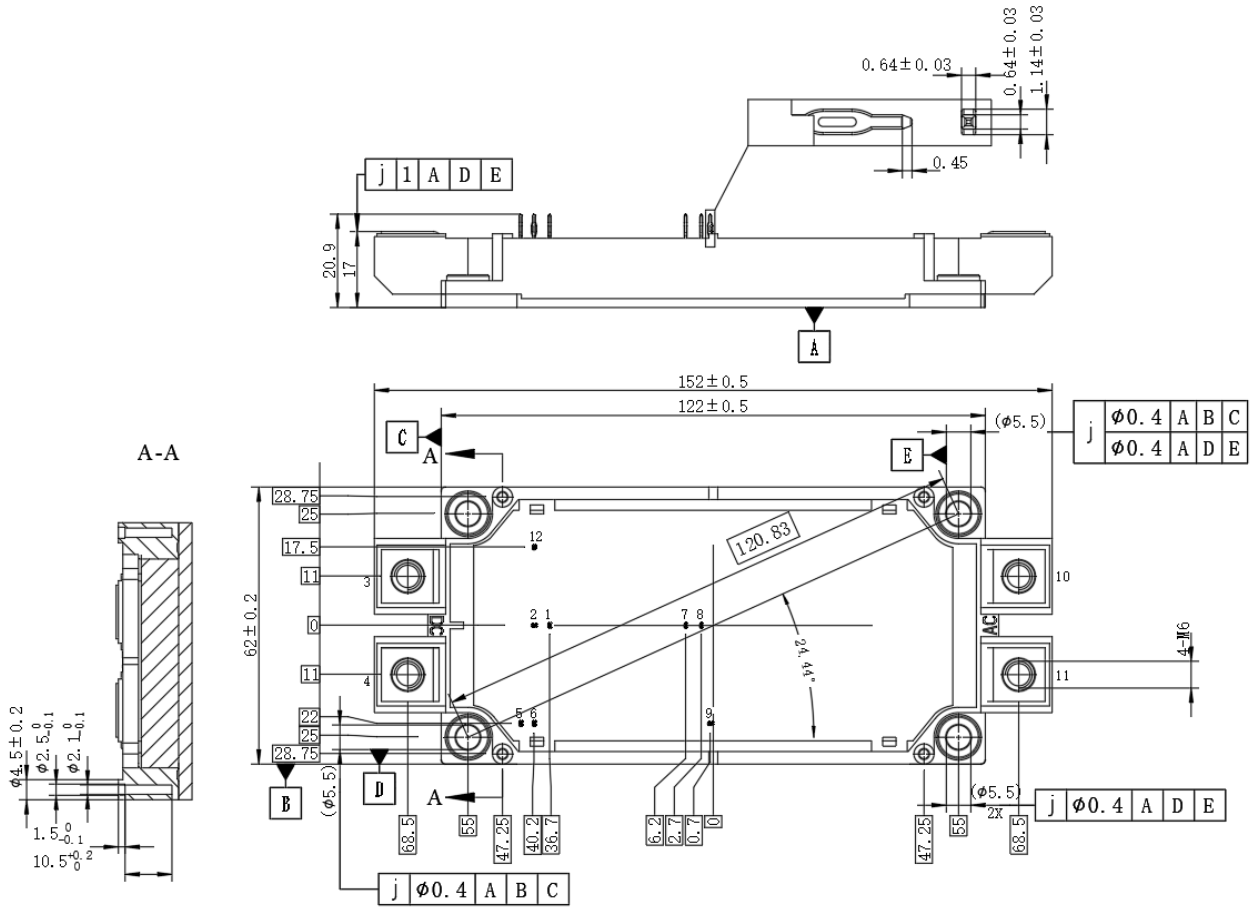

Figure2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =50Hz, t =1min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
Module lead resistance, terminals – chip	T_C =25°C	0.2	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	350	g

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Sourse Voltage	D-S Short, AC frequency ⩾1Hz, Note1	-11 to 23	V
I_{DS}	DC Continuous Drain Current	T_C =25°C , V_{GS} =18V	680	A
I_{DS}	DC Continuous Drain Current	T_C =85°C , V_{GS} =18V	525	A
I_{SD}	Source (Body diode) Current	T_C =25°C, with ON signal	680	A
I_{SD}	Source (Body diode) Current	T_C =85°C, with ON signal	525	A
I_{DSM}	Pulse Drain Current	T_C =85°C, Pulse width =1ms, V_{GS} =18V, Note2	1200	A
P_{tot}	Total Power Dissipation	T_C =25°C	2500	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, -4V/+15V, -5V/+18V

Note2: Pulse width limited by maximum junction temperature

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 =6mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS} =1200V, V_{GS} =0V		-	-	60	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D =60mA, V_{DS} =V_{GS}	T_j =25°C	2.1	3.2	5.8	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V	T_j =25°C	-	-	600	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =600A, V_{GS} =18V	T_j =25°C	1.5	2.2	3.1	mΩ
			T_j =175°C	3.5	5.4	7.2	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =600A, V_{GS} =18V	T_j =25°C	9.0	1.32	1.86	V
			T_j =175°C	2.1	3.24	4.32	V
C_{iss}	Input Capacitance	V_D =850V, V_{GS} =0V, f =1MHz		-	24	-	nF
C_{oss}	Output Capacitance			-	1.84	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.132	-	nF
Q_g	Total gate charge	V_{DD} =850V, I_D =600A, V_{GS} =-5/+18V		-	1140	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD} =600V I_D =600A V_{GS} =+15/-4V $R_{G(on)}$ =5.1Ω $R_{G(off)}$ =3.3Ω Inductive load switching operation	T_j =25°C	-	140	-	ns
			T_j =150°C	-	119	-	
t_r	Rise time		T_j =25°C	-	104	-	ns
			T_j =150°C	-	89	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	278	-	ns
			T_j =150°C	-	302	-	
t_f	Fall time		T_j =25°C	-	67	-	ns
			T_j =150°C	-	89	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	29.6	-	mJ
			T_j =150°C	-	24.2	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	27.2	-	mJ
			T_j =150°C	-	28.9	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.06	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note3		-	0.015	-	K/W

Note3: Assumes Thermal Conductivity of grease is 0.9W/m・K and thickness is 50um.

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-4V I_{SD} =600A	T_j =25°C	3.9	4.9	5.6	V
			T_j =175°C	3.1	4.2	5.2	
T_{rr}	Reverse recovery time	V_{DD} =600V, I_D =400A V_{GS} =-4/+15V $R_{g(on)}$ =5.1Ω $R_{g(off)}$ =3.3Ω Inductive load switching operation	T_j =25°C	-	39	-	ns
			T_j =150°C	-	56	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	2.12	-	μC
			T_j =150°C	-	5.48	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.55	-	mJ
			T_j =150°C	-	1.72	-	

Test Conditions

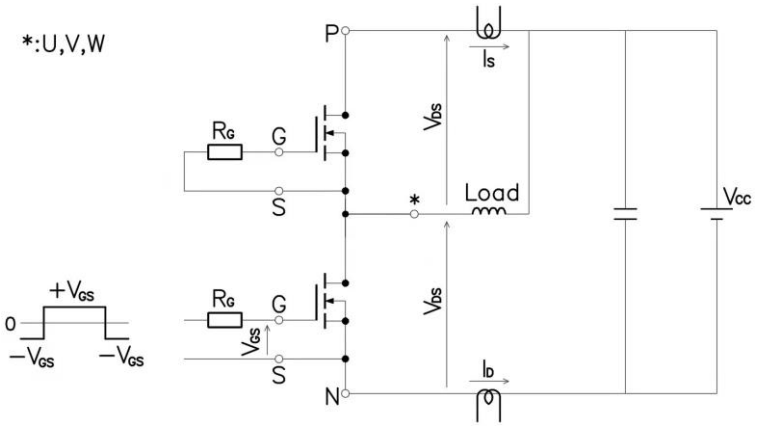

Figure 3. Switching time measure circuit

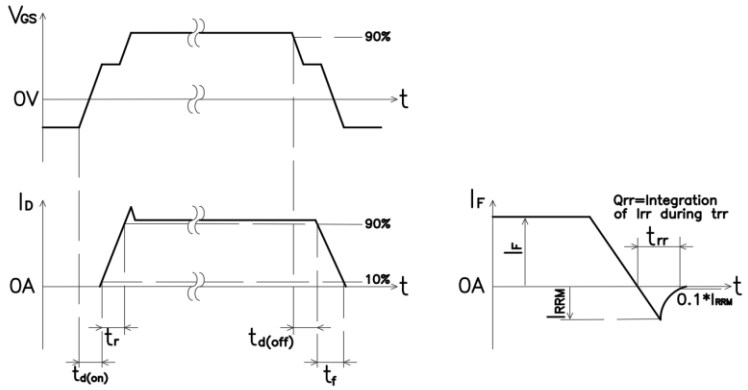

Figure 4. Switching time definition

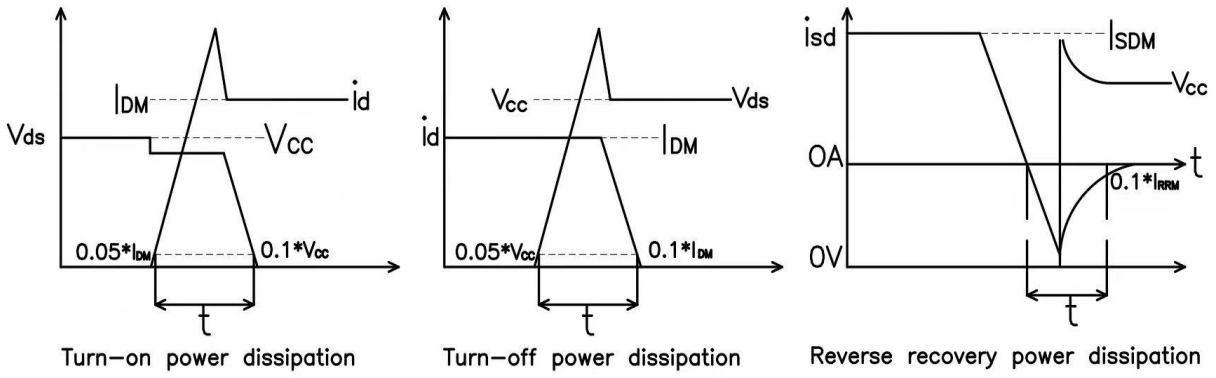

Figure 5. Switching power dissipation definition

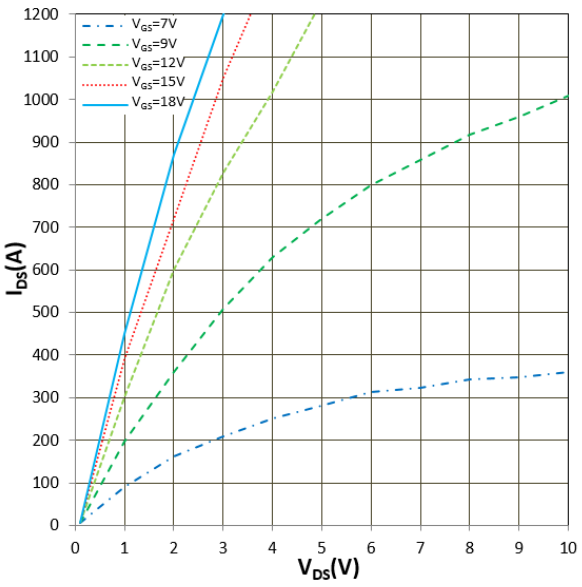

Figure 6. I_{DS} vs V_{DS}
T_j =25℃

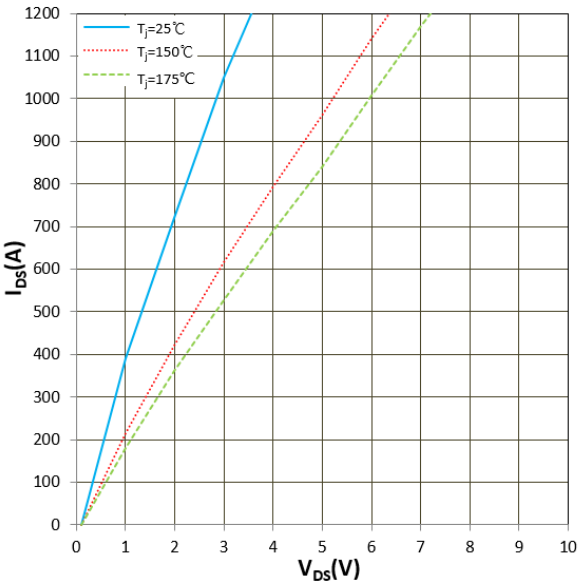

Figure 7. I_{DS} vs V_{DS}
V_{GS} =15V

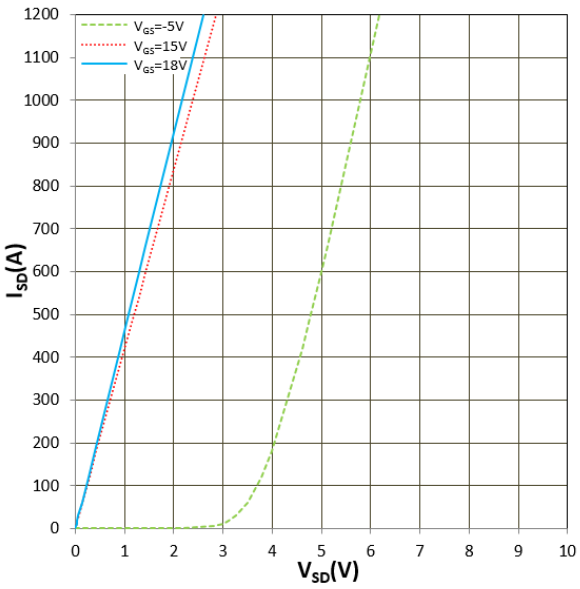

Figure 8. I_{SD} vs V_{SD}
T_j =25℃

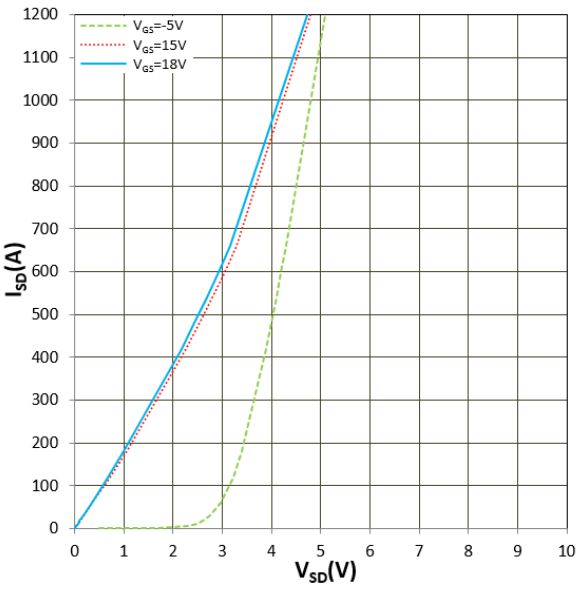

Figure 9. I_{SD} vs V_{SD}
T_j =150℃,

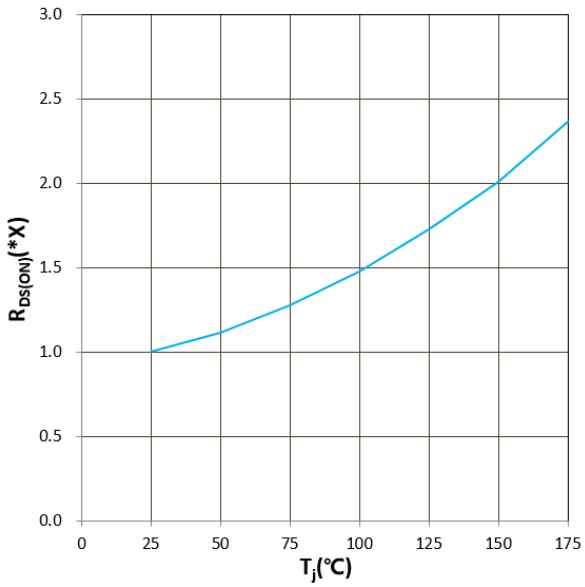

Figure 10. $R_{DS(ON)}$ vs T_j
V_{GS} =+18V, I_D =600A, 1.0X =2.2mΩ

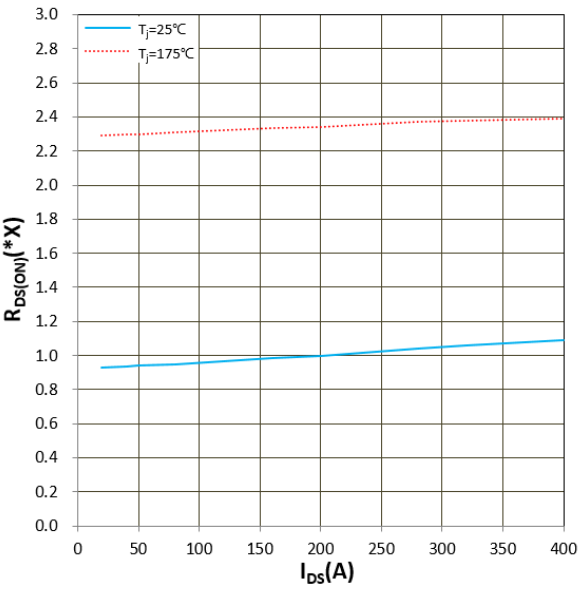

Figure 11. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V, I_D =600A, 1.0X =2.2mΩ

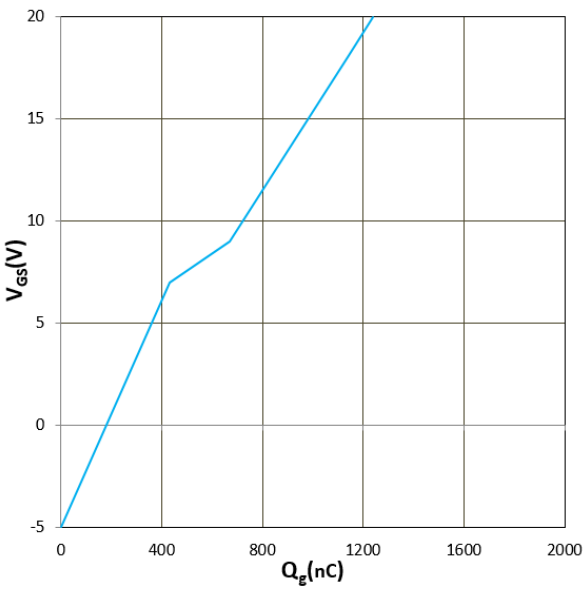

Figure 12. V_{GS} vs Q_g
T_j =25℃, I_{GS} =6mA

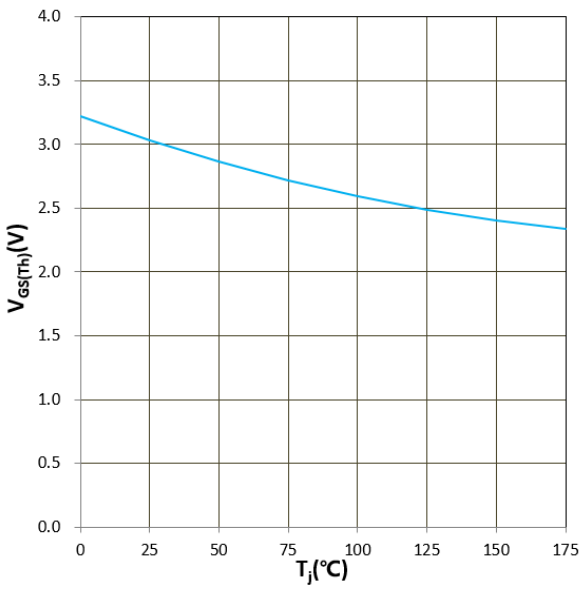

Figure 13. $V_{GS(TH)}$ vs T_j
V_{GS} =V_{DS}, I_D =60mA

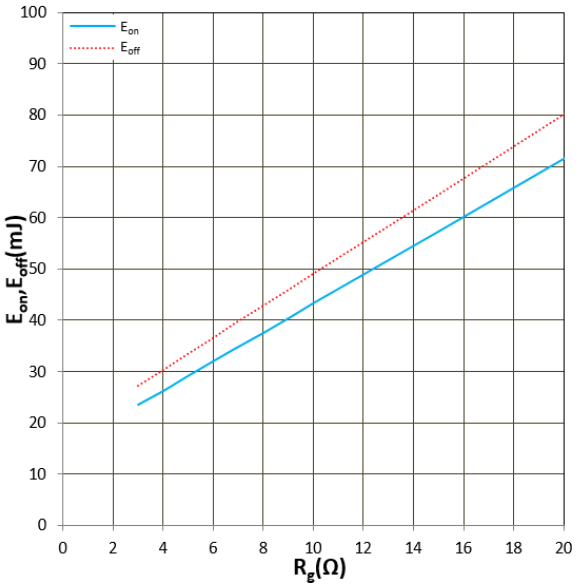

Figure 14. E_{on}, E_{off} vs R_g
T_j =25°C, V_{CC} =600V, V_{GS} =+15V/-4V, I_D =600A
Inductive Load

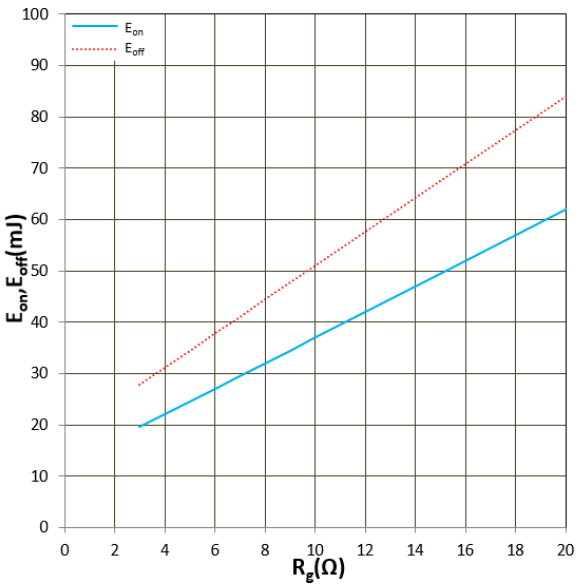

Figure 15. E_{on}, E_{off} vs R_g
T_j =150°C, V_{CC} =600V, V_{GS} =+15V/-4V, I_D =600A
Inductive Load

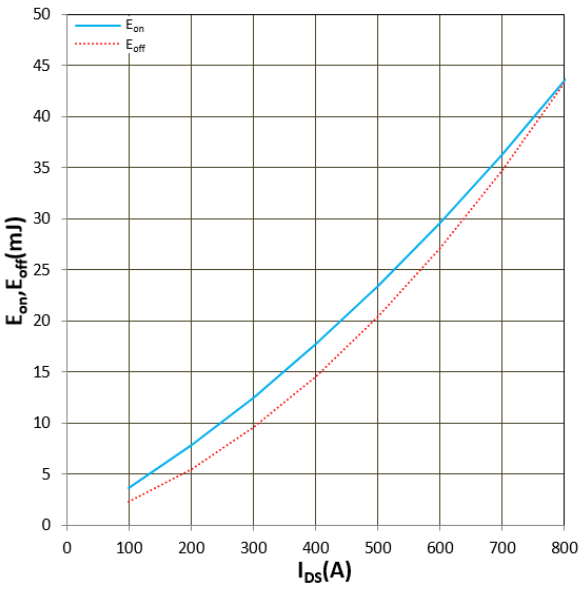

Figure 16. E_{on}, E_{off} vs I_{DS}
T_j =25°C, V_{CC} =600V, V_{GS} =+15V/-4V
$R_{g(on)}$ =5.1Ω, $R_{g(off)}$ =3.3Ω, Inductive Load

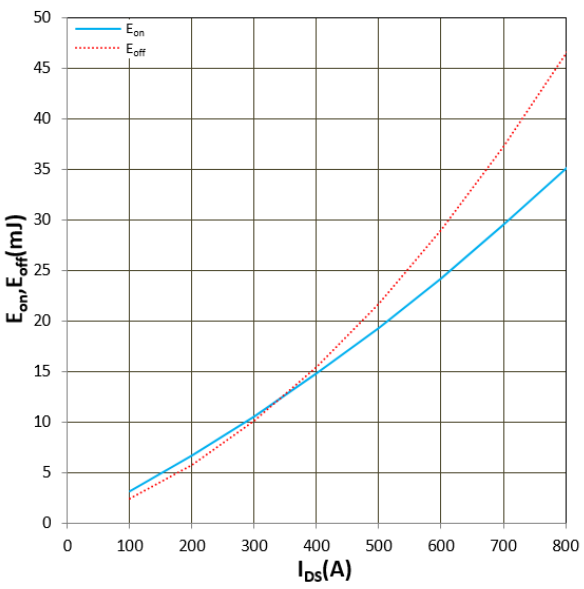

Figure 17. E_{on}, E_{off} vs I_{DS}
T_j =150°C, V_{CC} =600V, V_{GS} =+15V/-4V
$R_{g(on)}$ =5.1Ω, $R_{g(off)}$ =3.3Ω, Inductive Load

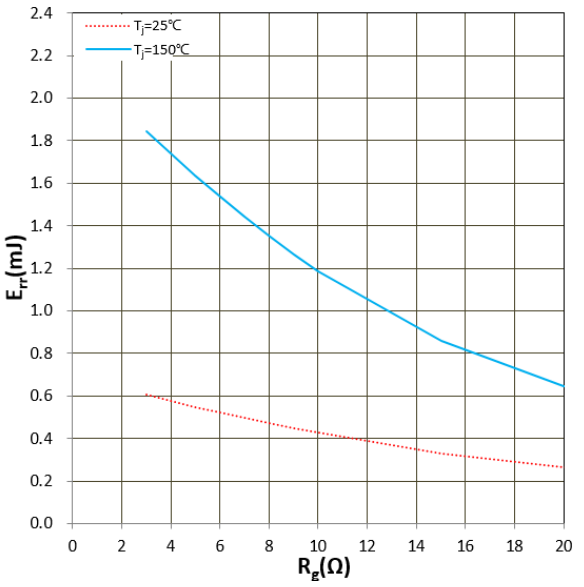

Figure 18. E_{rr} vs R_G
V_{DD} =600V, I_F =600A, V_{GS} =+15V/-4V
Inductive Load

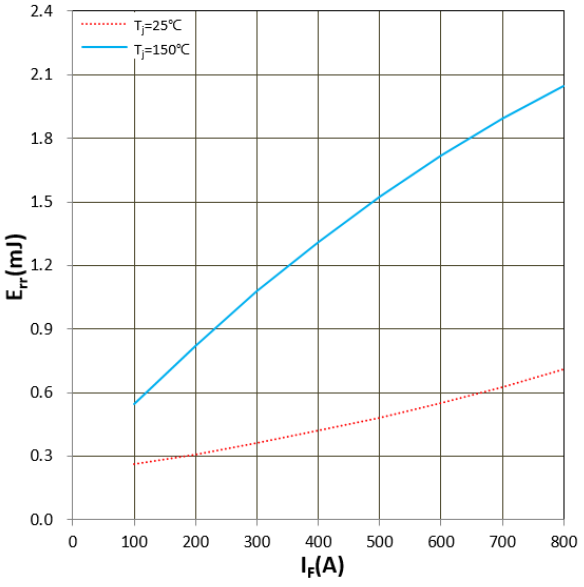

Figure 19. E_{rr} vs I_F
V_{DD} =600V, $R_{g(on)}$ =5.1Ω, $R_{g(off)}$ =3.3Ω
V_{GS} =+15V/-4V, Inductive Load

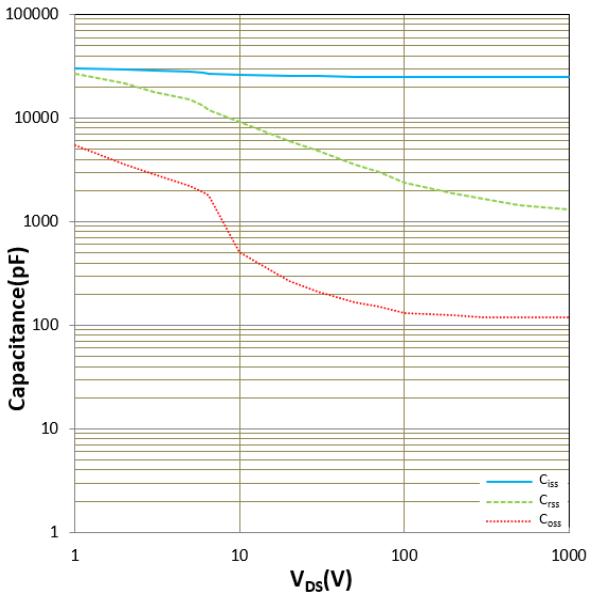

Figure 20. C_{ies},C_{oss},C_{rss} vs V_{DS}
T_j =25℃

IMPORTANT NOTICE：

This product data sheet describes the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively under the terms and conditions of the supply agreement. There will be no guarantee or of any kind for the product and its characteristics.

The data contained in this document is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the product's suitability for the intended application and the completeness of the product data concerning such application.

Due to technical requirements, our product may contain dangerous substances. For information on the types in question, please contact the sales staff responsible for you.

For further information on the product, technology, delivery terms and conditions and prices please contact the sales staff (Sales@leapers-power.com).

Changes of this product data sheet are reserved.