

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 Si₃N₄ 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

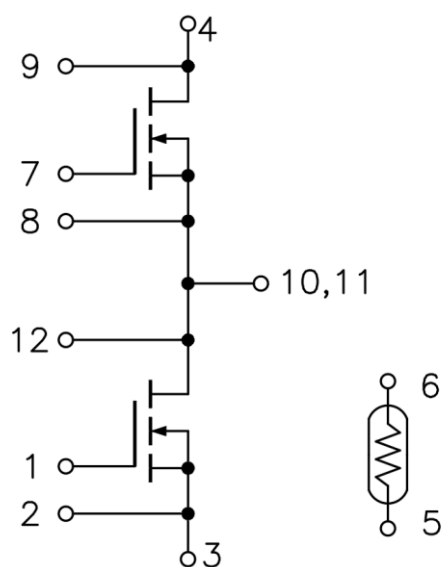


Figure 1. Out drawing & circuit diagram for DFS600HF12I5B3

Pin Configuration and Marking Information

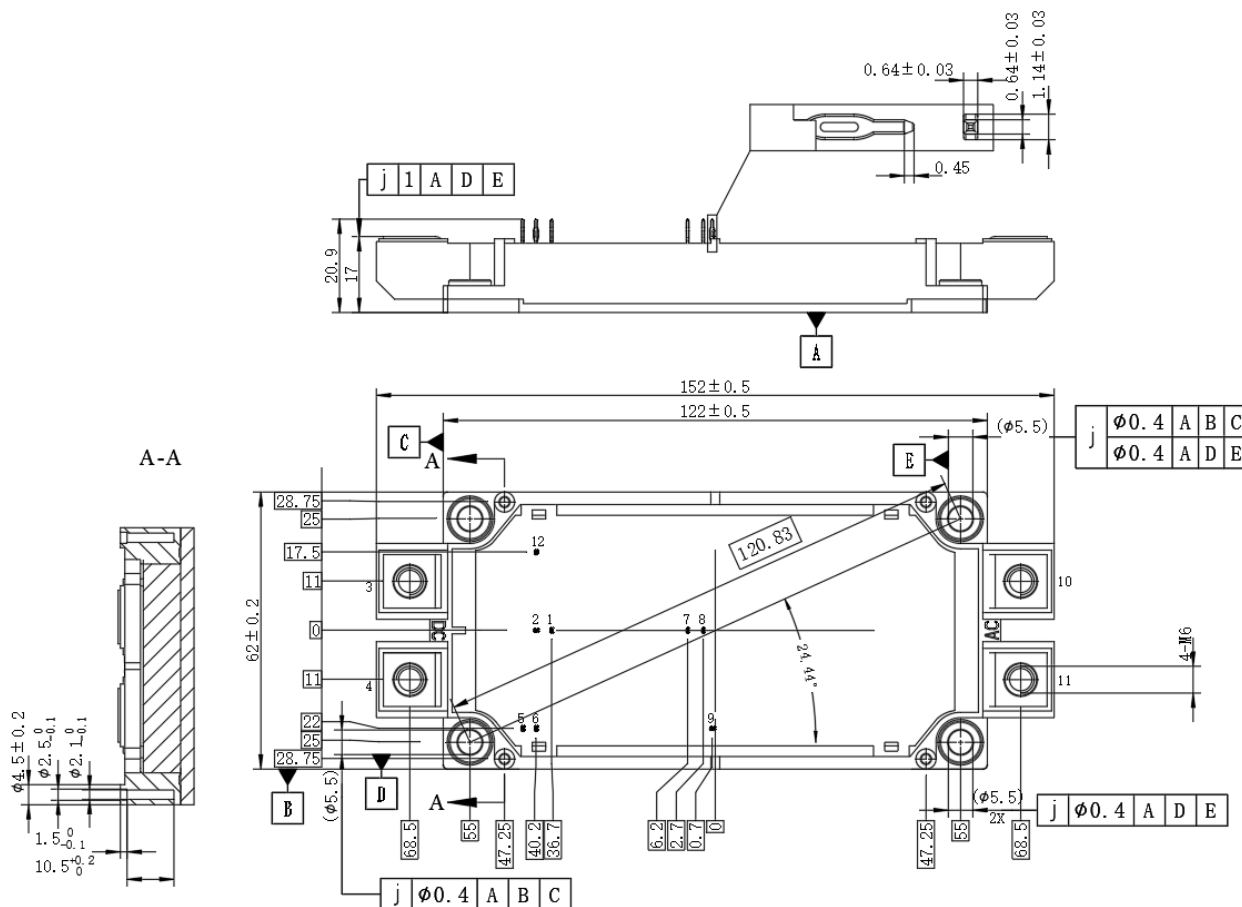


Figure2. Pin configuration

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 ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DS}	Drain-Source Voltage	G-S Short	1200	V
V_{GS}	Gate-Source Voltage	D-S Short, AC frequency $\geq 1\text{Hz}$, Note1	-11 to 23	V
I_{DS}	DC Continuous Drain Current	$T_C = 25^\circ\text{C}$, $V_{GS} = 18\text{V}$	680	A
I_{DS}	DC Continuous Drain Current	$T_C = 85^\circ\text{C}$, $V_{GS} = 18\text{V}$	525	A
I_{SD}	Source (Body diode) Current	$T_C = 25^\circ\text{C}$, with ON signal	680	A
I_{SD}	Source (Body diode) Current	$T_C = 85^\circ\text{C}$, with ON signal	525	A
I_{DSM}	Pulse Drain Current	$T_C = 85^\circ\text{C}$, Pulse width = 1ms, $V_{GS} = 18\text{V}$, Note2	1200	A
P_{tot}	Total Power Dissipation	$T_C = 25^\circ\text{C}$	2500	W
T_{jmax}	Max Junction Temperature	-	175	$^\circ\text{C}$
T_{jop}	Operating junction Temperature	-	-40 to 150	$^\circ\text{C}$
T_{stg}	Storage Temperature	-	-40 to 125	$^\circ\text{C}$

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	$T_C = 25^\circ\text{C}$	-	5	-	$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C = 100^\circ\text{C}$, $R_{100} = 493\Omega$	5	-	5	%
P_{25}	Power dissipation	$T_C = 25^\circ\text{C}$	-	-	20	mW
$B_{25/50}$	B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	K
$B_{25/80}$	B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3411	-	K
$B_{25/100}$	B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	-	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	I _D =600A	T _j =25°C	1.5	2.2	3.1	mΩ
	On-state resistance	V _{GS} =18V	T _j =175°C	3.5	5.4	7.2	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =600A	T _j =25°C	9.0	1.32	1.86	V
	On-state Voltage	V _{GS} =18V	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 50μm.

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
			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	T _j =25°C	-	39	-
			T _j =150°C	-	56	-
Q _{rr}	Reverse recovery charge	R _{g(on)} =5.1Ω R _{g(off)} =3.3Ω	T _j =25°C	-	2.12	-
			T _j =150°C	-	5.48	-
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j =25°C	-	0.55	-
			T _j =150°C	-	1.72	-

Test Conditions

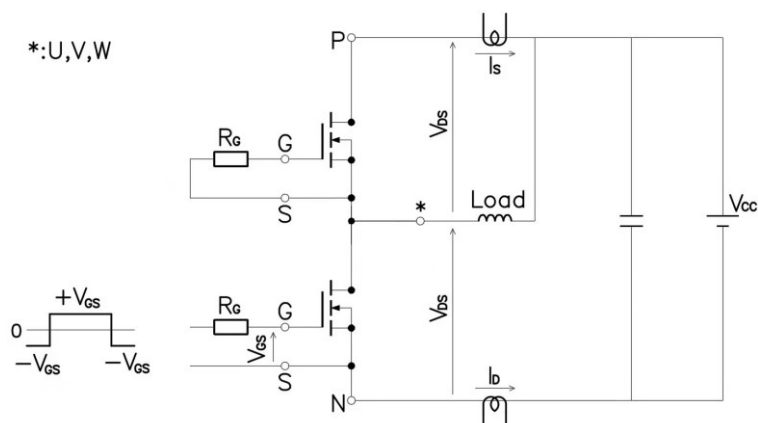


Figure 3. Switching time measure circuit

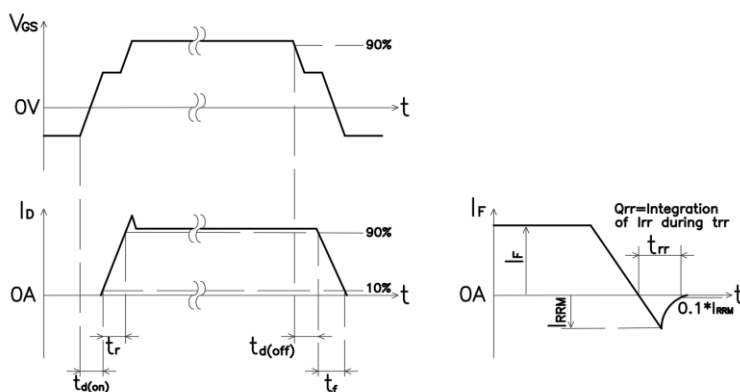


Figure 4. Switching time definition

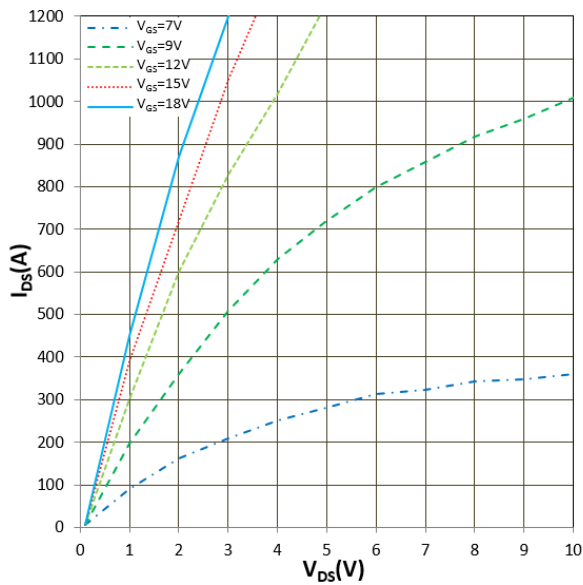


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

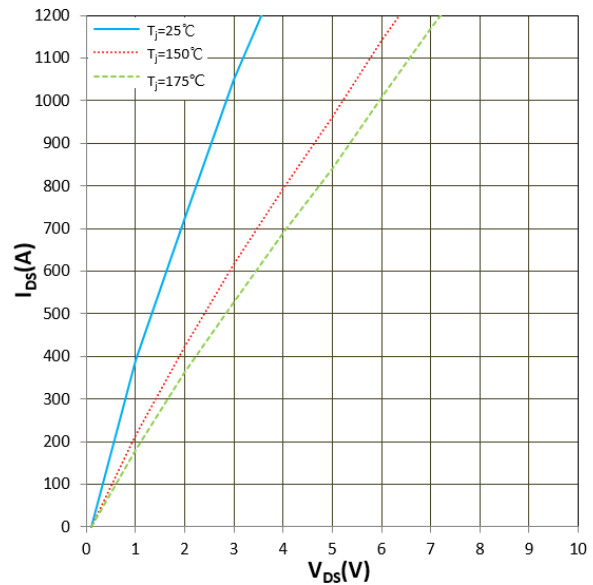


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$

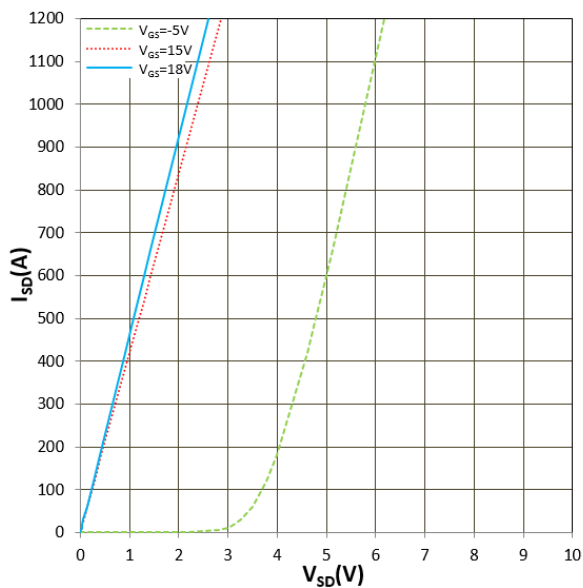


Figure 7. I_{SD} vs V_{SD}
 $T_j = 25^\circ\text{C}$

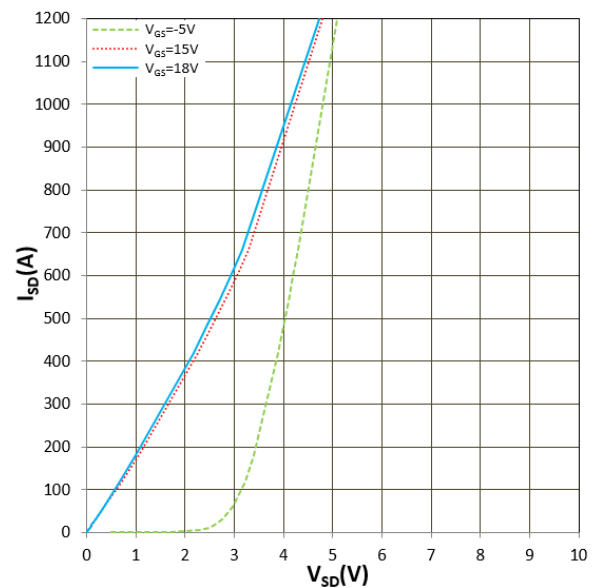


Figure 8. I_{SD} vs V_{SD}
 $T_j = 150^\circ\text{C}$,

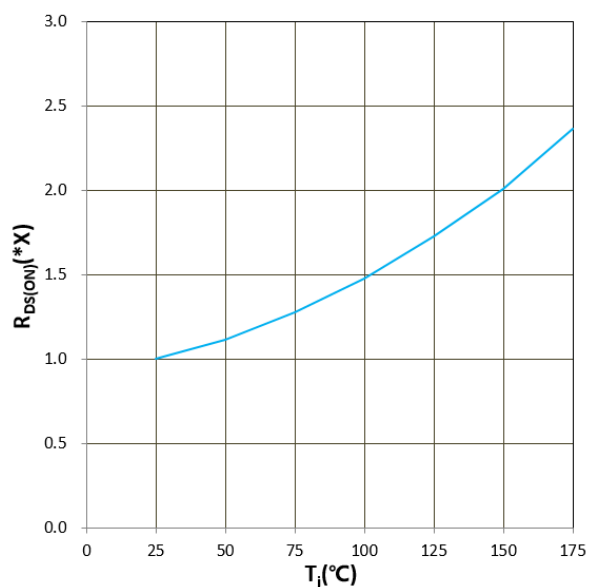


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +18V$, $I_D = 600A$, $1.0X = 2.2m\Omega$

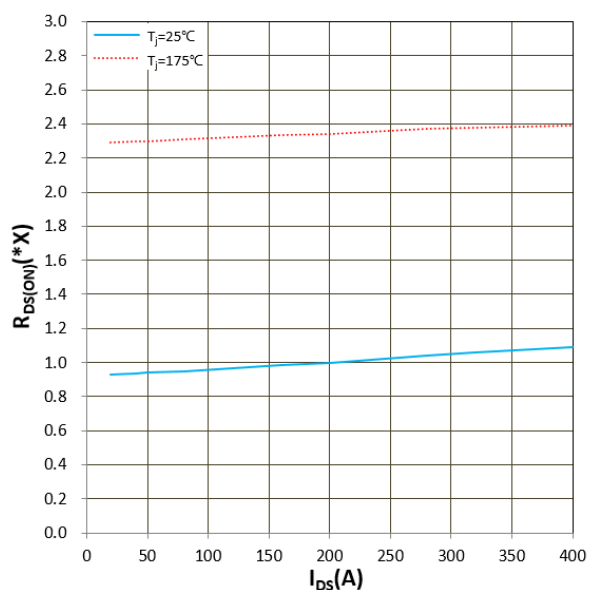


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +18V$, $I_D = 600A$, $1.0X = 2.2m\Omega$

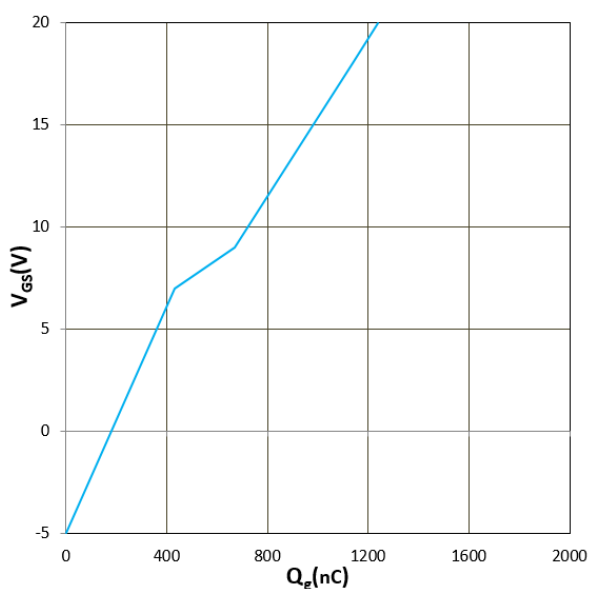


Figure 11. V_{GS} vs Q_g
 $T_j = 25^\circ C$, $I_{GS} = 6mA$

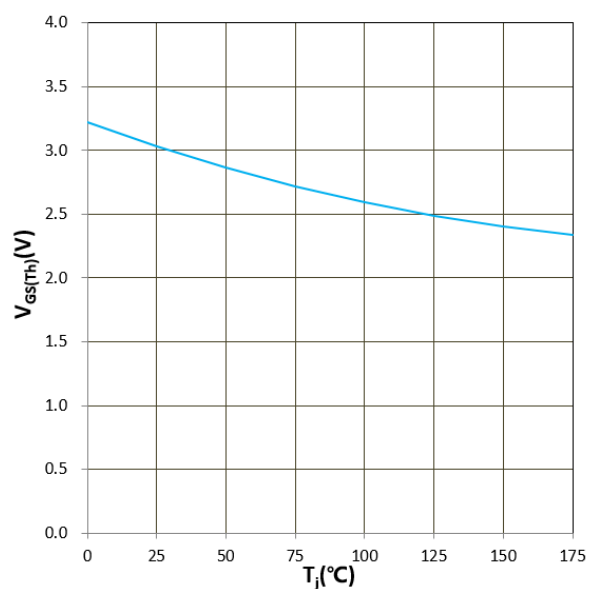


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 60mA$

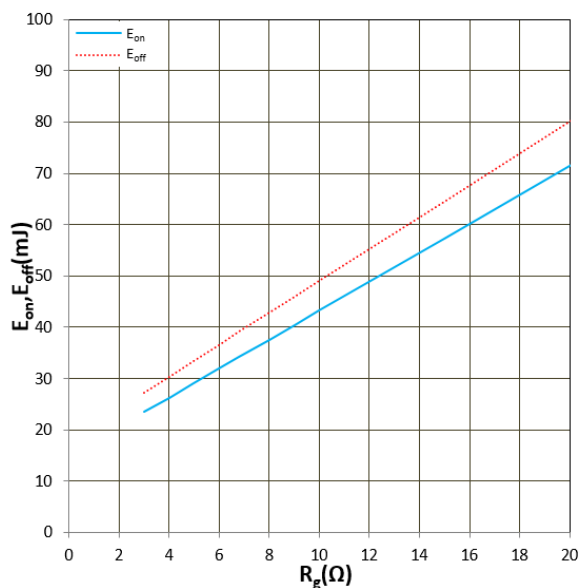


Figure 13. E_{on}, E_{off} vs R_g
T_j=25°C, V_{CC}=600V, V_{GS}=+15V/-4V, I_D=600A
Inductive Load

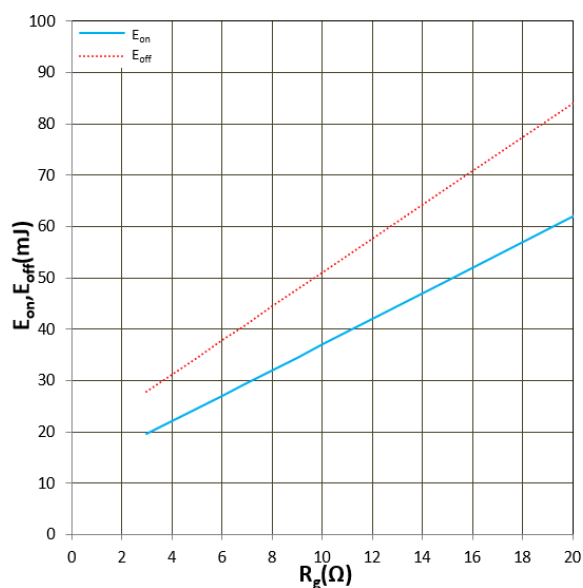


Figure 14. E_{on}, E_{off} vs R_g
T_j=150°C, V_{CC}=600V, V_{GS}=+15V/-4V, I_D=600A
Inductive Load

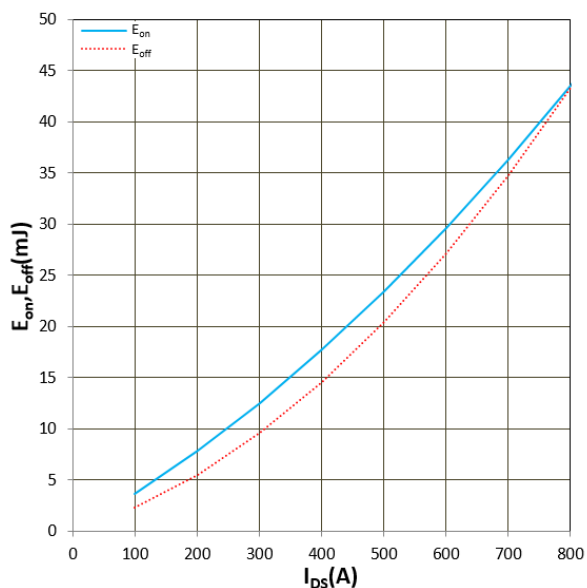


Figure 15. E_{on}, E_{off} vs I_{DS}
T_j=25°C, V_{CC}=600V, V_{GS}=+15V/-4V
R_{g(on)}=5.1Ω, R_{g(off)}=3.3Ω, Inductive Load

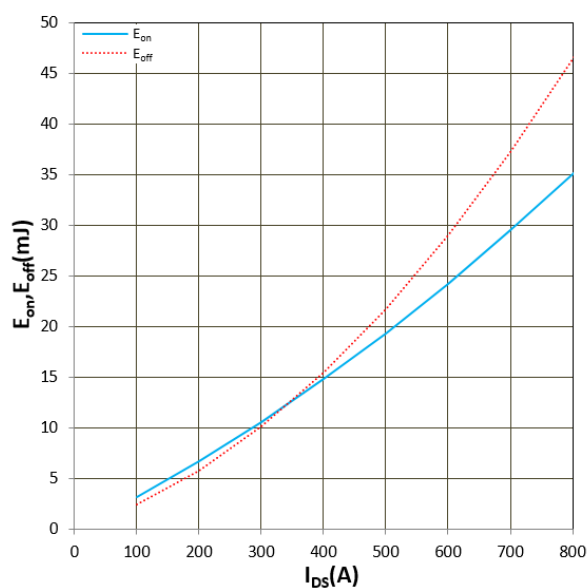
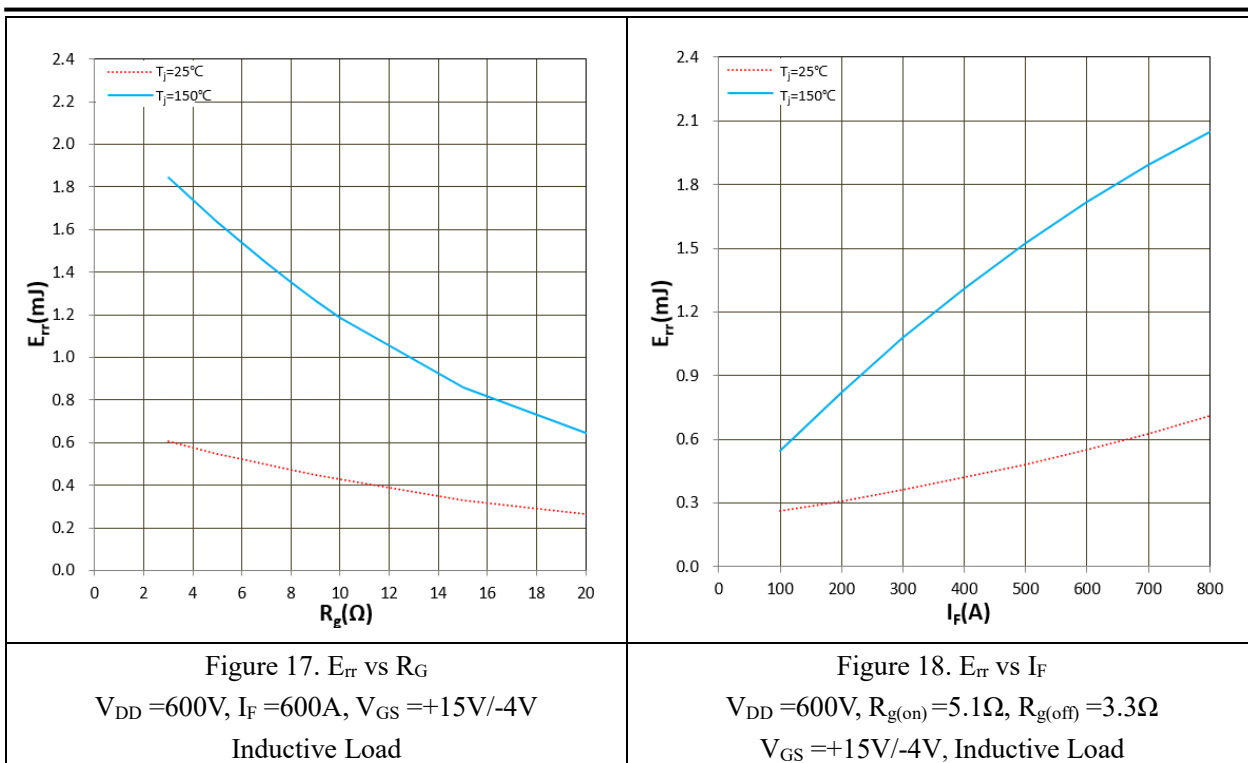


Figure 16. E_{on}, E_{off} vs I_{DS}
T_j=150°C, V_{CC}=600V, V_{GS}=+15V/-4V
R_{g(on)}=5.1Ω, R_{g(off)}=3.3Ω, Inductive Load



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