DFS600HF17I4I1

1700V/4.03mΩ Half Bridge SiC Module

Description

The DFS600HF17I4I1 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

- Blocking voltage 1700V
- $R_{DS(on)}$ =4.03mΩ@V_{GS} =18V
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses
- RoHS compliant
- REACH compliant

RoHS Compliant

REACH Compliant

Applications

- High Power Switching Applications
- Motor Drives
- Solar inverter Systems
- Uninterrupted Power Supply

Circuit diagram

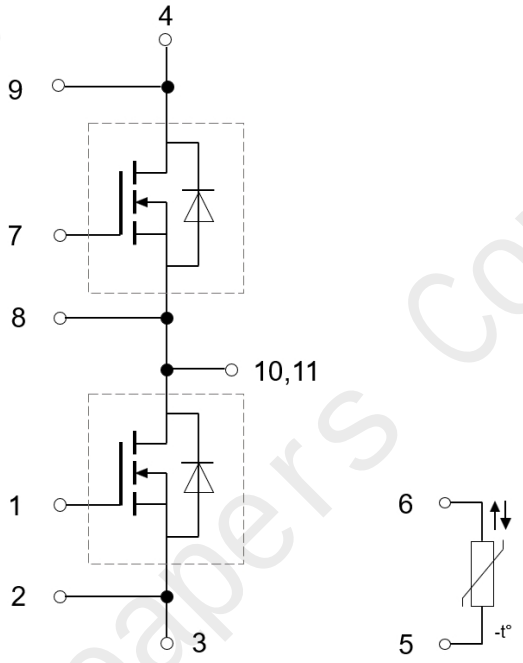
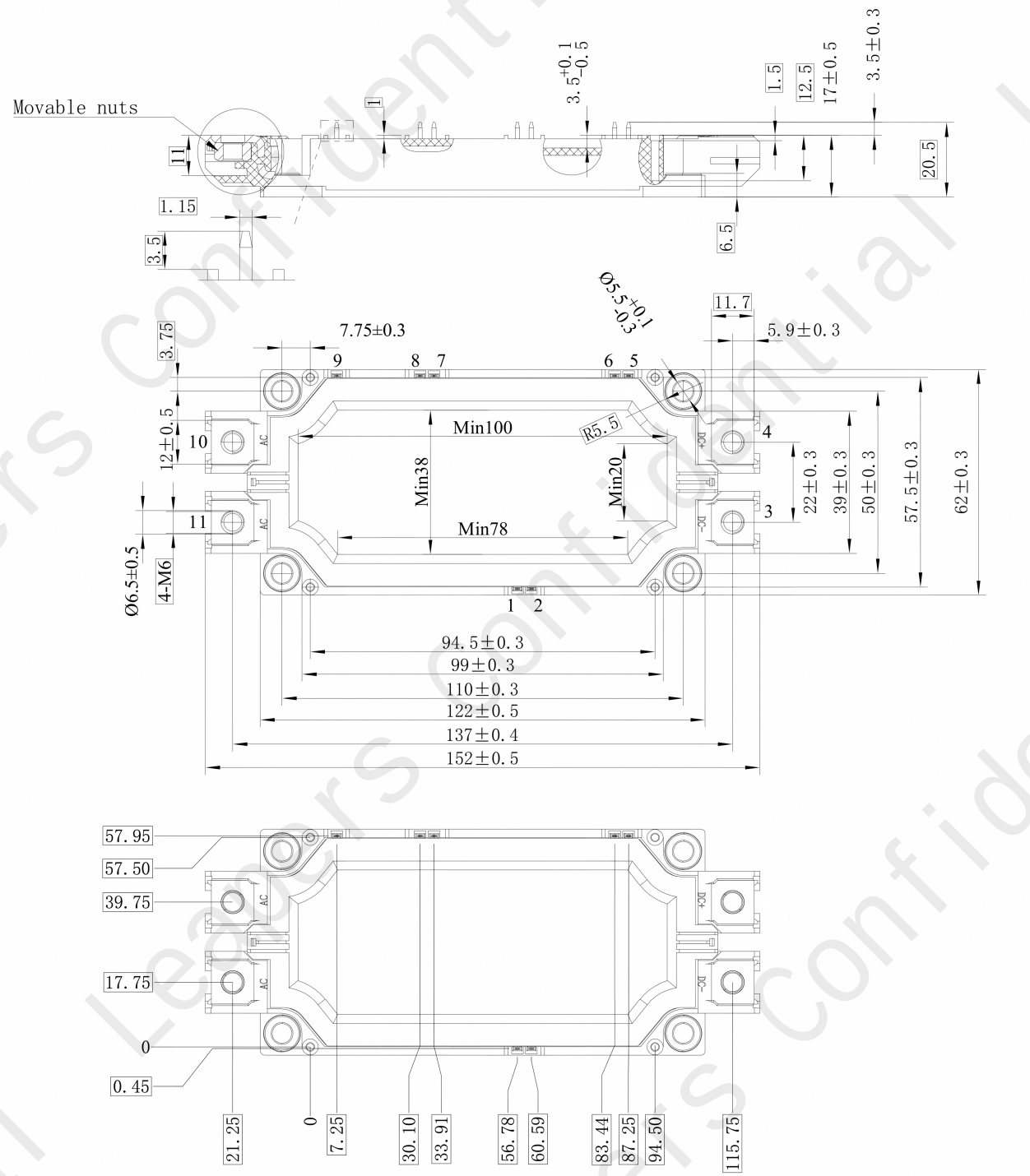


Figure 1. Out drawing & circuit diagram for DFS600HF17I4I1

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Outline drawing (Unit : mm)



NPW0003_001

Figure 2. Pin configuration

Module

Parameter	Condition	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 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
Stray inductance	-	20	nH
CTI	-	>400	-
Module lead resistance, terminals–chip	T_C =25°C	0.5	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	340	g

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

Symbol	Parameter	Condition		Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short		1700	V
V_{GSS}	Gate-Source Voltage	Duty cycle<1%, and pulse width<200ns, Note1		-10/23	V
V_{GSOP}	Recommended Gate-Source Voltage	-		-4/18	
I_{DS}	DC Continuous Drain Current	V_{GS} =18V, Note2	T_C =25°C	527	A
			T_C =100°C	373	
I_{DSM}	Pulse Forward Current	Pulse width =1ms, Note3		1054	A
P_{tot}	Total Power Dissipation	T_C =25°C, Note4		2419	W
T_{jmax}	Max Junction Temperature	Note5		175	°C
T_{jop}	Operating junction temperature	-		-40 to 175	°C
T_{stg}	Storage Temperature	-		-40 to 150	°C

Note1: Pulse width limited by maximum junction temperature

Note2: Current limit calculated by $I_{D(max)}= \sqrt{(P_D/R_{DS(typ)}(T_{vj(max)}))}$

Note3: Under Pw≤10us, Duty cycle≤1%， $I_{DS(pulse)}$=1054A

Note4: $P_D= (T_{vj}- T_c)/R_{th(jc,typ)}$

Note5: T_{jmax}=175°C verified by chip

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R_{100}	T_C =100°C, R_{100} =491Ω	-5	-	5	%
P_{25}	Power dissipation	T_C =25°C	-	-	60	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))]	-	3425	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3443	-	K

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=600μA		1700	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1700V, V_{GS}=0V		-	12	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=120mA, V_{DS}=V_{GS}	T_j=25°C	-	2.71	-	V
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V		-	-	600	nA
I_{GSS-}		V_{GS}= -5V, V_{DS}=0V		-600	-	-	
$R_{DS(on)}$	Static drain-source On-state resistance	I_D=600A, V_{GS}=+18V	T_j=25°C	-	4.03	-	mΩ
			T_j=175°C	-	8.68	-	
		I_D=600A, V_{GS}=+15V	T_j=25°C	-	4.61	-	
			T_j=175°C	-	9.14	-	
C_{iss}	Input Capacitance	V_D=25V, V_{GS}=0V, f=100kHz, V_{AC}=25mV		-	38.74	-	nF
C_{oss}	Output Capacitance			-	6.69	-	
C_{rss}	Reverse transfer Capacitance			-	0.34	-	
R_{Gint}	Internal gate resistor	f=1MHz		-	1.02	-	Ω
Q_G	Total gate charge	V_{DD}=900V, I_D=600A, V_{GS}=+18/-4V		-	1667	-	nC
Q_{GS}	Gate-source charge			-	556	-	
Q_{GD}	Gate-drain charge			-	513	-	
$t_{d(on)}$	Turn-on delay time	V_{DD}=800V, I_D=600A, V_{GS}=+18/-4V, R_g=7.5Ω, Inductive load switching operation	T_j=25°C	-	226.8	-	ns
			T_j=175°C	-	192	-	
t_r	Rise time		T_j=25°C	-	144	-	
			T_j=175°C	-	124	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	501.2	-	
			T_j=175°C	-	534.8	-	
t_f	Fall time		T_j=25°C	-	144	-	
			T_j=175°C	-	140	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	62.5	-	mJ
			T_j=175°C	-	66.1	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	56.7	-	
			T_j=175°C	-	60.1	-	
$R_{th(j-c)}$	Thermal Resistance	Junction to case		-	0.062	-	K/W

Note1: Assumes Thermal Conductivity of grease is 0.9W/m·K and thickness is 50μm.

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
V_{SD}	Body Diode Forward Voltage	V_{GS} = -4V I_{SD} =600A	T_j =25°C	-	6.51	-	V
			T_j =175°C	-	5.77	-	
T_{rr}	Reverse recovery time	V_{DD} =800V I_D =600A V_{GS} =+18/-4V R_g =7.5Ω Inductive load switching operation	T_j =25°C	-	132	-	ns
			T_j =175°C	-	136	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	8.7	-	μC
			T_j =175°C	-	29.2	-	
I_{RRM}	Peak reverse recovery current		T_j =25°C	-	142.8	-	A
			T_j =175°C	-	330.6	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	2.55	-	mJ
			T_j =175°C	-	10.35	-	

Test Conditions

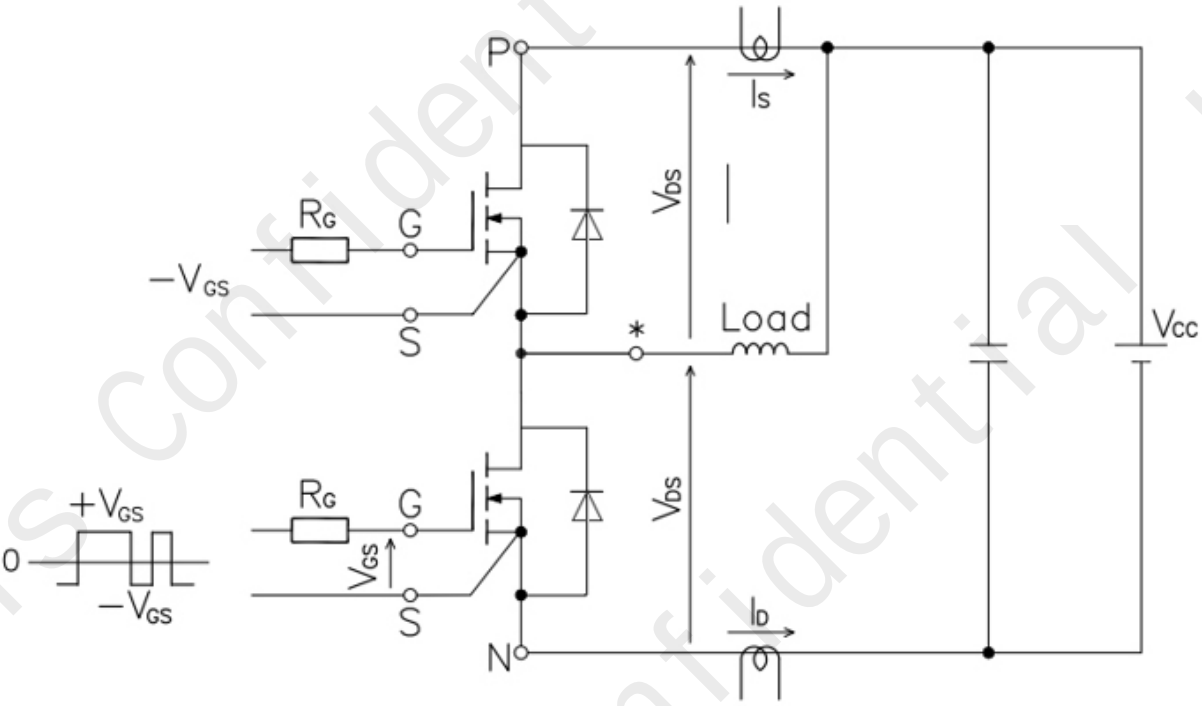


Figure 3. Switching time measure circuit

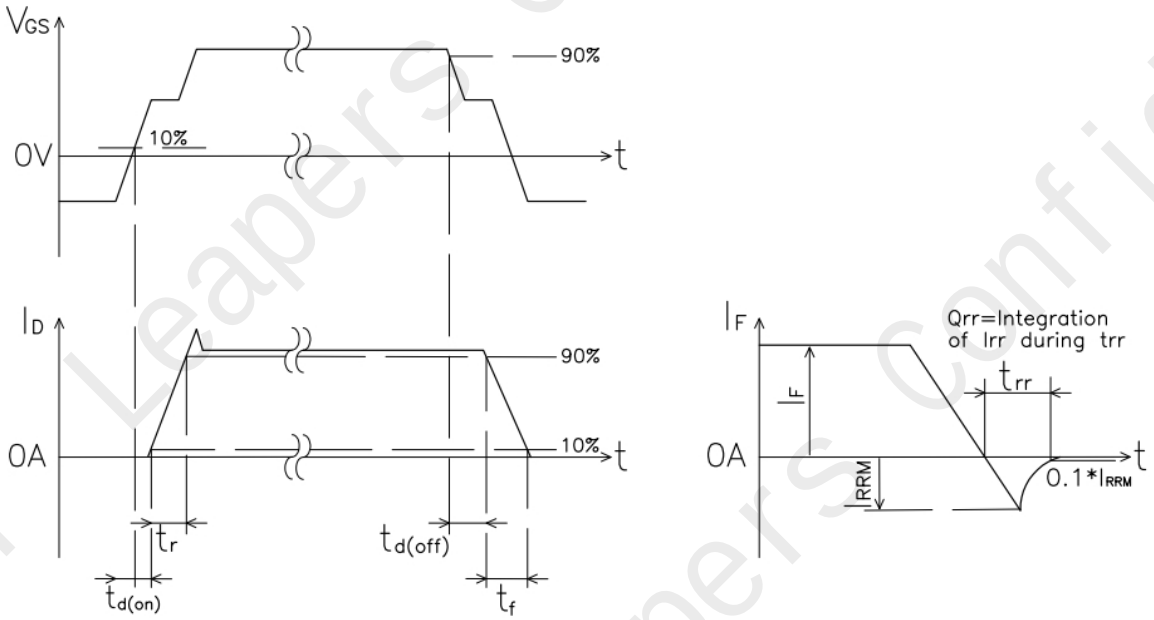


Figure 4. Switching time definition

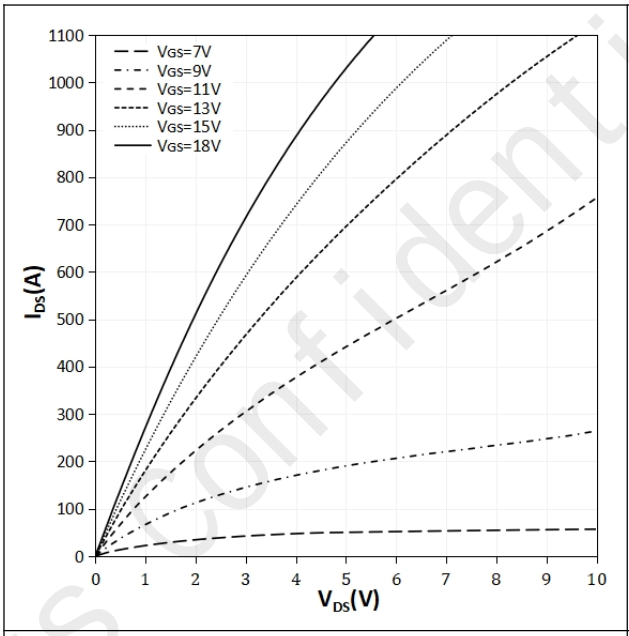


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, Typical Output characteristic

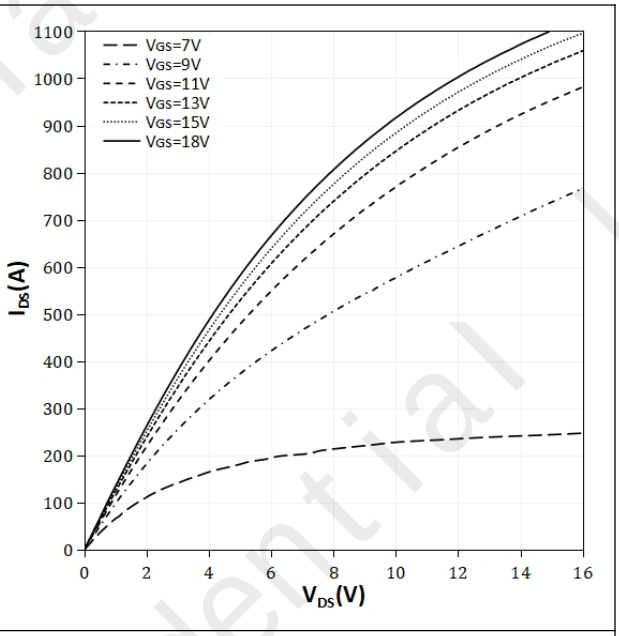


Figure 6. I_{DS} vs V_{DS}
T_j =175°C, Typical Output characteristic

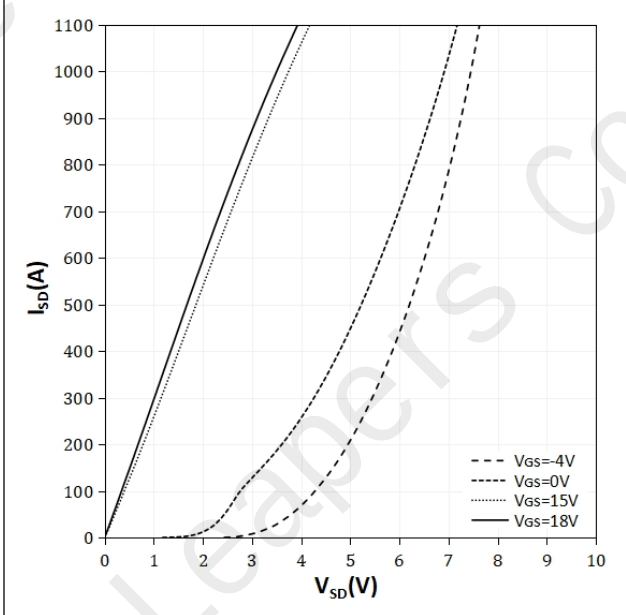


Figure 7. I_{SD} vs V_{SD}
T_j =25°C, Typical Output characteristic

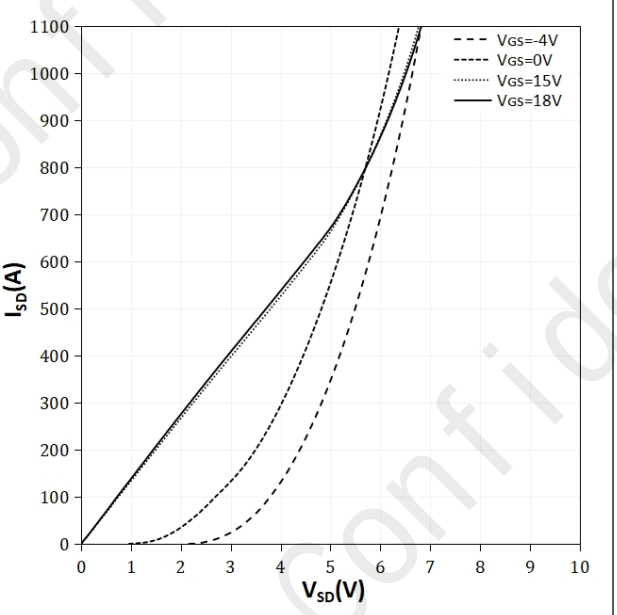


Figure 8. I_{SD} vs V_{SD}
T_j =175°C, Typical Output characteristic

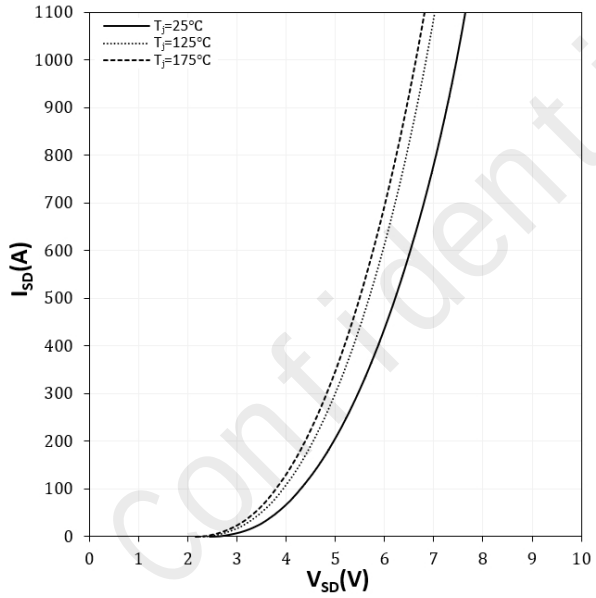


Figure 9. I_{SD} vs V_{SD}
V_{GS} = -4V

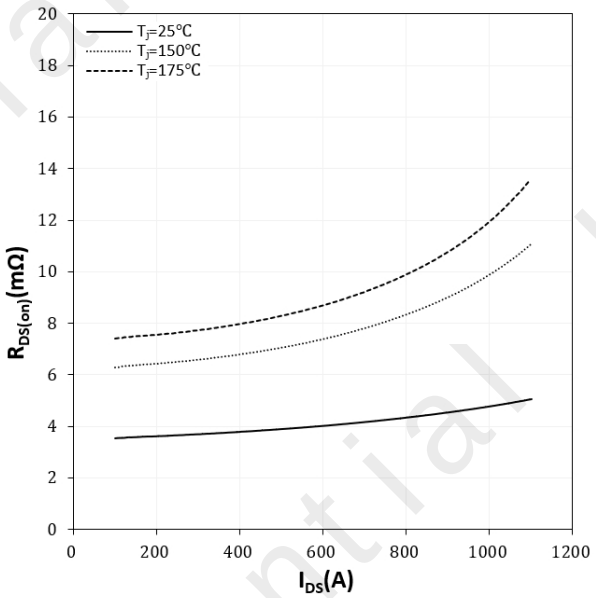


Figure 10. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V

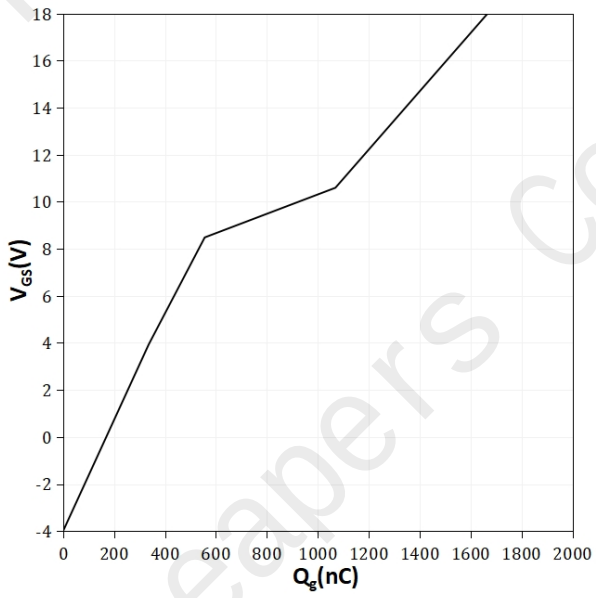


Figure 11. V_{GS} vs Q_g
V_{DS} =900V, I_D =600A , I_g=50mA , T_j =25°C

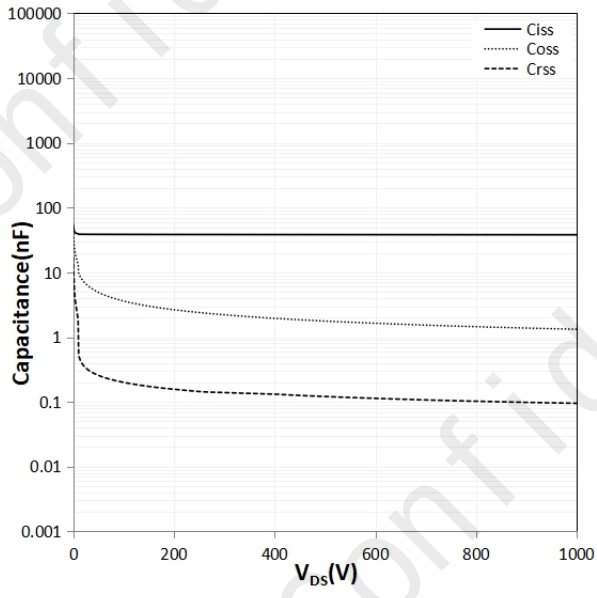


Figure 12. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
f =100kHz, T_j =25°C

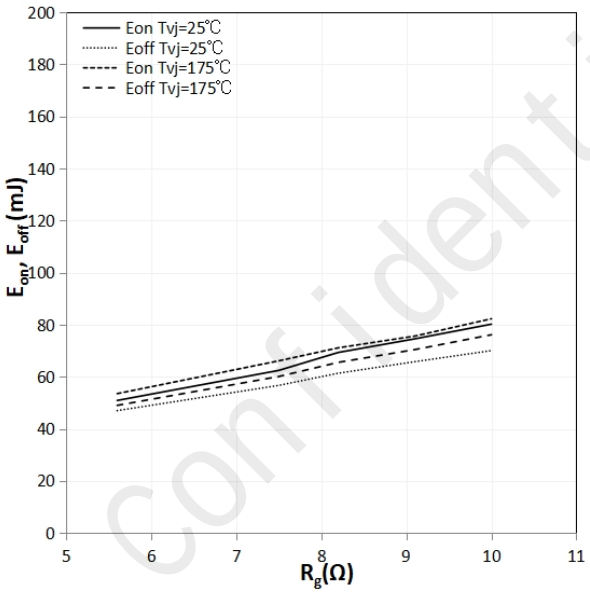


Figure 13. E_{on}, E_{off} vs R_g
V_{DS} =800V, I_D =600A, V_{GS} = -4V/+18V
Inductive Load

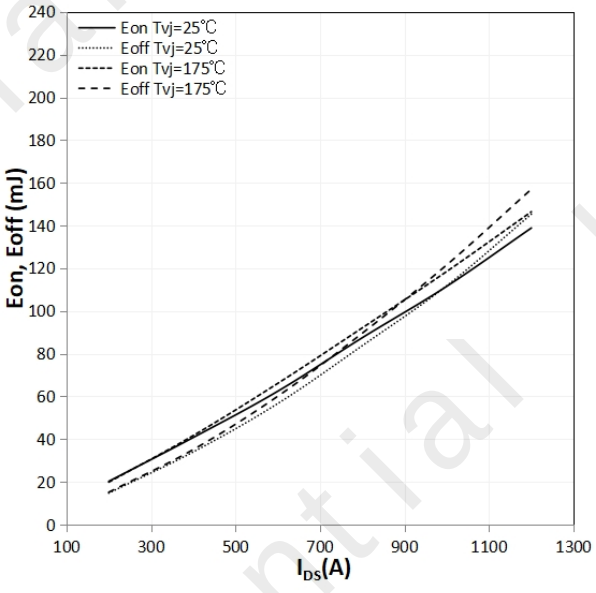


Figure 14. E_{on}, E_{off} vs I_{DS}
V_{DS} =800V, R_g=7.5Ω,V_{GS} = -4V/+18V
Inductive Load

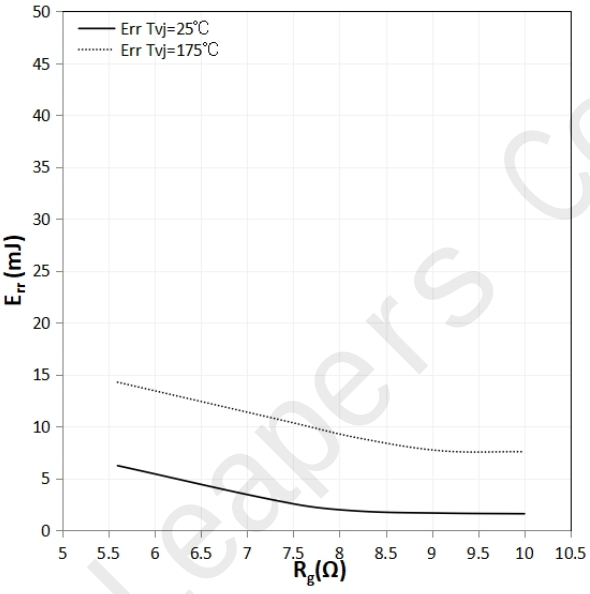


Figure 15. E_{rr} vs R_g
V_{DS} =800V, I_D =600A, V_{GS} = -4V/+18V
Inductive Load

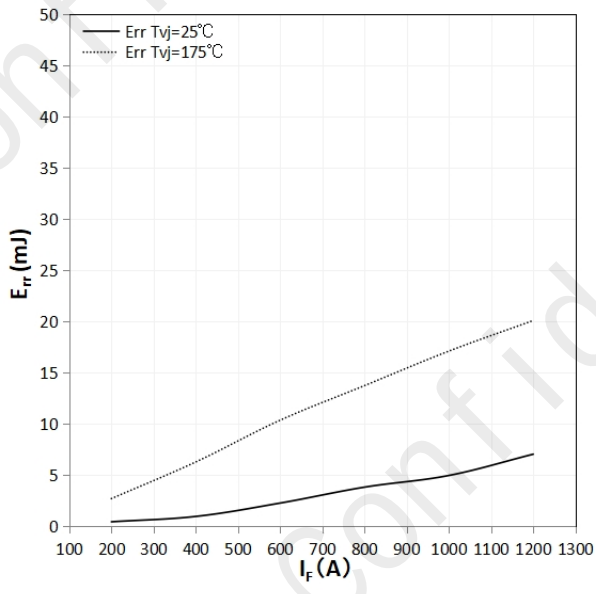
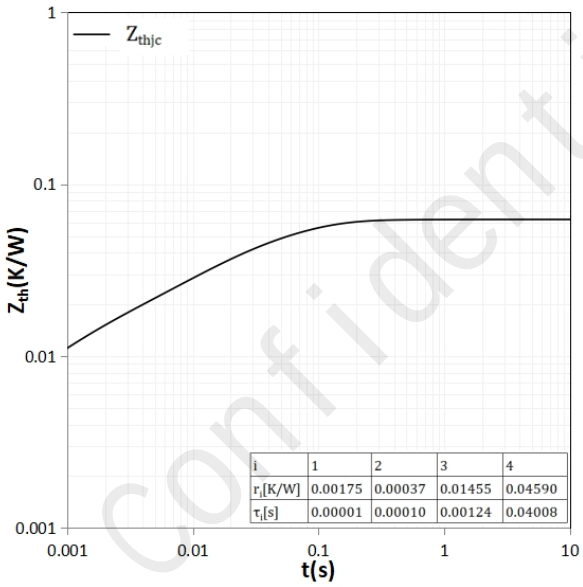


Figure 16. E_{rr} vs I_F
V_{DS} =800V, R_g = 7.5Ω, V_{GS} = -4V/+18V
Inductive Load



i	1	2	3	4
r_i[K/W]	0.00175	0.00037	0.01455	0.04590
τ_i[s]	0.00001	0.00010	0.00124	0.04008

Figure 17. Transient themal impedance Z_{thjc} for MOSFET

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