DFS450HF22I4T1

2200V/450A Half Bridge SiC MOSFET Module

Description

The DFS450HF22I4T1 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

- 2200V/4.2mΩ
- Low thermal resistance with AlN AMB
- Low inductive design
- Thermistor inside

Applications

- Smart grid
- Motor Drive
- Renewable energy

Circuit diagram

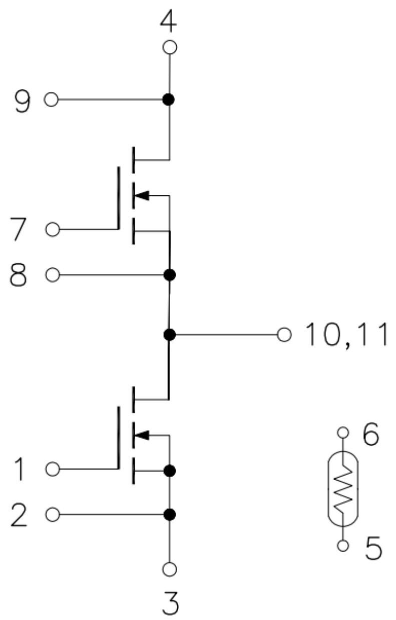

Figure 1. Out drawing & circuit diagram for DFS450HF22I4T1

Pin Configuaration and Marking Information

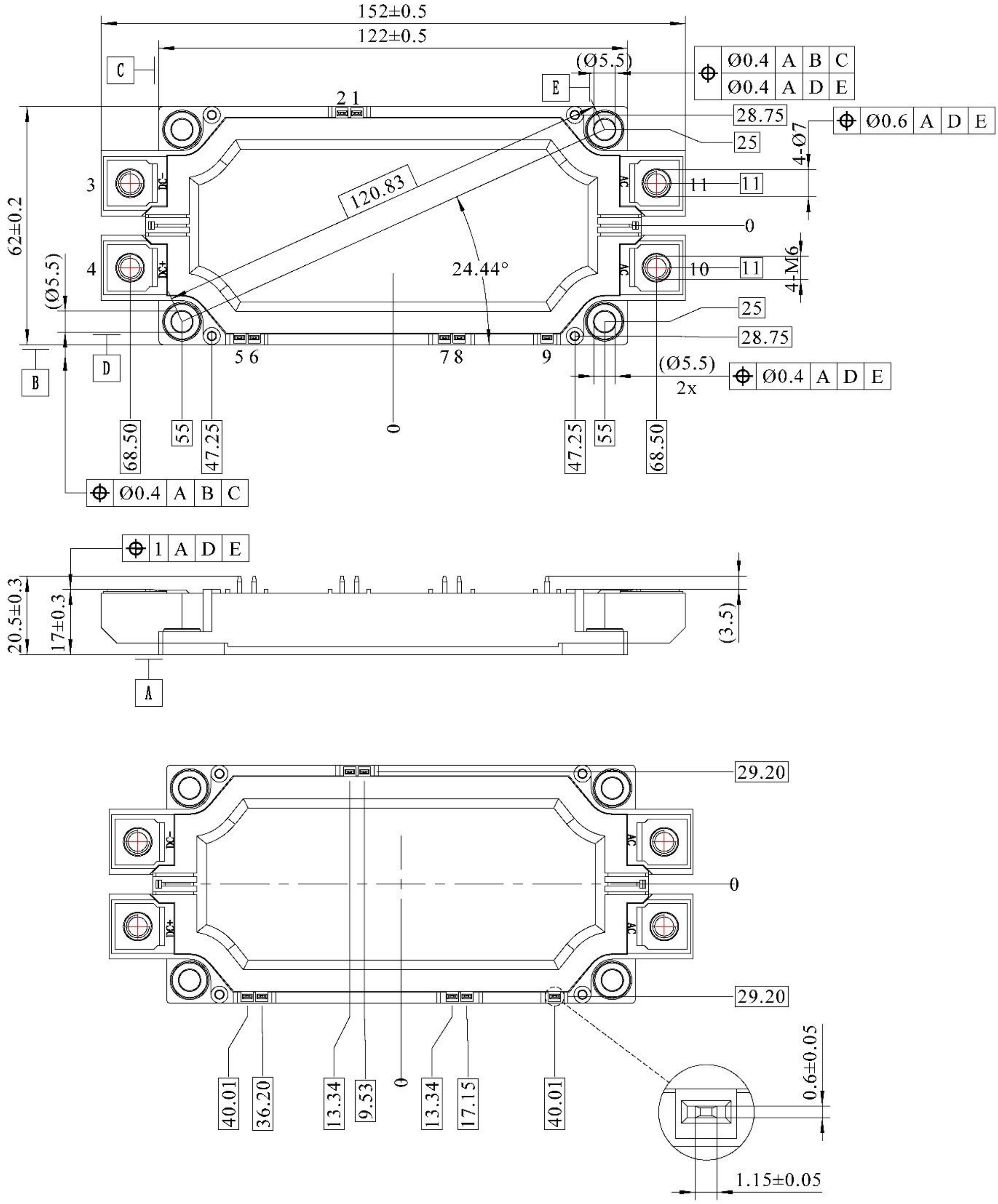

Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	4.0	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	-	600	-
Module lead resistance, terminals – chip	T_C =25°C	0.5	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	Condition	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	2200	V
V_{GSS}	Gate-Sourse Voltage	D-S Short, AC frequency ≥1Hz, Note1	-10 to 25	V
I_{DS}	DC Continuous Drain Current	T_C =25°C , V_{GS} =+20V	520	A
I_{DS}	DC Continuous Drain Current	T_C =60°C , V_{GS} =+20V	440	A
I_{SD}	Source (Body diode) Current	T_C =25°C, with ON signal	520	A
I_{SD}	Source (Body diode) Current	T_C =60°C, with ON signal	440	A
I_{DSM}	Pulse Drain Current	T_C =25°C, Pulse width =1ms, V_{GS} =+20V, Note2	1000	A
P_{tot}	Total Power Dissipation	T_C =25°C	2273	W
T_{jmax}	Max Junction Temperature	-	150	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +20V/-6V

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 R_{100}	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 Min.	Value Typ.	Value Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =1mA		2200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS} =2200V, V_{GS} =0V		-	-	200	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D =170mA, V_{DS} =10V		3.5	4.5	5.5	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =25V/-10V, V_{DS} =0V		-	-	±400	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =450A, V_{GS} =+20V	T_j =25°C	-	4.2	-	mΩ
			T_j =150°C	-	8.4	11.8	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =450A, V_{GS} =+20V	T_j =25°C	-	1.89	-	V
			T_j =150°C	-	3.78	5.31	V
R_{Gint}	Internal Gate Resistance	T_j =25°C		-	4.1	-	Ω
C_{iss}	Input Capacitance	V_{DS} =1100V, V_{GS} =0V, f =10kHz		-	36.7	-	nF
C_{oss}	Output Capacitance			-	1.2	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.03	-	nF
Q_g	Total gate charge	V_{DS} =1100V, I_D =170A, V_{GS} =+20V/-6V		-	1080	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD} =1100V, I_D =450A, V_{GS} =+20/-6V, R_{gon} / R_{goff} =0.75/3.0Ω, Inductive load switching operation	T_j =25°C	-	135	-	ns
			T_j =150°C	-	160	-	ns
t_r	Rise time		T_j =25°C	-	35	-	ns
			T_j =150°C	-	40	-	ns
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	345	-	ns
			T_j =150°C	-	300	-	ns
t_f	Fall time		T_j =25°C	-	115	-	ns
			T_j =150°C	-	60	-	ns
E_{on}	Turn-on power dissipation		T_j =25°C	-	16.0	-	mJ
			T_j =150°C	-	14.2	-	mJ
E_{off}	Turn-off power dissipation		T_j =25°C	-	24.8	-	mJ
			T_j =150°C	-	22.6	-	mJ
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.055	-	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} =-6V I_{SD} =450A	T_j =25°C	-	3.0	-	V
			T_j =150°C	-	5.0	-	
T_{rr}	Reverse recovery time	V_{DD} =1100V, I_D =450A V_{GS} =+20/-6V, R_{gon}/R_{goff} =0.75/3.0Ω Inductive load	T_j =25°C	-	40	-	ns
			T_j =150°C	-	30	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	1.35	-	mJ
			T_j =150°C	-	1.20	-	

Test Conditions

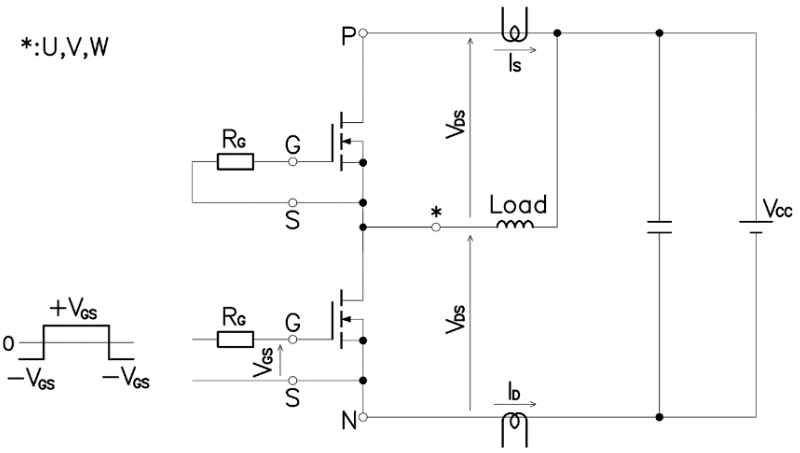

Figure 3. Switching time measure circuit

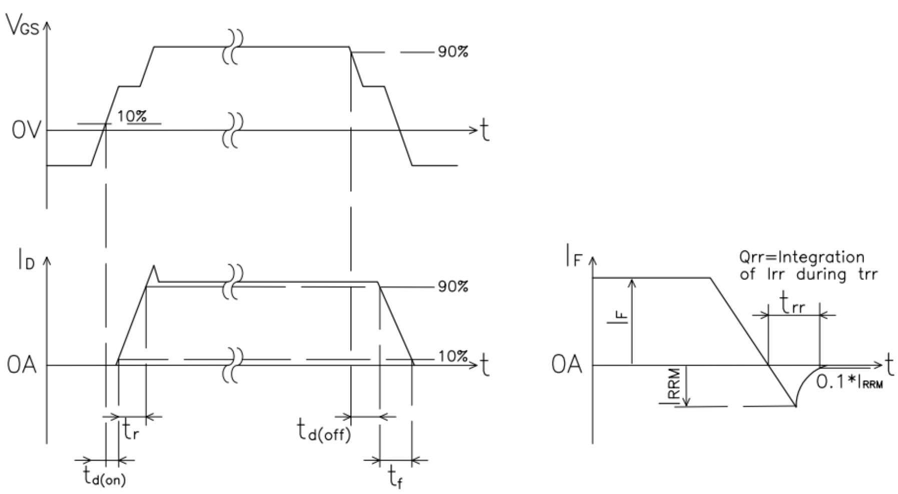

Figure 4. Switching time definition

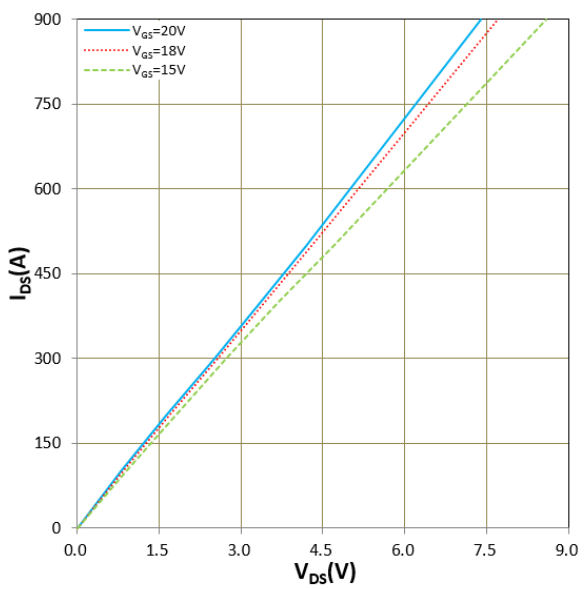

Figure 5. I_{DS} vs V_{DS}

T_j=150°C

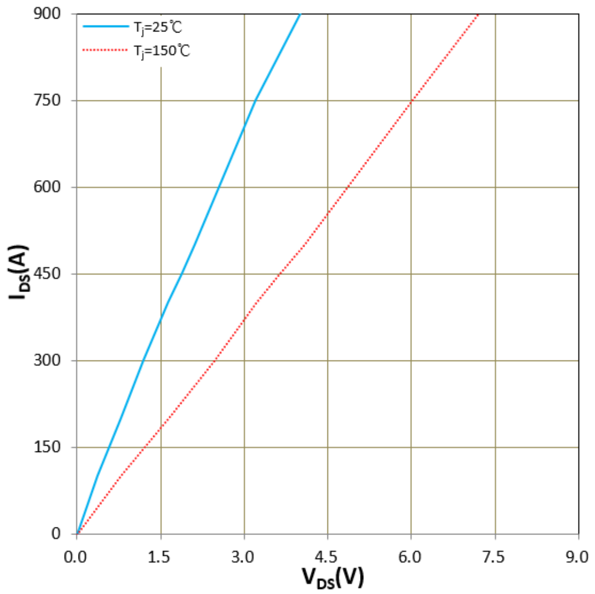

Figure 6. I_{DS} vs V_{DS}

V_{GS} =+20V

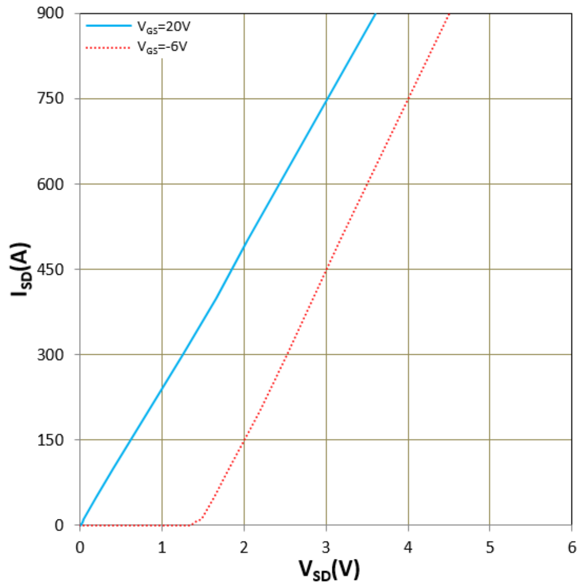

Figure 7. I_{SD} vs V_{SD} (V_F)

T_j =25°C

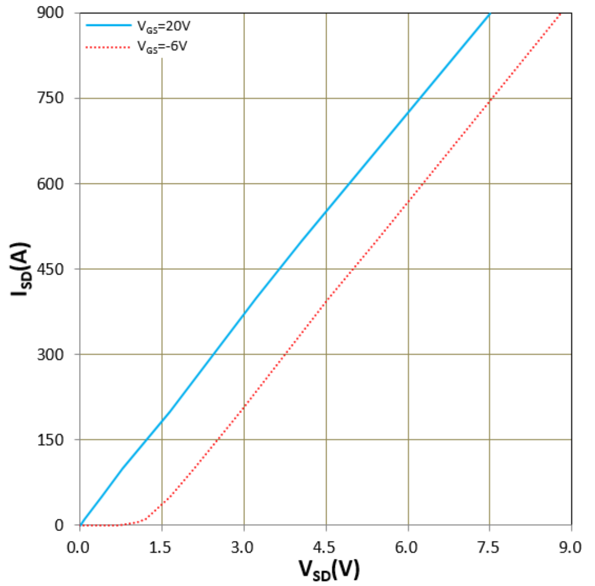

Figure8. I_{SD} vs V_{SD} (V_F)

T_j =150°C

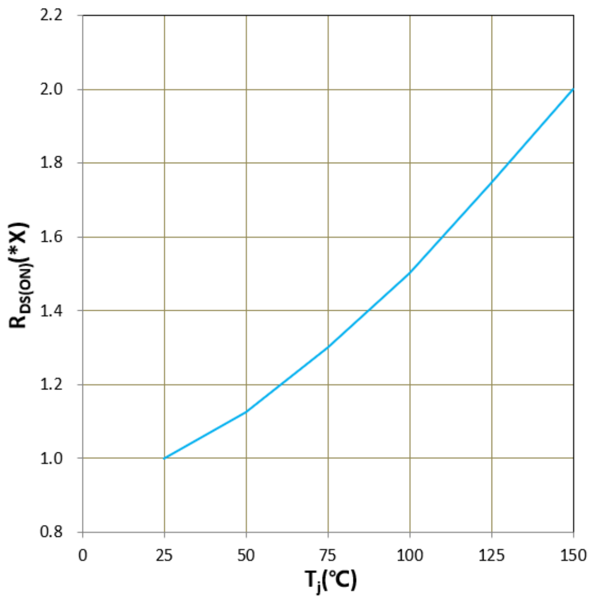

Figure 9. $R_{DS(ON)}$ vs T_j

V_{GS} =+20V, I_D =450A, 1.0X =4.2mΩ

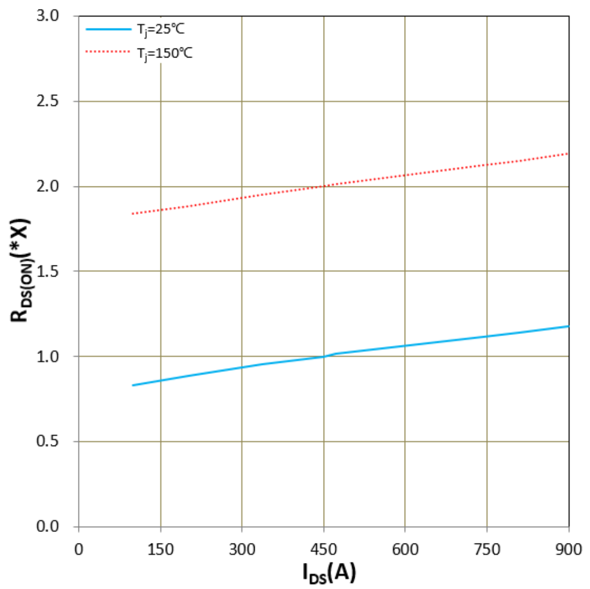

Figure 10. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+20V, 1.0X =4.2mΩ

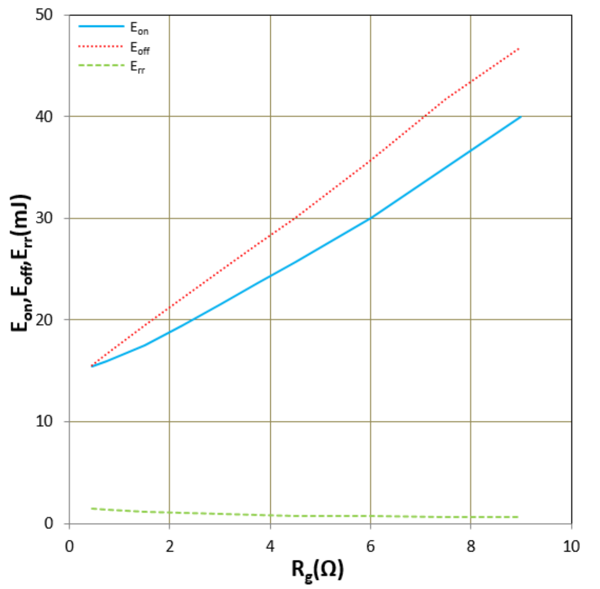

Figure 11. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{DD} =1100V, I_D =450A, V_{GS} =+20V/-6V

Inductive Load

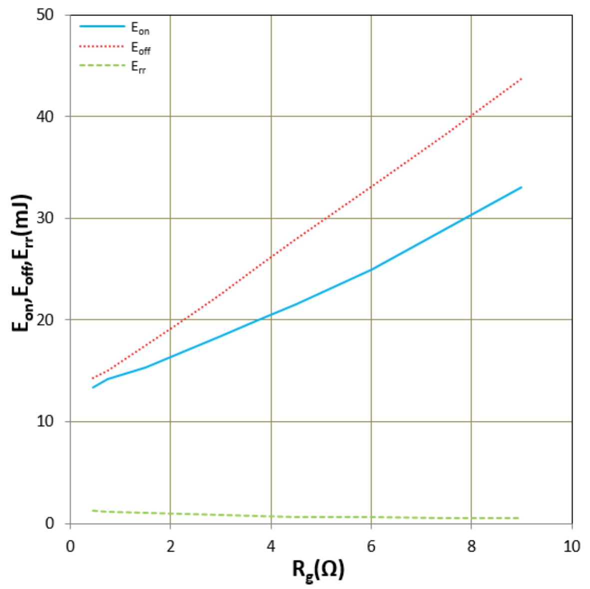

Figure 12. E_{on}, E_{off} , E_{rr} vs R_g

T_j =150°C, V_{DD} =1100V, I_D =450A, V_{GS} =+20V/-6V

Inductive Load

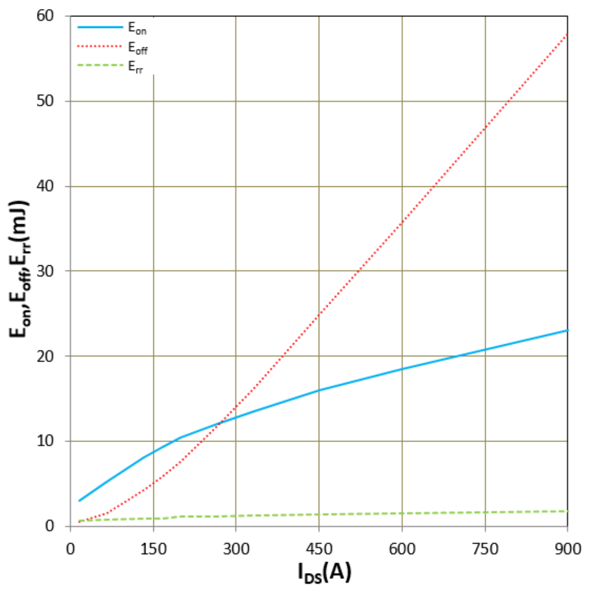

Figure 13. E_{on}, E_{off} , E_{rr} vs I_{DS}
T_j =25°C, V_{DD} =1100V, R_{GON} / R_{GOFF} =0.75/3.0Ω
V_{GS} =+20V/-6V, Inductive Load

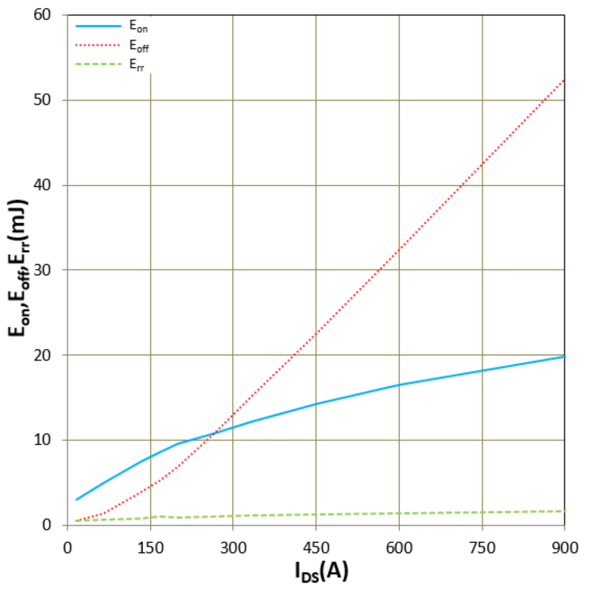

Figure 14. E_{on}, E_{off} , E_{rr} vs I_{DS}
T_j =150°C, V_{DD} =1100V, R_{GON} / R_{GOFF} =0.75/3.0Ω
V_{GS} =+20V/-6V, Inductive Load

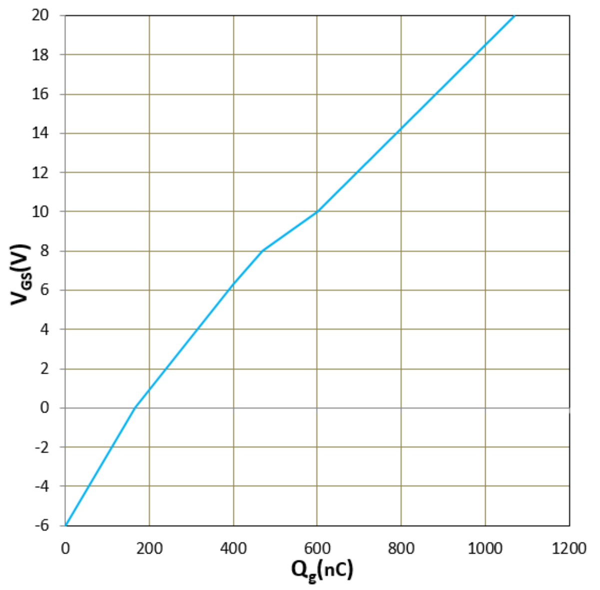

Figure15. V_{GS} vs Q_g
V_{CC} =1100V, I_D =450A, T_j =150°C

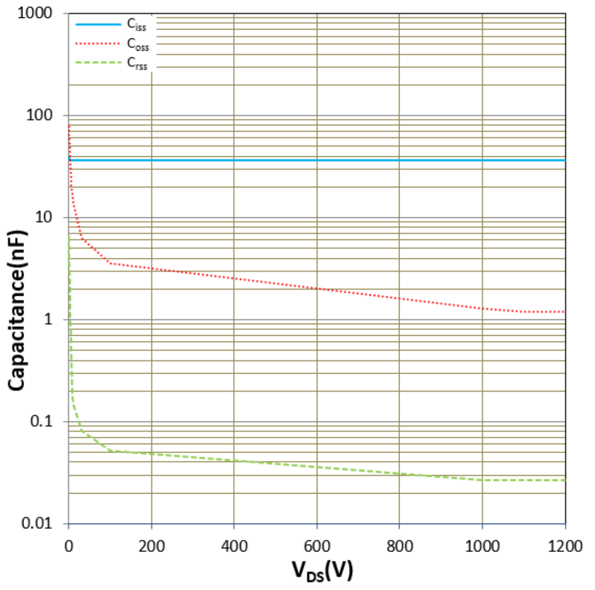

Figure 16. C_{ies},C_{oss},C_{rss} vs V_{DS}
T_j =25°C, V_{GS} =0V, f =10kHz

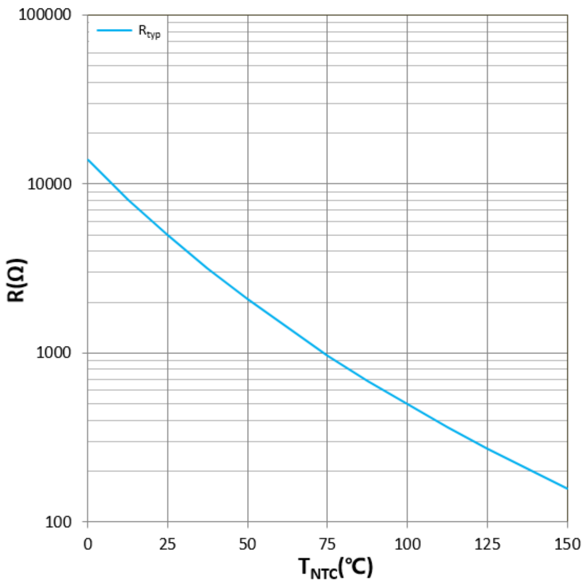	
Figure 17. R vs T_{NTC}	

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