

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 AlNAMB
- Low inductive design
- Thermistor inside

Applications

- Smart grid
- Motor Drive
- Renewable energy

Circuit diagram

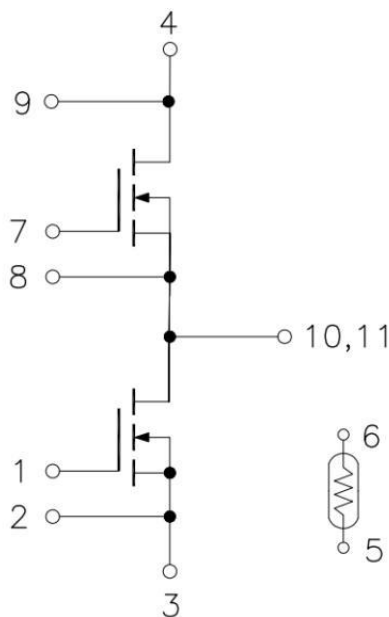


Figure 1. Out drawing & circuit diagram for DFS450HF22I4T1

Pin Configuration and Marking Information

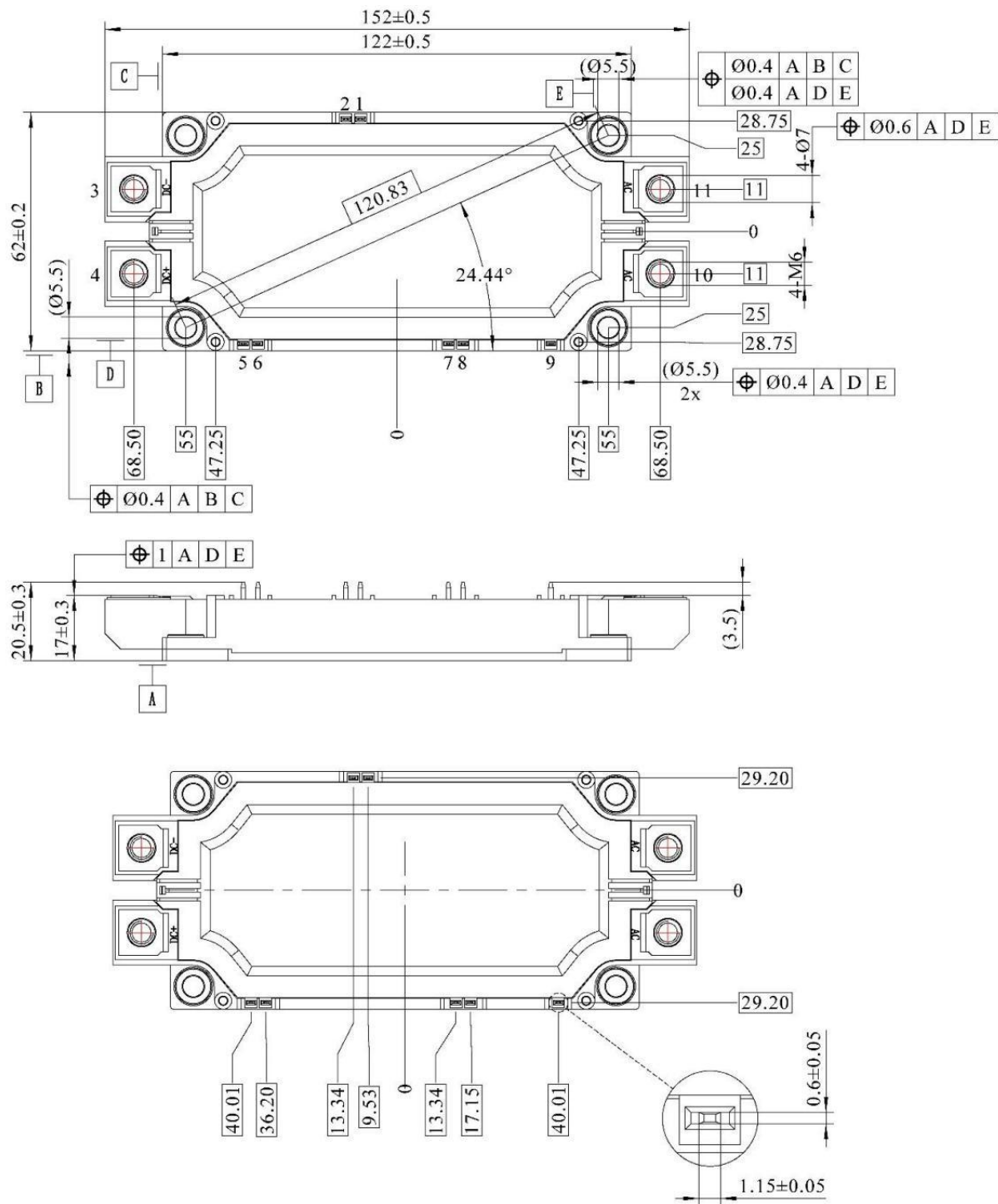


Figure 2. Pin configuration

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-Source 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	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	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 =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	I _D =450A	T _J =25°C	-	4.2	-	mΩ
	On-state resistance	V _{GS} =+20V	T _J =150°C	-	8.4	11.8	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =450A	T _J =25°C	-	1.89	-	V
	On-state Voltage	V _{GS} =+20V	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	-	
t _r	Rise time		T _J =25°C	-	35	-	ns
			T _J =150°C	-	40	-	
t _{d(off)}	Turn-off delay time		T _J =25°C	-	345	-	ns
			T _J =150°C	-	300	-	
t _f	Fall time		T _J =25°C	-	115	-	ns
			T _J =150°C	-	60	-	
E _{on}	Turn-on power dissipation		T _J =25°C	-	16.0	-	mJ
			T _J =150°C	-	14.2	-	
E _{off}	Turn-off power dissipation		T _J =25°C	-	24.8	-	mJ
			T _J =150°C	-	22.6	-	

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V _{SD}	Body Diode Forward Voltage	V _{GS} =-6V	T _J =25°C	-	3.0	-	V
		I _{SD} =450A	T _J =150°C	-	5.0	-	
T _{rr}	Reverse recovery time	V _{DD} =1100V, I _D =450A	T _J =25°C	-	40	-	ns
		V _{GS} =+20/-6V,	T _J =150°C	-	30	-	
E _{rr}	Diode switching power dissipation	R _{gon} /R _{goff} =0.75/3.0Ω	T _J =25°C	-	1.35	-	mJ
		Inductive load	T _J =150°C	-	1.20	-	

Test Conditions

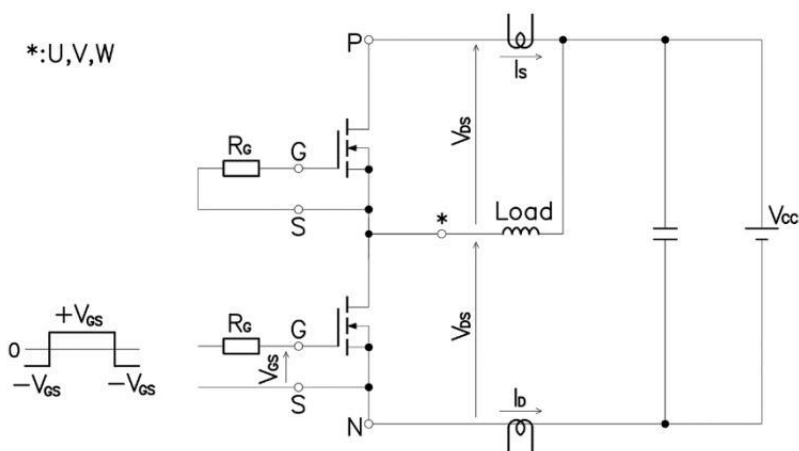


Figure 3. Switching time measure circuit

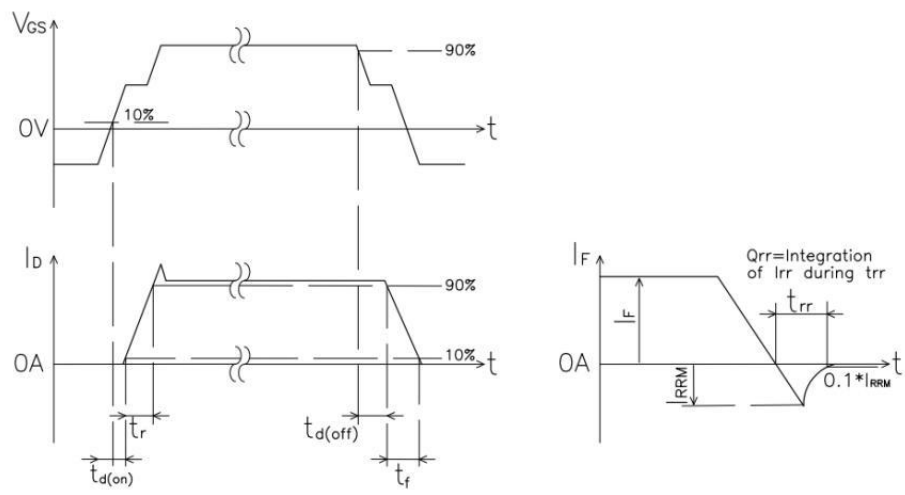


Figure 4. Switching time definition

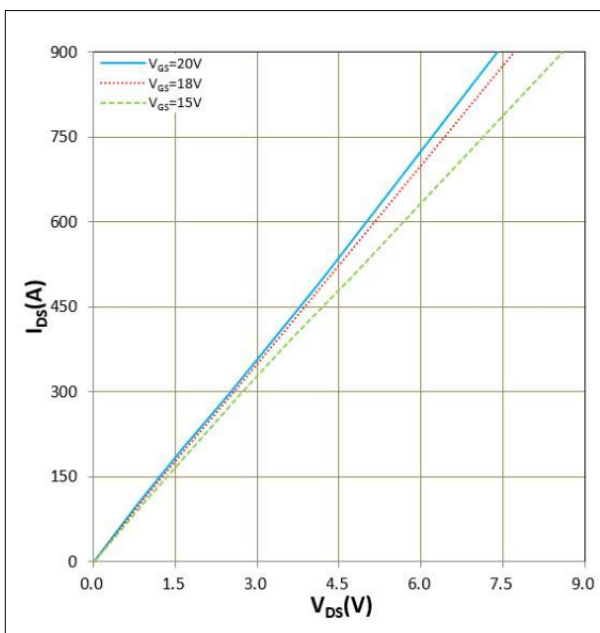


Figure 5. I_{DS} vs V_{DS}
 $T_j = 150^\circ\text{C}$

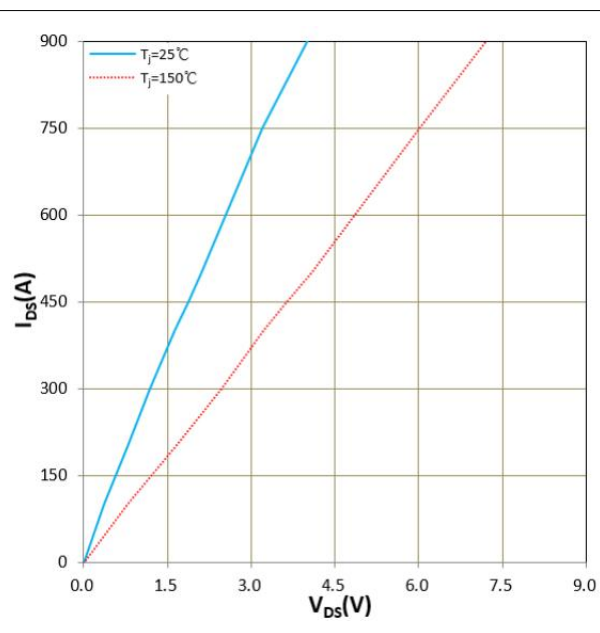


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = +20\text{V}$

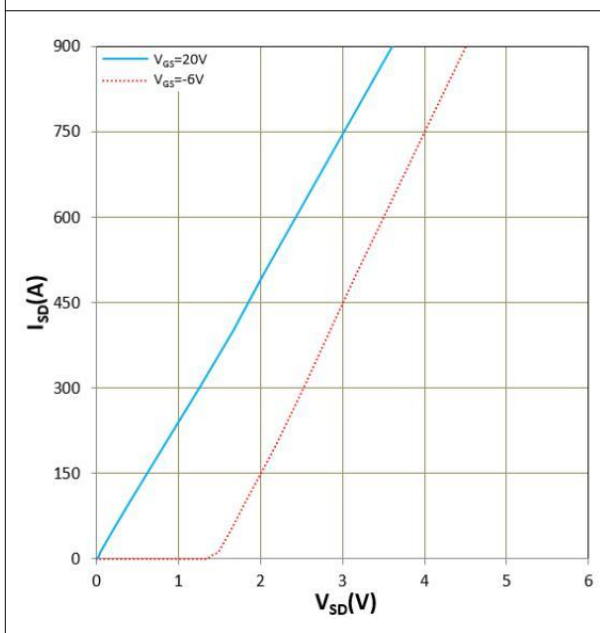


Figure 7. I_{SD} vs $V_{SD} (V_F)$
 $T_j = 25^\circ\text{C}$

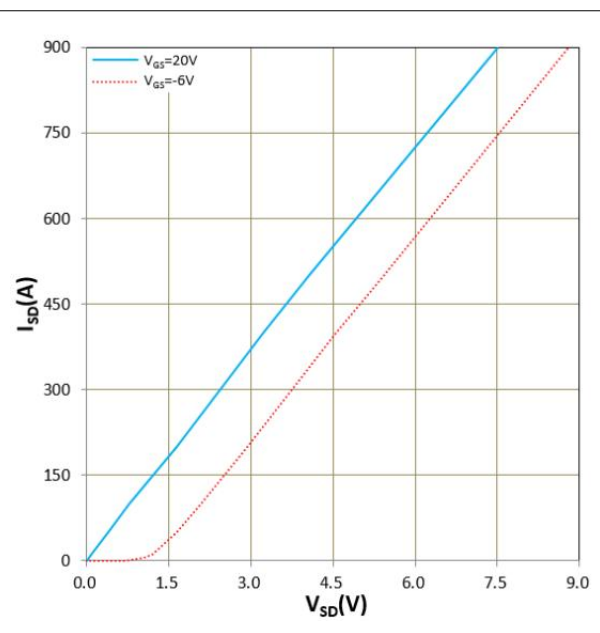


Figure 8. I_{SD} vs $V_{SD} (V_F)$
 $T_j = 150^\circ\text{C}$

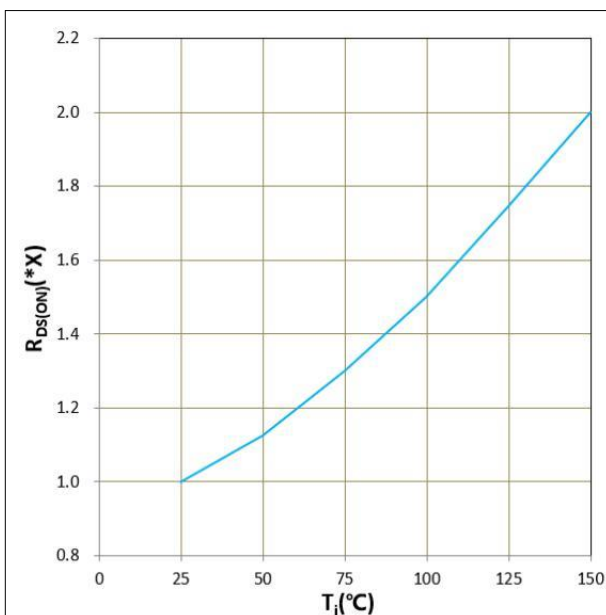


Figure 9. $R_{DS(ON)}$ vs T_j

$V_{GS} = +20V$, $I_D = 450A$, $1.0X = 4.2m\Omega$

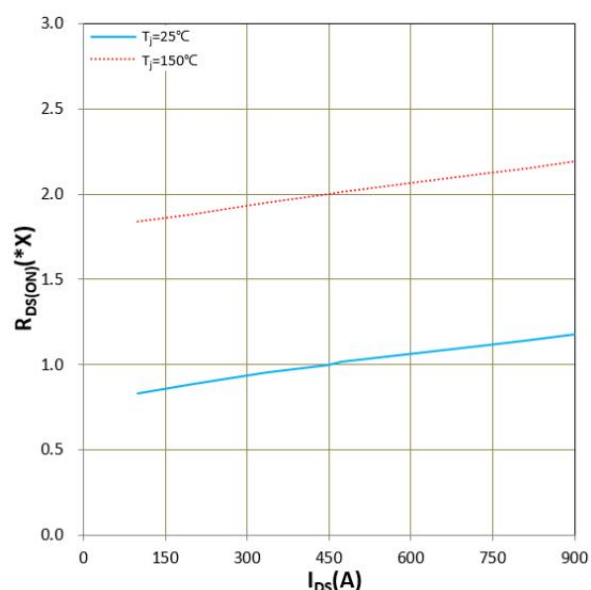


Figure 10. $R_{DS(ON)}$ vs I_{DS}

$V_{GS} = +20V$, $1.0X = 4.2m\Omega$

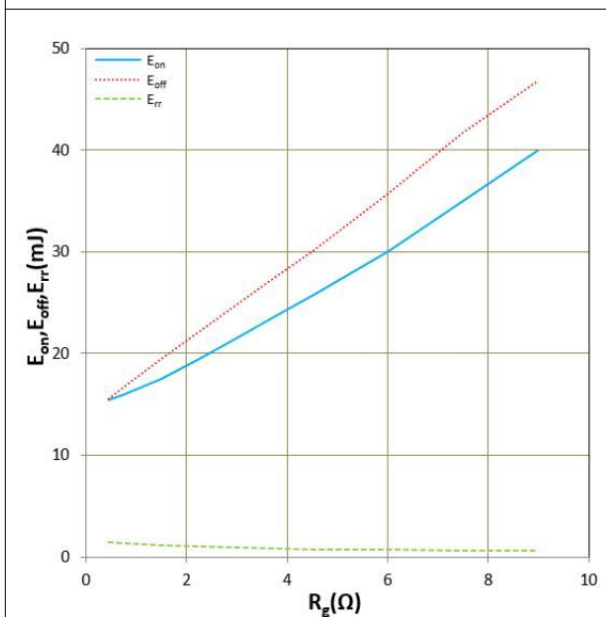


Figure 11. E_{on} , E_{off} , E_{rr} vs R_g

$T_j = 25^\circ C$, $V_{DD} = 1100V$, $I_D = 450A$, $V_{GS} = +20V/-6V$
Inductive Load

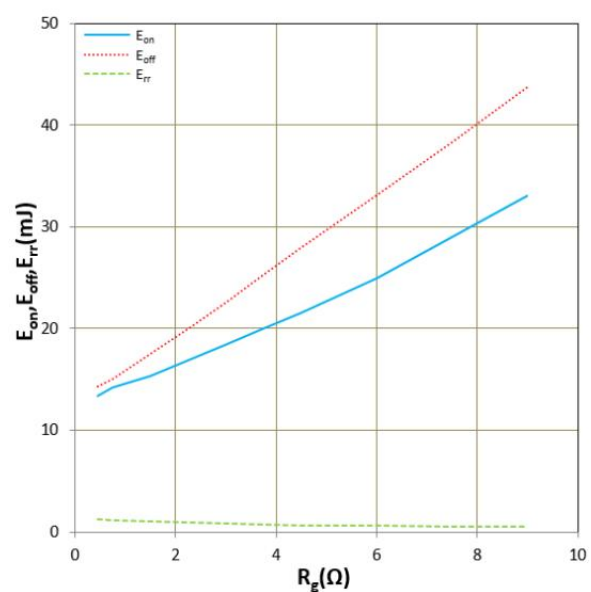


Figure 12. E_{on} , E_{off} , E_{rr} vs R_g

$T_j = 150^\circ C$, $V_{DD} = 1100V$, $I_D = 450A$, $V_{GS} = +20V/-6V$
Inductive Load

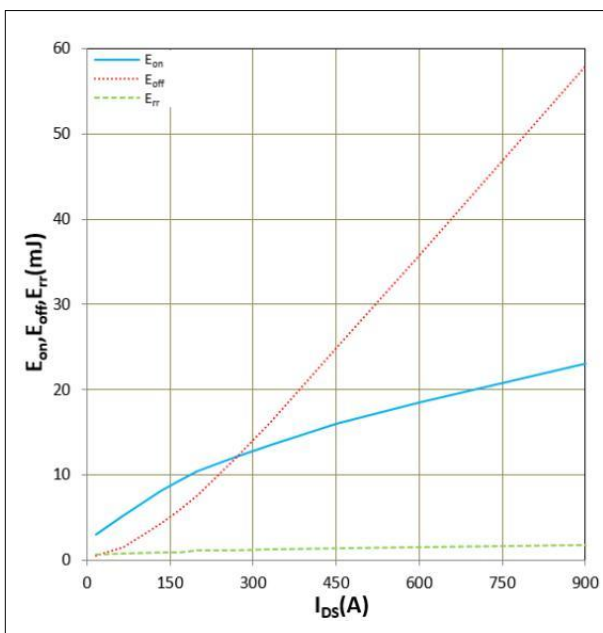


Figure 13. E_{on}, E_{off}, E_{rr} vs I_{DS}

T_j = 25°C, V_{DD} = 1100V, R_{GON} / R_{GOFF} = 0.75/3.0Ω

V_{GS} = +20V/-6V, Inductive Load

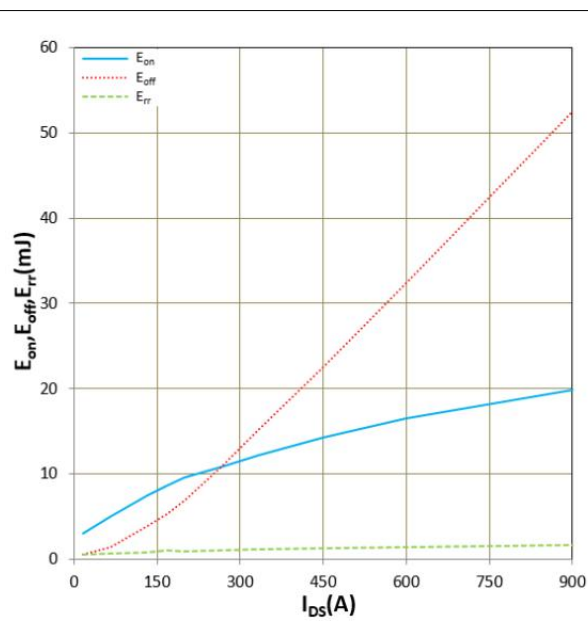


Figure 14. E_{on}, E_{off}, E_{rr} vs I_{DS}

T_j = 150°C, V_{DD} = 1100V, R_{GON} / R_{GOFF} = 0.75/3.0Ω

V_{GS} = +20V/-6V, Inductive Load

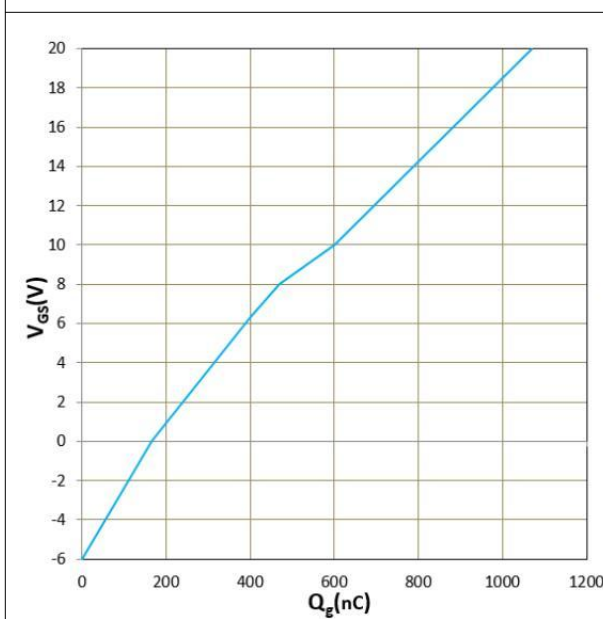


Figure 15. V_{GS} vs Q_g

V_{CC} = 1100V, I_D = 450A, T_j = 150°C

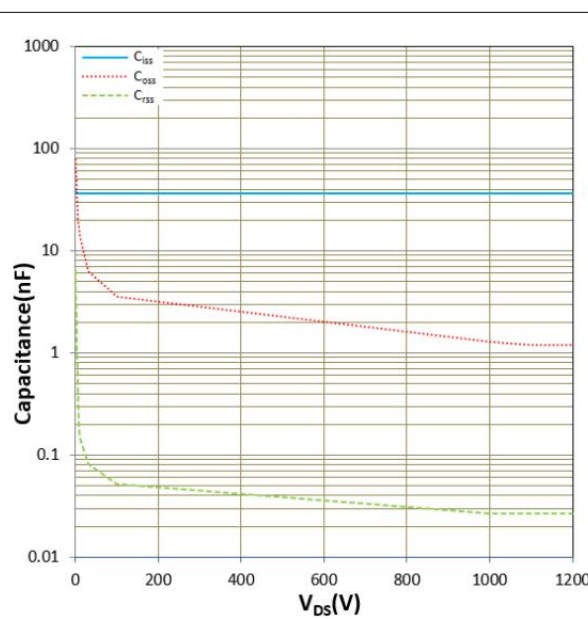
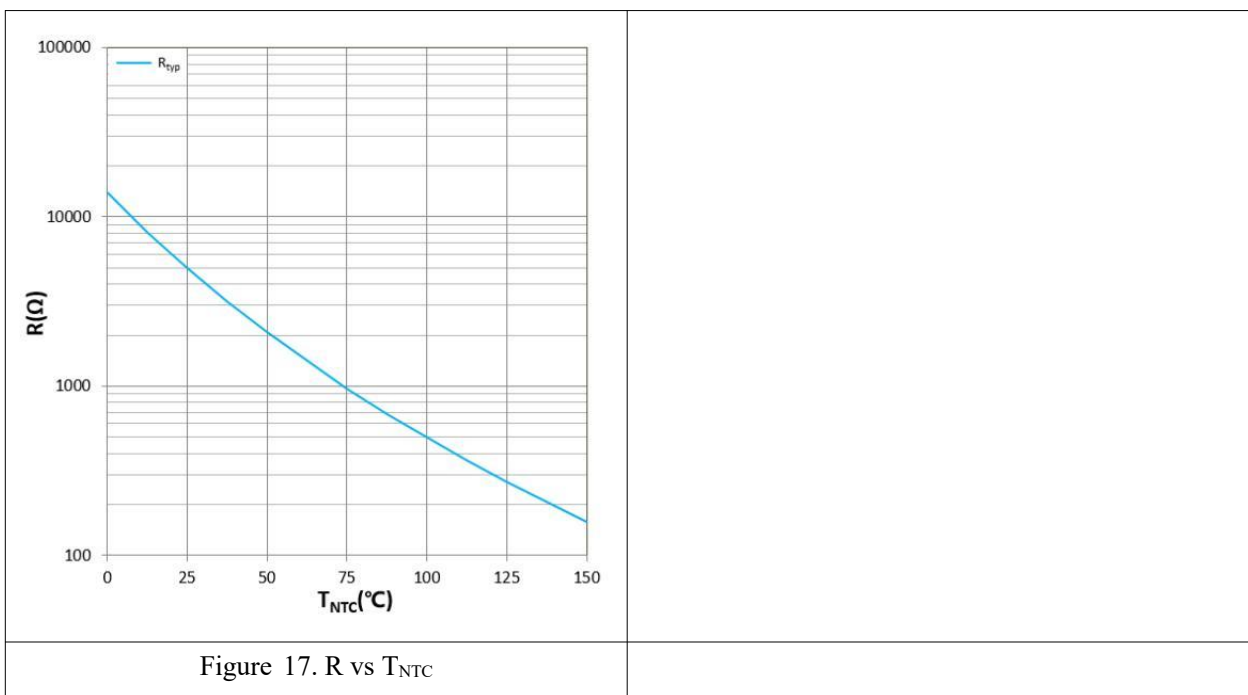


Figure 16. C_{ies}, C_{oss}, C_{rss} vs V_{DS}

T_j = 25°C, V_{GS} = 0V, f = 10kHz



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