

Description

The DFS600HF22I4T1 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/2.8mΩ
- Low thermal resistance with AlN AMB
- Low inductive design
- Thermistor inside

Applications

- Smart grid
- Motor Drive
- Renewable energy

Circuit diagram

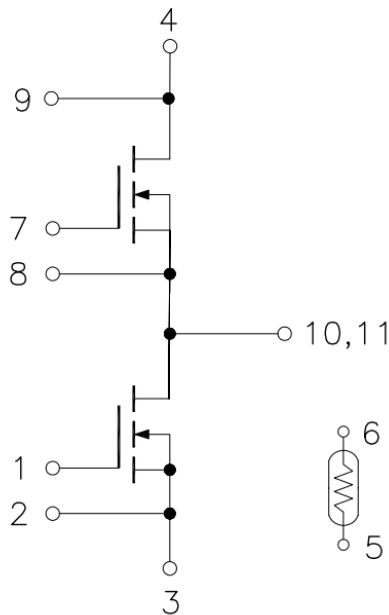


Figure 1. Out drawing & circuit diagram for DFS600HF22I4T1

Pin Configuration and Marking Information

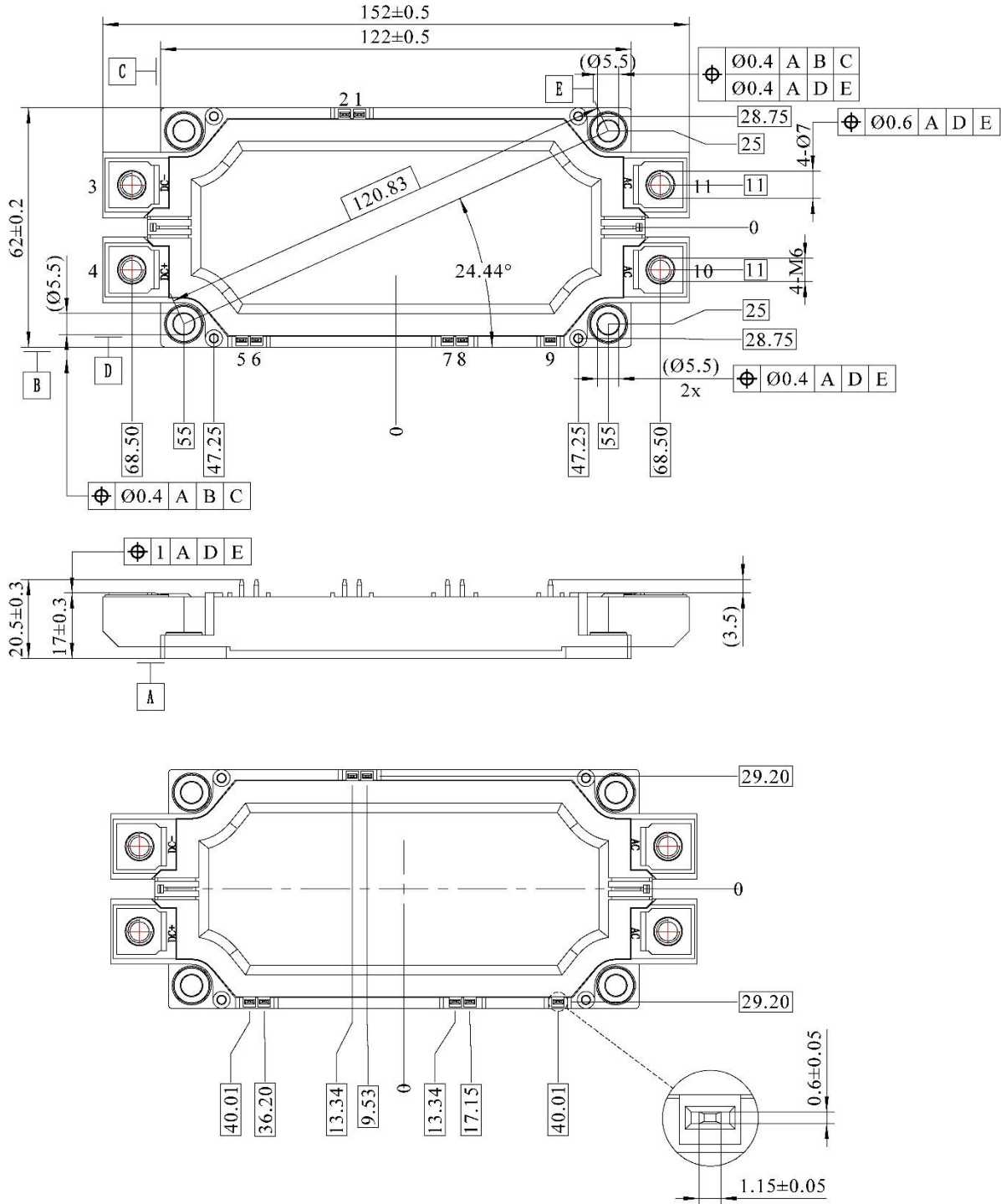


Figure 2. Pin configuration

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	Rated	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	730	A
I _{DS}	DC Continuous Drain Current	T _c =60°C , V _{GS} =+20V	620	A
I _{SD}	Source (Body diode) Current	T _c =25°C, with ON signal	730	A
I _{SD}	Source (Body diode) Current	T _c =60°C, with ON signal	620	A
I _{DSM}	Pulse Drain Current	T _c =25°C, Pulse width =1ms, V _{GS} =+20V, Note2	1200	A
P _{tot}	Total Power Dissipation	T _c =25°C	3200	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 K))]	-	3375	-	K
B _{25/80}	B-value	R ₂ =R ₂₅ exp [B _{25/80} (1/T ₂ - 1/(298,15 K))]	-	3411	-	K
B _{25/100}	B-value	R ₂ =R ₂₅ exp [B _{25/100} (1/T ₂ - 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 =1mA	2200	-	-	V	
I _{DSS}	Zero gate voltage drain Current	V _{DS} =2200V, V _{GS} =0V	-	-	300	μA	
V _{GS(th)}	Gate-source threshold Voltage	I _D =250mA, V _{DS} =10V	3.5	4.5	5.5	V	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =25V/-10V, V _{DS} =0V	-	-	± 600	nA	
R _{DS(on)} (Chip)	Static drain-source	I _D =600A V _{GS} =+20V	T _j =25°C	-	2.8	-	mΩ
	On-state resistance		T _j =150°C	-	5.7	8.1	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =600A V _{GS} =+20V	T _j =25°C	-	1.68	-	V
	On-state Voltage		T _j =150°C	-	3.42	4.86	V
R _{Gint}	Internal Gate Resistance	T _j =25°C	-	2.7	-	Ω	
C _{iss}	Input Capacitance	V _{DS} =1100V, V _{GS} =0V, f =10kHz	-	55	-	nF	
C _{oss}	Output Capacitance		-	1.8	-	nF	
C _{rss}	Reverse transfer Capacitance		-	0.05	-	nF	
Q _g	Total gate charge	V _{DS} =1100V, I _D =250A, V _{GS} =+20V/-6V	-	1605	-	nC	
t _{d(on)}	Turn-on delay time	V _{DD} =1100V I _D =600A V _{GS} =+20/-6V R _{gon} /R _{goff} =0.75/3.0Ω Inductive load switching operation	T _j =25°C	-	151	-	ns
			T _j =150°C	-	178	-	
t _r	Rise time		T _j =25°C	-	39	-	ns
			T _j =150°C	-	45	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	355	-	ns
			T _j =150°C	-	321	-	
t _f	Fall time		T _j =25°C	-	121	-	ns
			T _j =150°C	-	69	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	18.5	-	mJ
			T _j =150°C	-	16.5	-	
E _{off}	Turn-off power dissipation	T _j =25°C	-	35.6	-	mJ	
		T _j =150°C	-	32.3	-		
R _{th(j-c)}	FET Thermal Resistance	Junction to Case	-	0.039	-	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} = -6V I _{SD} = 600A	T _j = 25°C	-	2.8	-	V
			T _j = 150°C	-	4.5	-	
T _{rr}	Reverse recovery time	V _{DD} = 1100V, I _D = 600A V _{GS} = +20/-6V, R _{gon} /R _{goff} = 0.75/3.0Ω	T _j = 25°C	-	43	-	ns
			T _j = 150°C	-	32	-	
E _{rr}	Diode switching power dissipation	Inductive load	T _j = 25°C	-	1.50	-	mJ
			T _j = 150°C	-	1.35	-	

Test Conditions

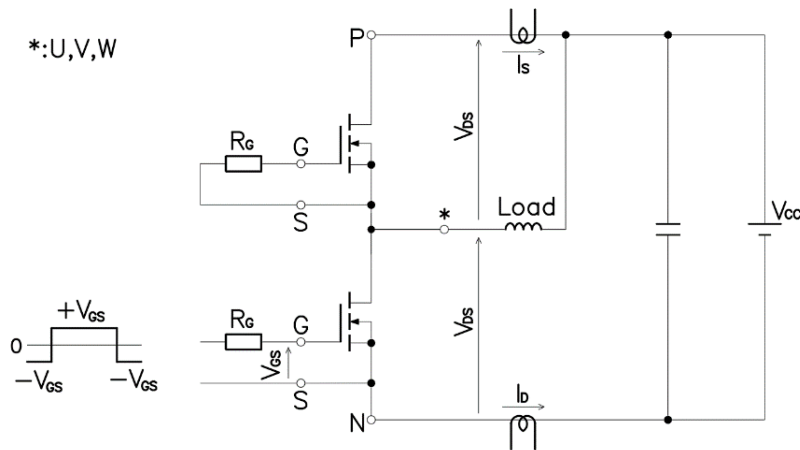


Figure 3. Switching time measure circuit

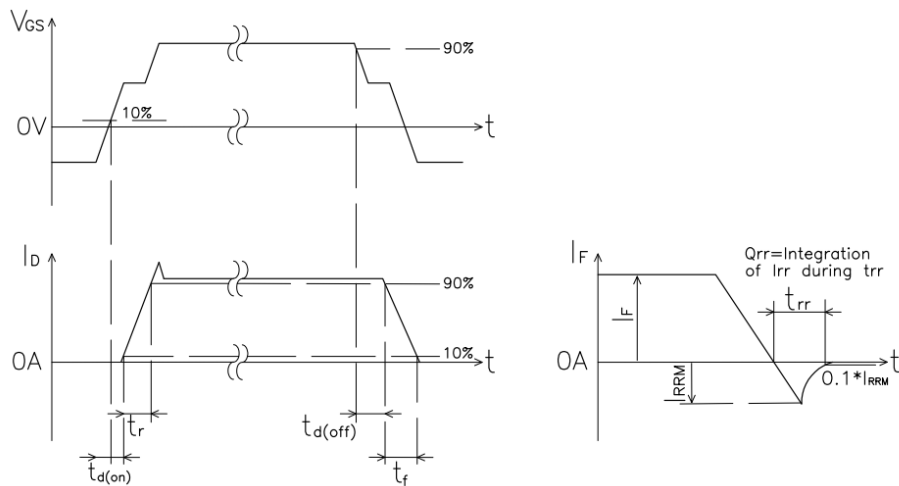


Figure 4. Switching time definition

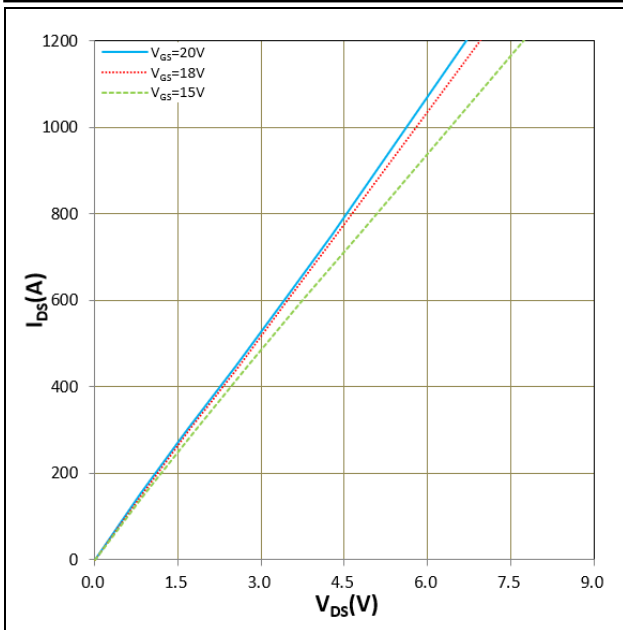


Figure 5. I_{DS} vs V_{DS}
 $T_j = 150^\circ\text{C}$

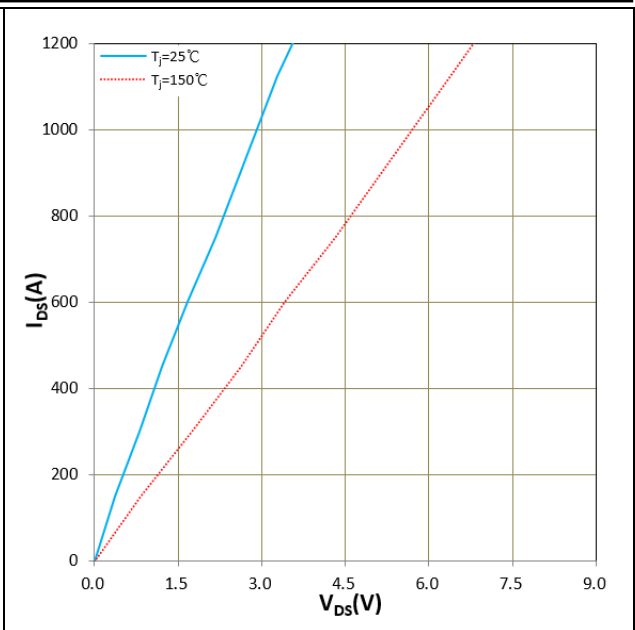


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = +20\text{V}$

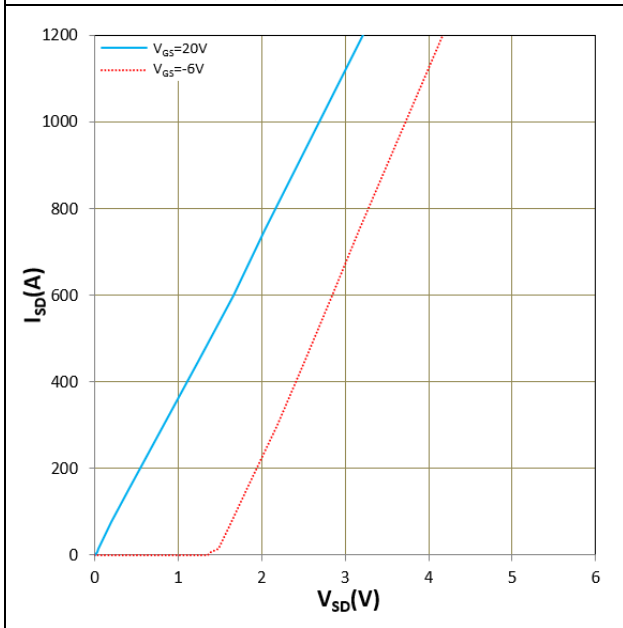


Figure 7. I_{SD} vs $V_{SD} (V_F)$
 $T_j = 25^\circ\text{C}$

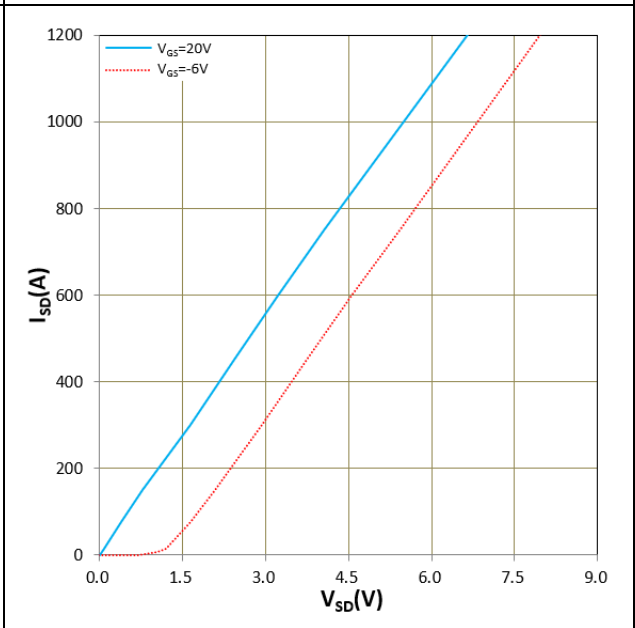


Figure 8. I_{SD} vs $V_{SD} (V_F)$
 $T_j = 150^\circ\text{C}$

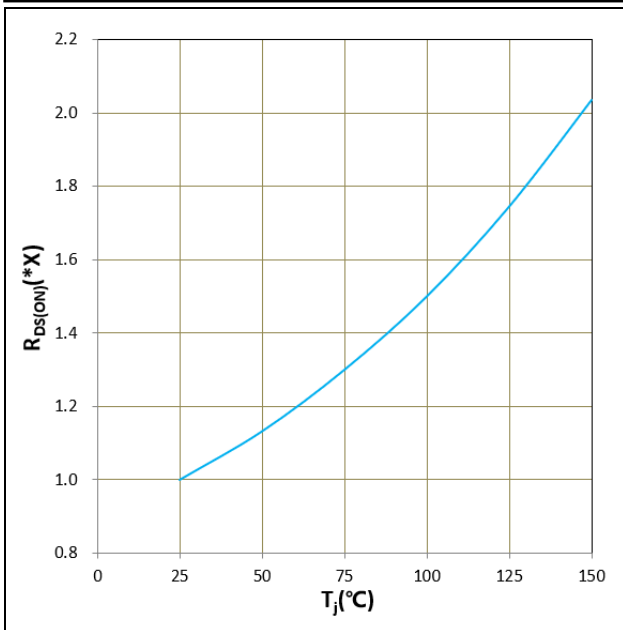


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +20V$, $I_D = 600A$, $1.0X = 2.8m\Omega$

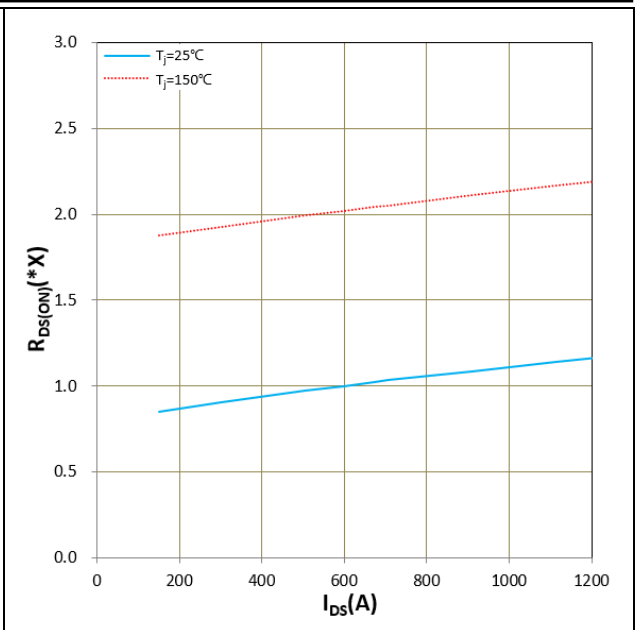


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +20V$, $1.0X = 2.8m\Omega$

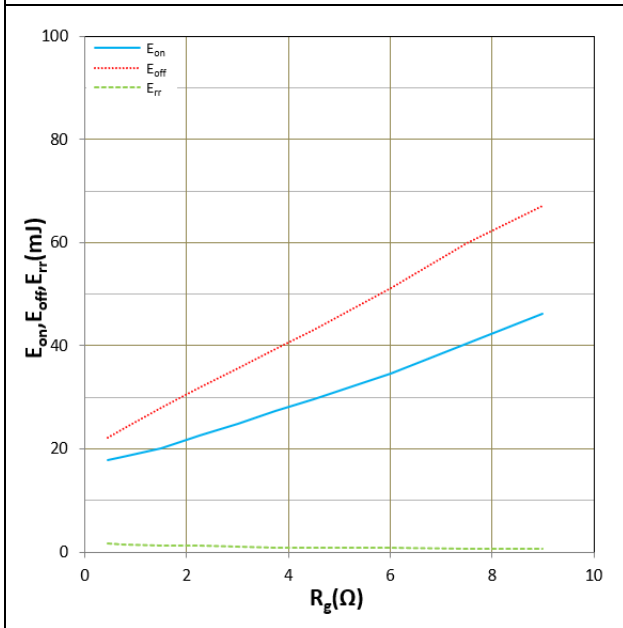


Figure 11. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 25^\circ C$, $V_{DD} = 1100V$, $I_D = 600A$, $V_{GS} = +20V/-6V$
 Inductive Load

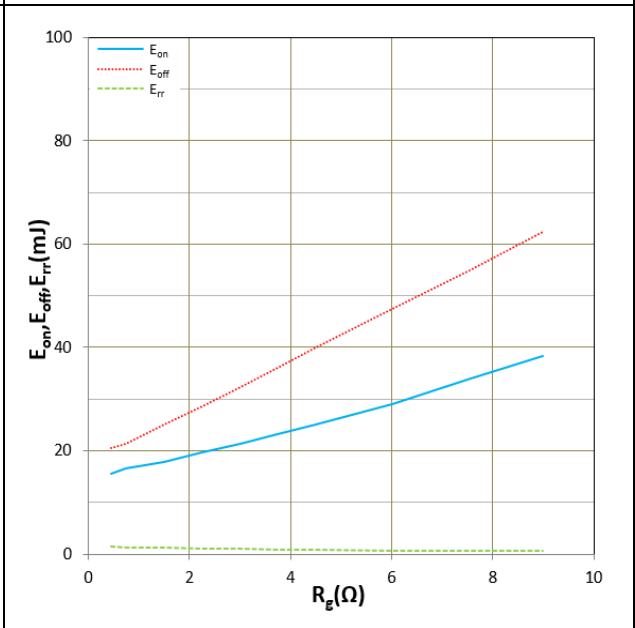


Figure 12. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 150^\circ C$, $V_{DD} = 1100V$, $I_D = 600A$, $V_{GS} = +20V/-6V$
 Inductive Load

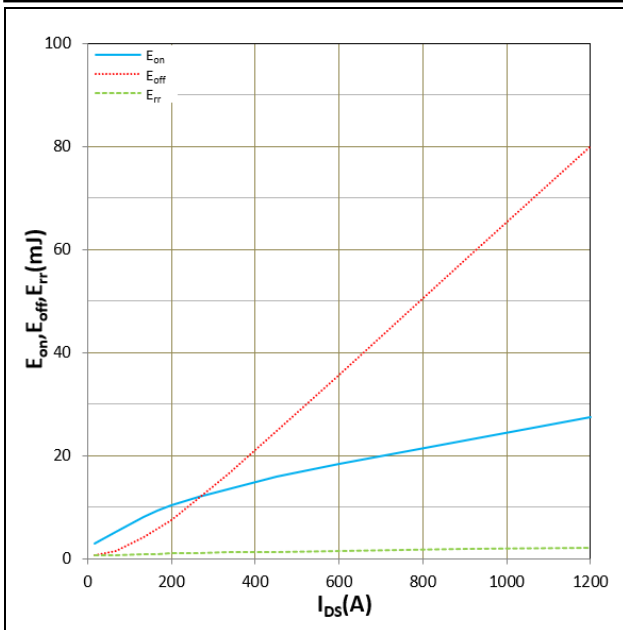


Figure 13. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j = 25^\circ\text{C}$, $V_{DD} = 1100\text{V}$, $R_{GON} / R_{GOFF} = 0.75/3.0\Omega$
 $V_{GS} = +20\text{V}/-6\text{V}$, Inductive Load

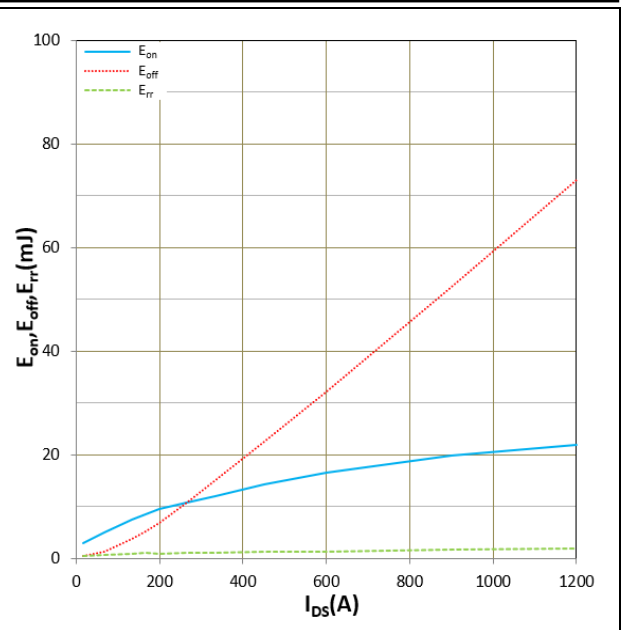


Figure 14. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j = 150^\circ\text{C}$, $V_{DD} = 1100\text{V}$, $R_{GON} / R_{GOFF} = 0.75/3.0\Omega$
 $V_{GS} = +20\text{V}/-6\text{V}$, Inductive Load

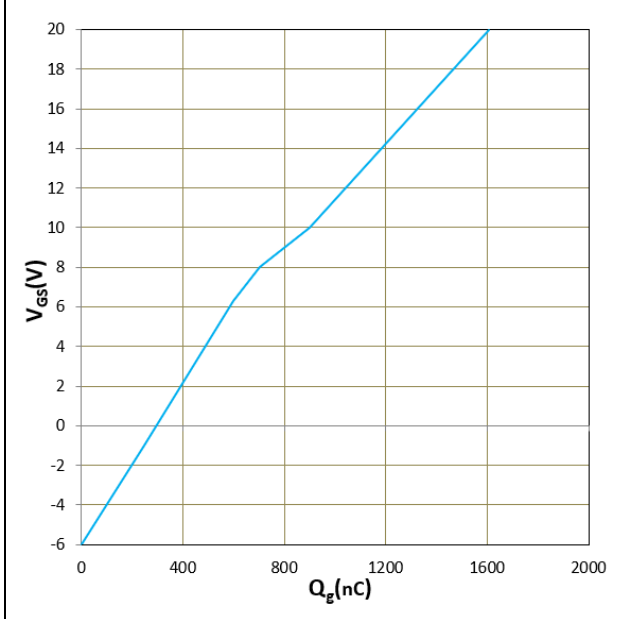


Figure 15. V_{GS} vs Q_g
 $V_{DD} = 1100\text{V}$, $I_D = 250\text{A}$, $T_j = 150^\circ\text{C}$

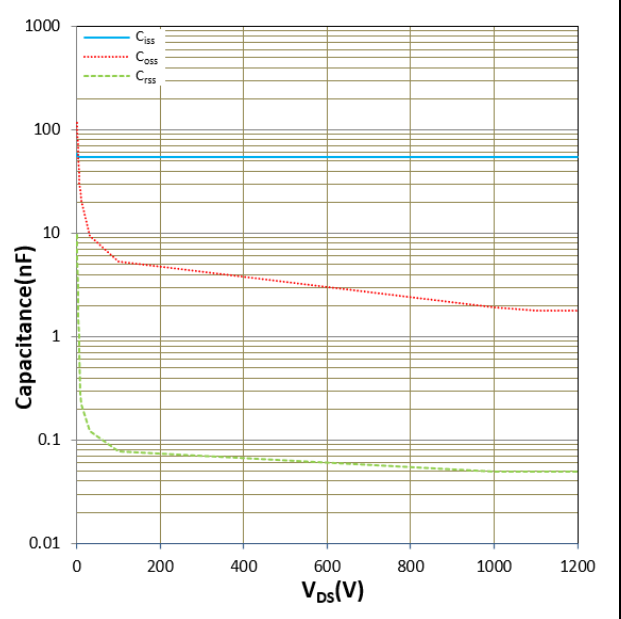
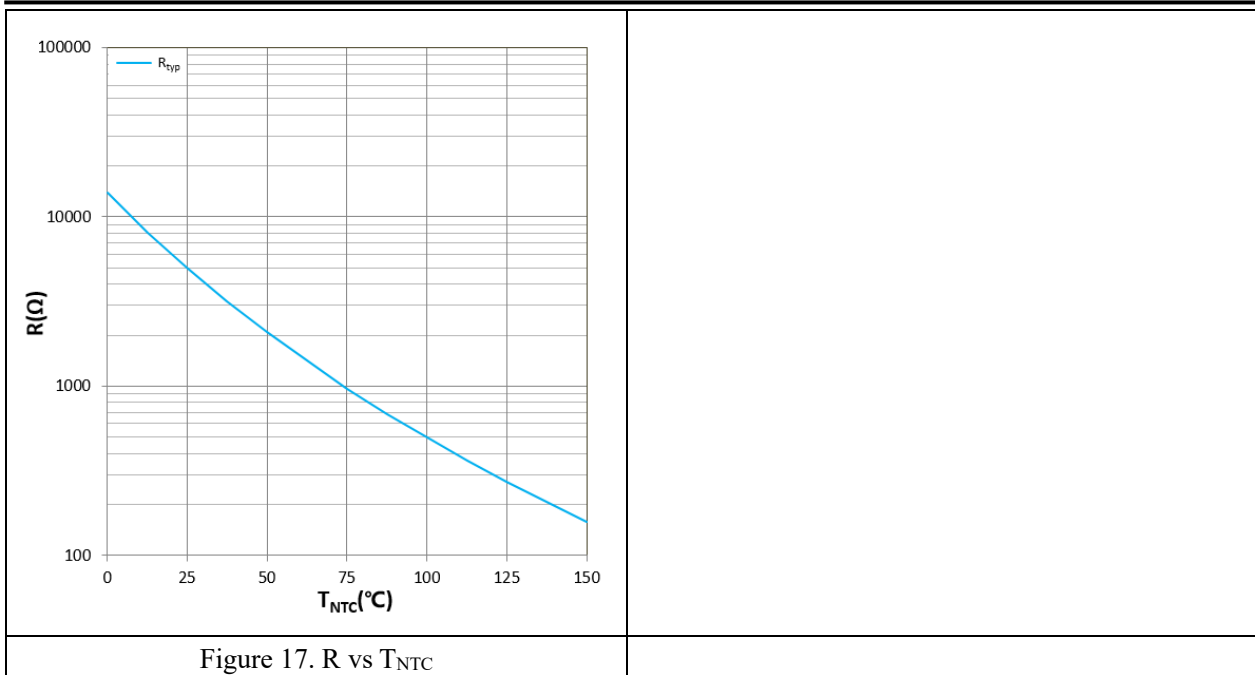


Figure 16. C_{ies} , C_{oss} , C_{rss} vs V_{DS}
 $T_j = 25^\circ\text{C}$, $V_{GS} = 0\text{V}$, $f = 10\text{kHz}$



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