DFS900CL12I4A1

1200V/900A Chopper SiC MOSFET Module

Description

The DFS900CL12I4A1 is a Chopper SiC MOSFET Power Module. It integrates high performance SiC MOSFET and SiC SBD chips designed for the applications such as Motor drives and Renewable energy.

Features

- Blocking voltage: 1200V
- $R_{DS(on)}$ =2.1mΩ (T_j =25°C,V_{GS} =18V)
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses

Applications

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Smart-Grid/Grid-Tied Distributed Generation

Circuit diagram

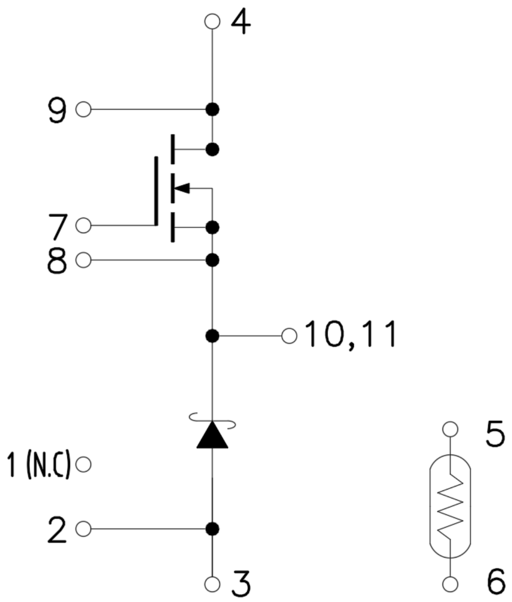


Figure 1. Out drawing & circuit diagram for DFS900CL12I4A1

Pin Configuration and Marking Information

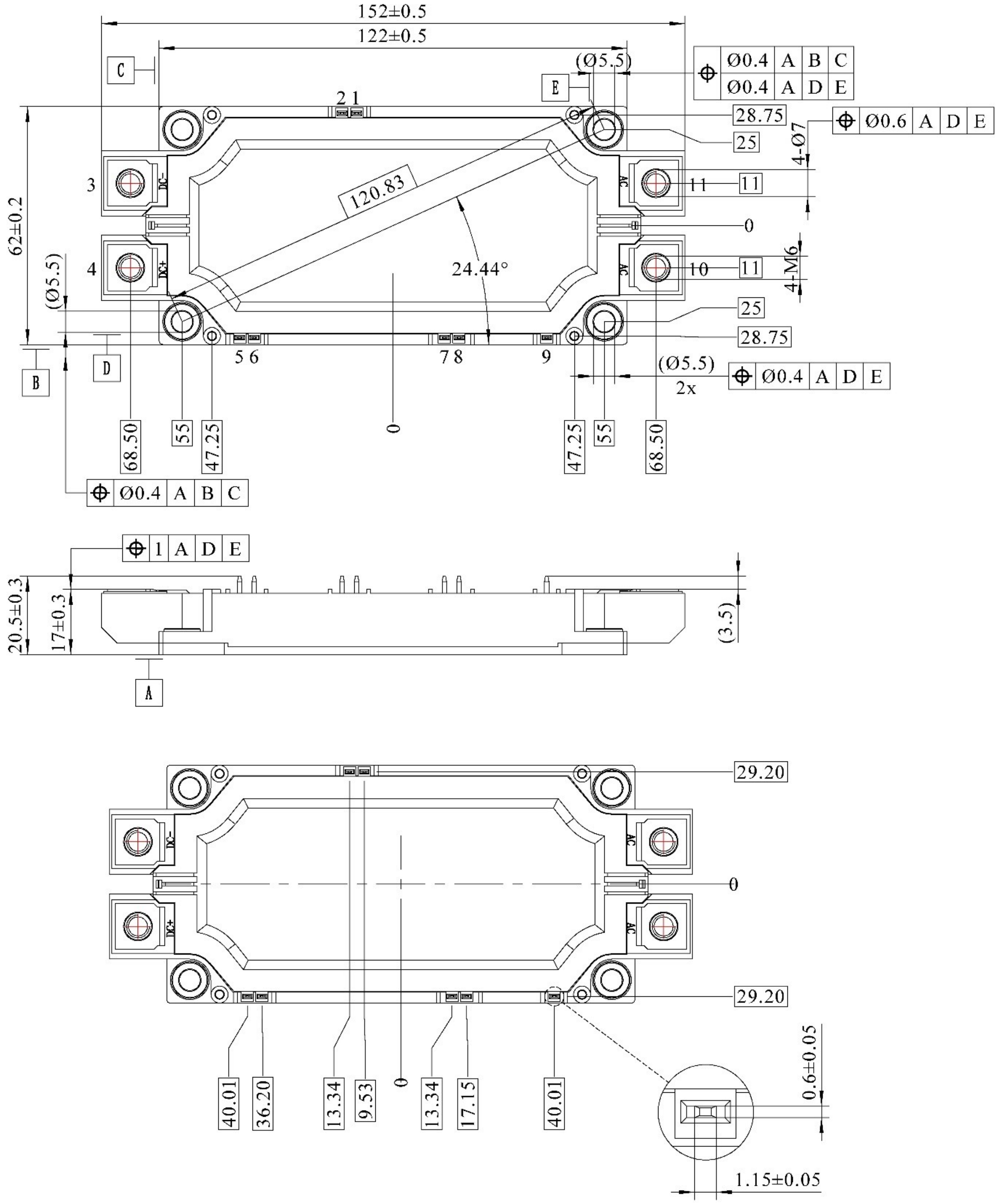


Figure 2. Pin configuration

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 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
Module lead resistance, terminals–chip	T_C =25°C	0.5	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	1200	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} =+18V	930	A
I_{DS}	DC Continuous Drain Current	T_C =80°C, V_{GS} =+18V	745	A
I_{DSM}	Pulse Drain Current	T_C =25°C, Pulse width =1ms, V_{GS} =+18V, Note2	1800	A
I_F	Forward Current (Diode)	-	900	A
I_{FRM}	Pulse Forward Current (Diode)	Less than 1ms, Note2	1800	A
P_{tot}	Total Power Dissipation	T_C=25°C	3330	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +18V/-5V ,+18V/-4V, +15V/-4V

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 (Tj =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 =800μA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS} =1200V, V_{GS} =0V		-	10	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D =160mA V_{DS} =V_{GS}	T_j =25°C	1.9	2.5	4.0	V
			T_j =175°C	-	1.6	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =18V, V_{DS} =0V, T_j =25°C		-	20	2000	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =900A V_{GS} =18V	T_j =25°C	-	2.1	-	mΩ
			T_j =175°C	-	3.8	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =900A V_{GS} =18V	T_j =25°C	-	1.89	-	V
			T_j =175°C	-	3.42	-	V
C_{iss}	Input Capacitance	V_D =1000V, V_{GS} =0V f =100kHz, V_{AC} =25mV		-	38.2	-	nF
C_{oss}	Output Capacitance			-	1.74	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.14	-	nF
Q_G	Total gate charge	V_{DD} =800V, I_D =400A, V_{GS} =+20/-5V		-	1895	-	nC
R_{Gint}	Internal Gate Resistance	T_j =25°C		-	0.9	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =600V I_D =900A V_{GS} =+18/-4V $R_{g(on)}$ =1.5Ω $R_{g(off)}$ =1.5Ω Inductive load switching operation	T_j =25°C	-	51	-	ns
			T_j =150°C	-	42	-	
t_r	Rise time		T_j =25°C	-	41	-	ns
			T_j =150°C	-	39	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	35	-	ns
			T_j =150°C	-	47	-	
t_f	Fall time		T_j =25°C	-	23	-	ns
			T_j =150°C	-	29	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	22.5	-	mJ
			T_j =150°C	-	31.6	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	6.6	-	mJ
			T_j =150°C	-	10.9	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.045	-	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.

SiC SBD Electrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{DC}	DC blocking Voltage	T_j =25°C		1200	-	-	V
V_{BR}	Breakdown Voltage	I_R =16mA, T_j =25°C		1200	-	-	V
V_F	Diode forward Voltage	I_F =900A	T_j =25°C	-	2.00	2.20	V
			T_j =125°C	-	2.90	-	
			T_j =175°C	-	3.70	-	
I_R	Reverse Current	V_R =1200V	T_j =25°C	-	48	800	μA
			T_j =125°C	-	392	-	
			T_j =175°C	-	1544	-	
Q_C	Total capacitive charge	V_R =800V	T_j =25°C	-	2152	-	nC
C	Total capacitance	V_R =800V	f =1MHz		1448		pF
$R_{th(j-c)}$	SiC SBD Thermal Resistance	Junction to Case		-	0.054	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note1		-	0.020	-	K/W

Test Conditions

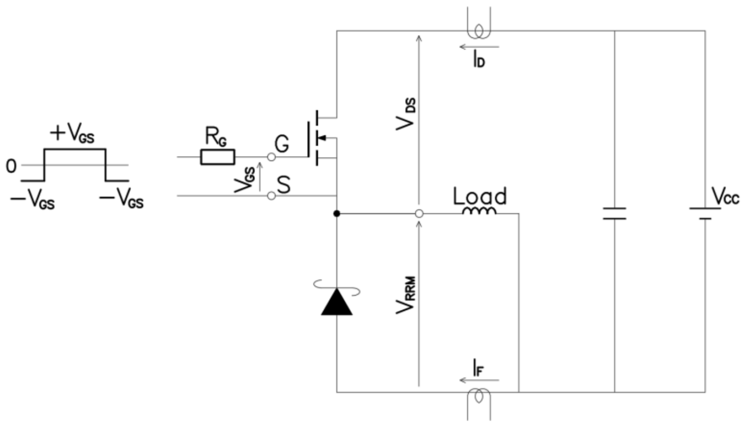


Figure 3. Switching time measure circuit

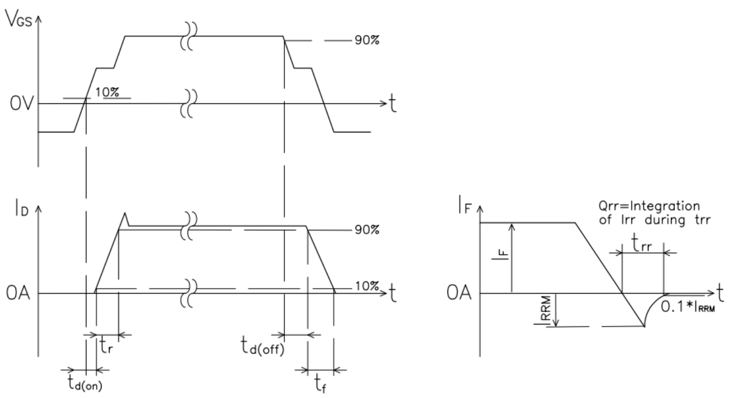
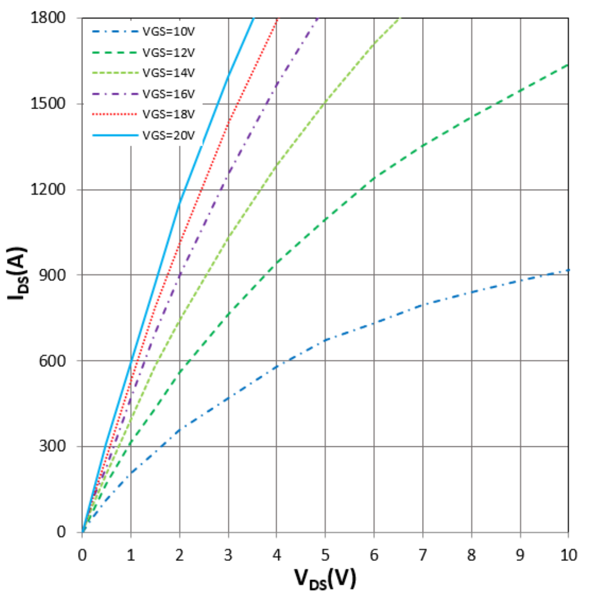


Figure 4. Switching time definition



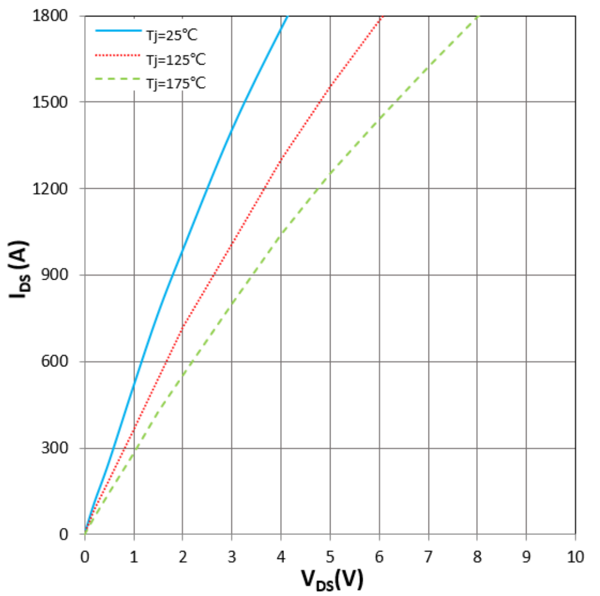
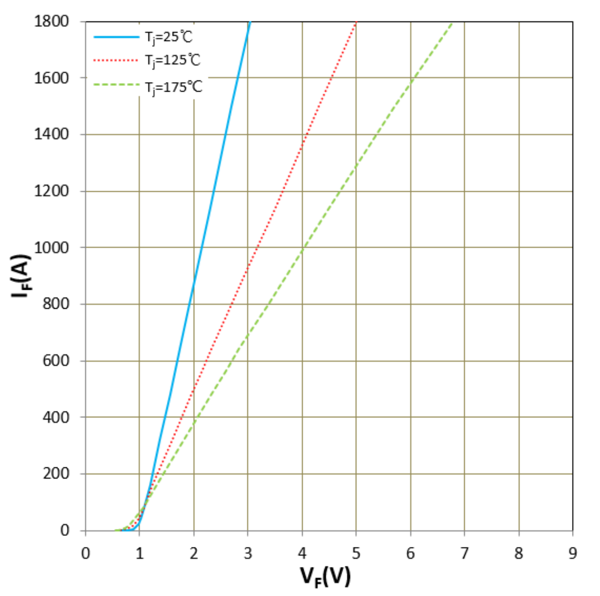


Figure 5. I_{DS} vs V_{DS}

T_j =25°C, V_{GS} parameter

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

V_{GS} =18V, T_j parameter



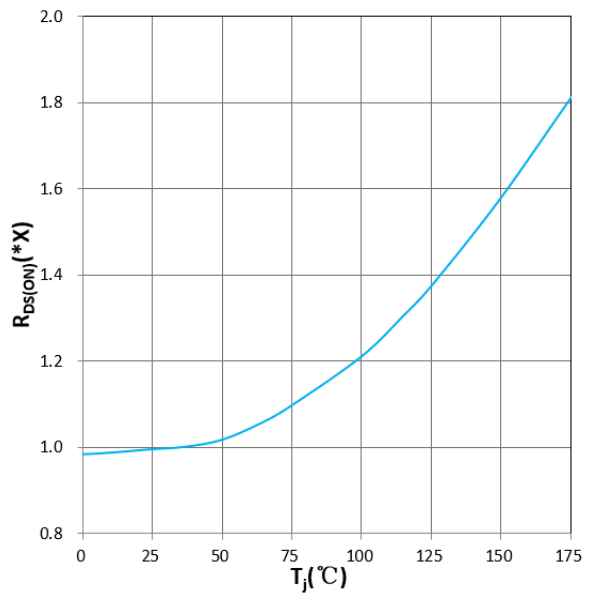


Figure 7. I_F vs V_F

T_j parameter

Figure 8. $R_{DS(ON)}$ vs T_j

V_{GS} =+18V, I_D =900A, 1.0X =2.1mΩ

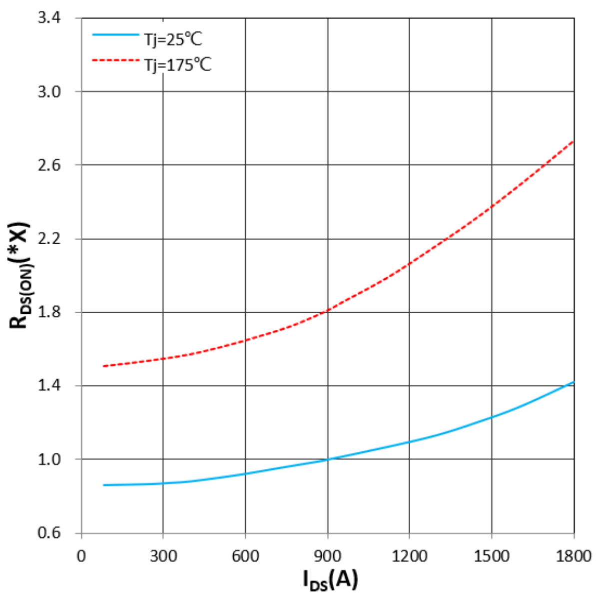


Figure 9. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+18V, 1.0X =2.1mΩ

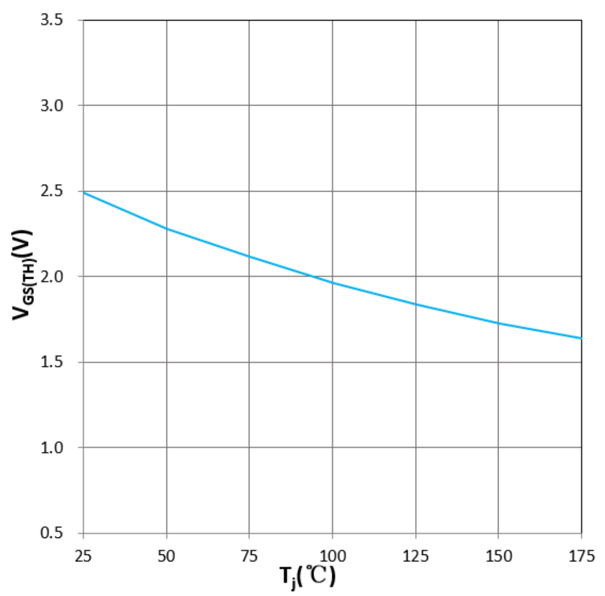


Figure 10. $V_{GS(TH)}$ vs T_j

V_{GS} =V_{DS} , I_D =160mA

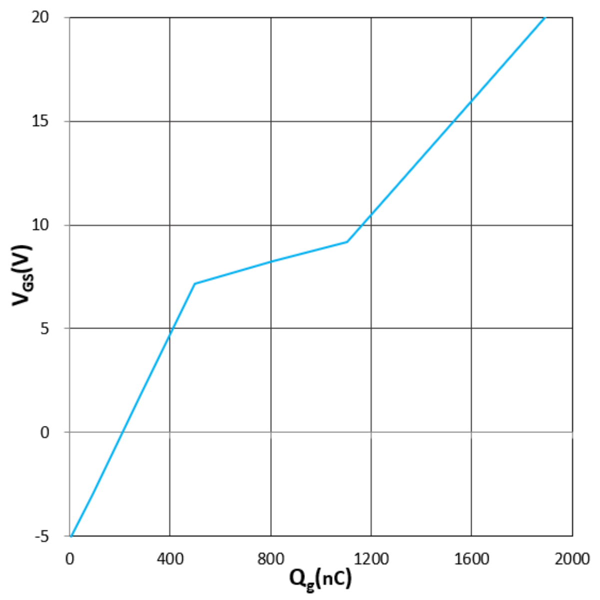


Figure 11. V_{GS} vs Q_g

T_j =25°C, V_{DS} =800V, I_D =400A

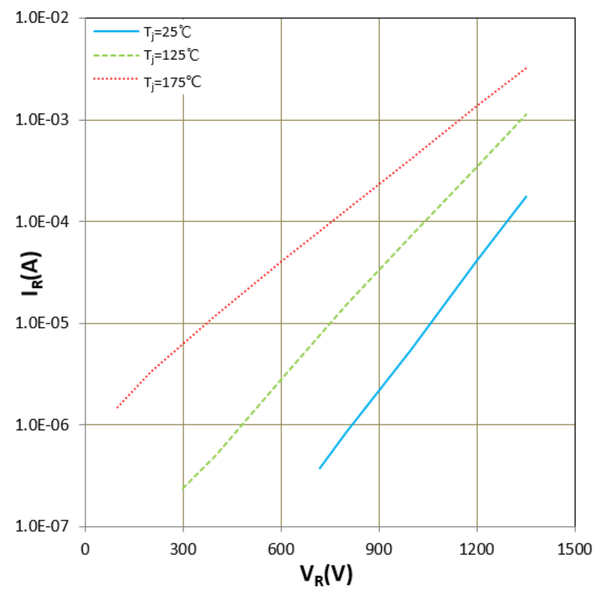


Figure 12. I_R vs V_R

T_j parameter

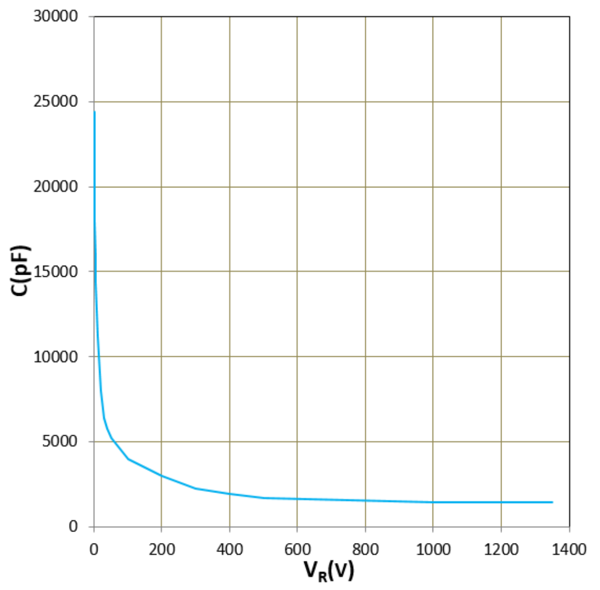


Figure 13. C vs V_R

T_j =25°C

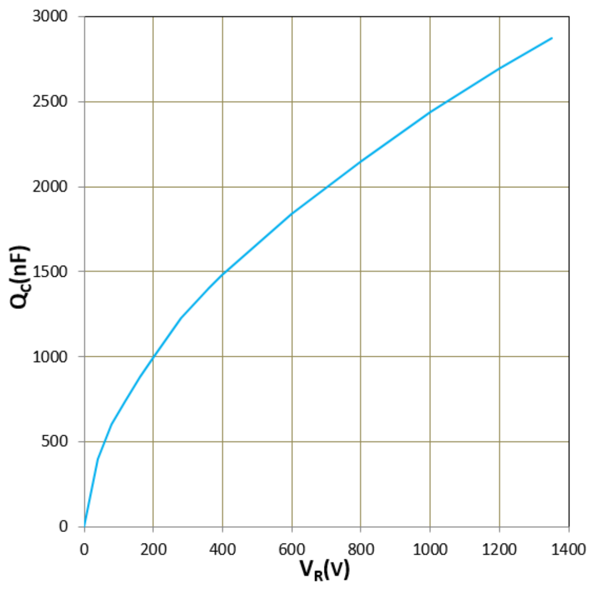


Figure 14. Q_C vs V_R

T_j =25°C

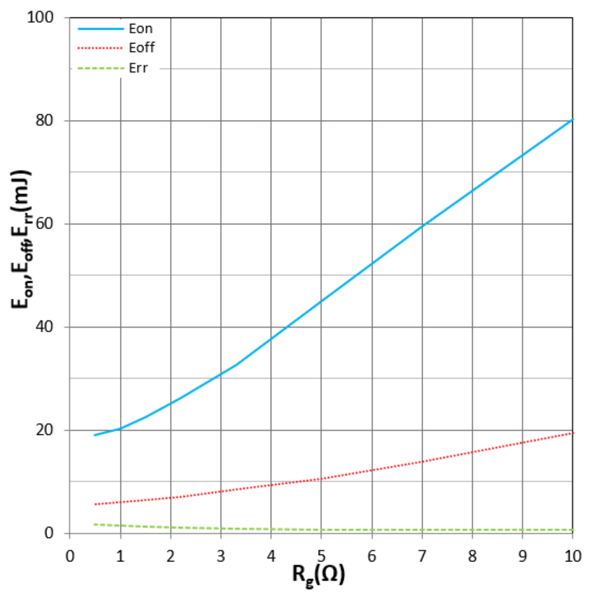


Figure 15. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-4V, I_D =900A

Inductive Load

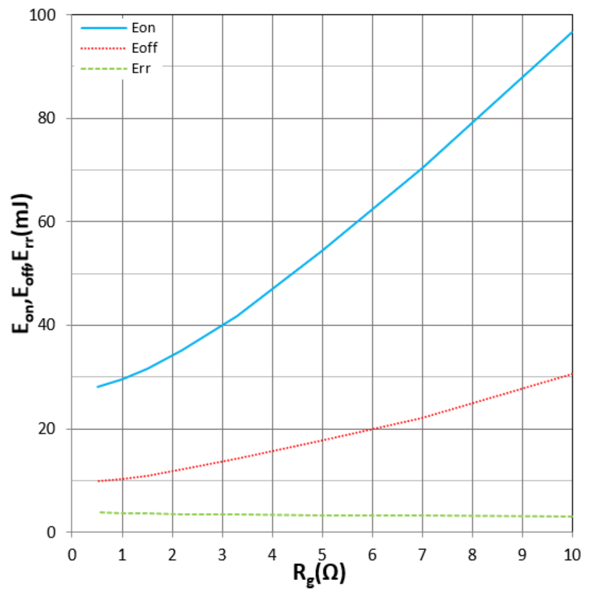


Figure 16. E_{on}, E_{off} , E_{rr} vs R_g

T_j =150°C, V_{DD}=600V, V_{GS} =+18V/-4V, I_D =900A

Inductive Load

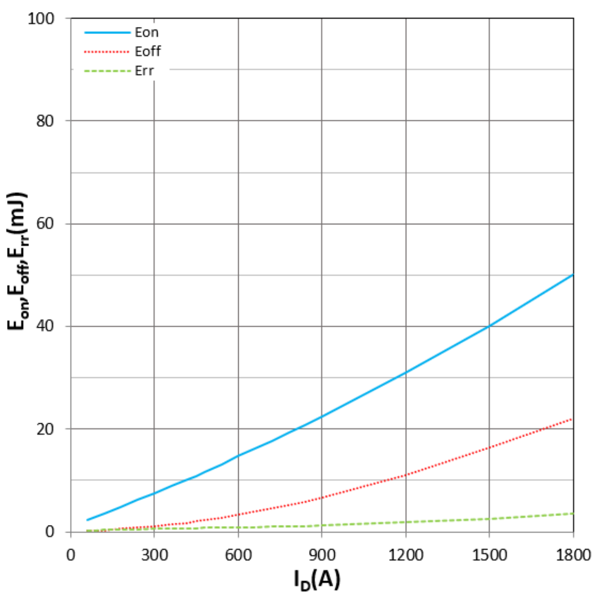


Figure 17. E_{on}, E_{off}, E_{rr} vs I_D
T_j=25°C, V_{DD}=600V, V_{GS}=+18V/-4V, R_g=1.5Ω
Inductive Load

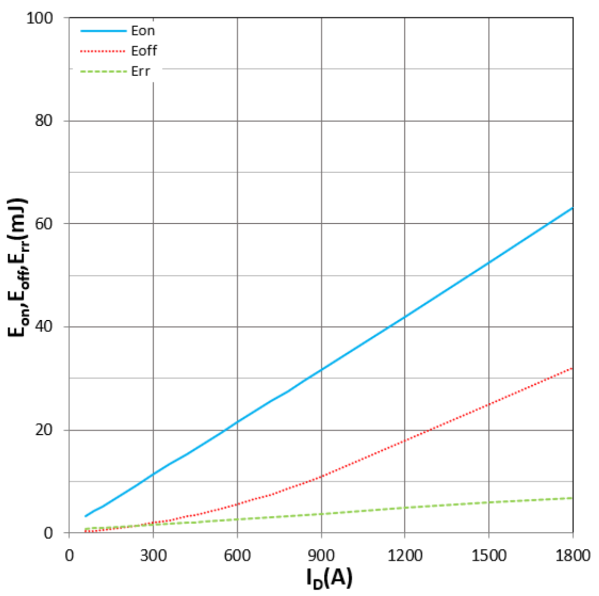


Figure 18. E_{on}, E_{off}, E_{rr} vs I_D
T_j=150°C, V_{DD}=600V, V_{GS}=+18V/-4V, R_g=1.5Ω
Inductive Load

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