

Description

The DFS540HF12DFC1 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:1200V
- $R_{ds(on)} = 2.9m\Omega$
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- 62mm half bridge module

Applications

- Motor Drives
- Vehicle Fast Chargers
- Renewable energy
- UPS

Circuit diagram

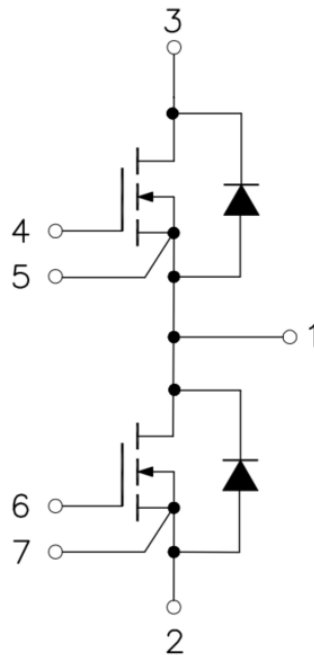


Figure 1. Out drawing & circuit diagram for DFS540HF12DFC2

Pin Configuration and Marking Information

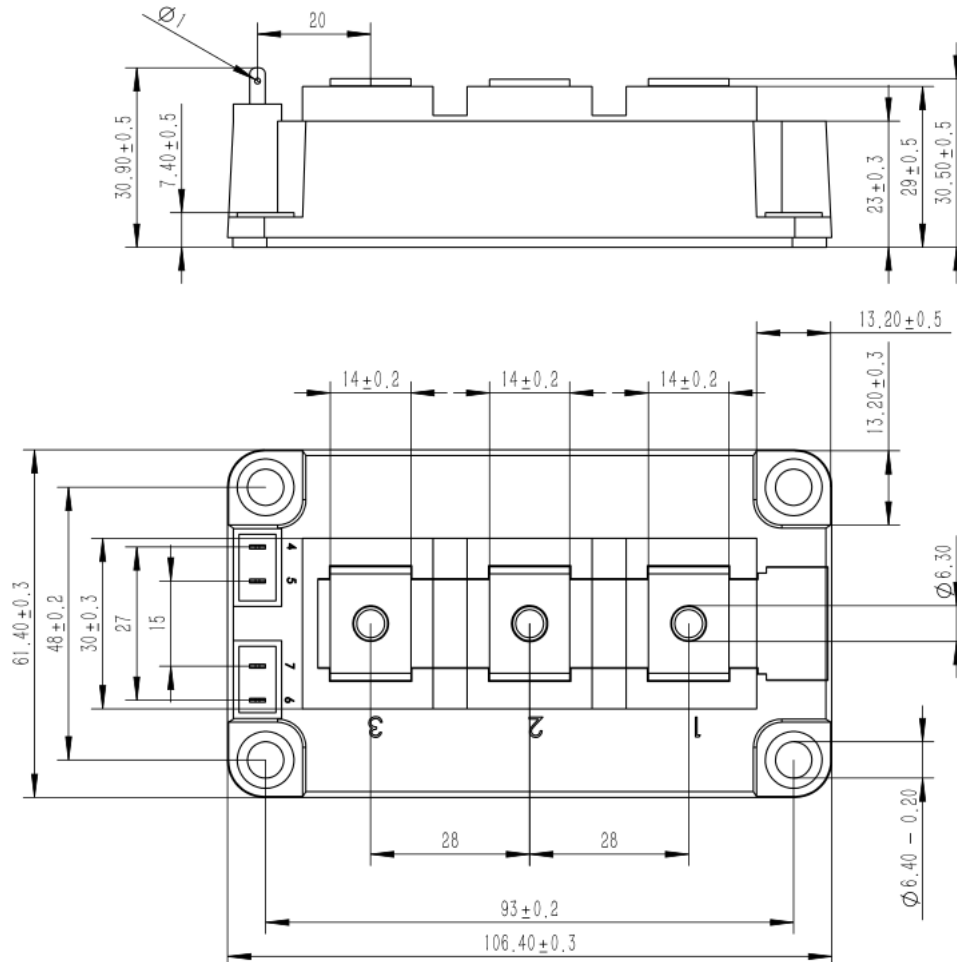


Figure 2. Pin configuration

Module

Parameter	Conditions	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
CTI	-	200	-
Module lead resistance, terminals – chip	T _C =25°C	0.6	mΩ
Mounting torque for module mounting	M6	4 to 6	Nm
Weight	-	320	g

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

Symbol	Parameter	Conditions	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 22	V
I _{DS}	DC Continuous Drain Current	T _C =25°C , V _{GS} =18V	680	A
I _{DS}	DC Continuous Drain Current	T _C =80°C , V _{GS} =18V	540	A
I _{SD}	Source-Drain Current(diode)	T _C =25°C, with ON signal	680	A
I _{SD}	Source-Drain Current(diode)	T _C =80°C, with ON signal	540	A
I _{DSM}	Pulse Drain Current	T _C =25°C, Pulse width =1ms, V _{GS} =18V, Note2	1200	A
P _{tot}	Total Power Dissipation	T _C =25°C	2140	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

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 =600uA		1200	-	-	V
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V		-	6	-	μA
V _{GS(th)}	Gate-source threshold Voltage	I _D =210mA, V _{DS} =V _{GS}	T _j =25°C	1.8	2.7	-	V
			T _j =175°C	-	2.05	-	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V	T _j =25°C	-	-	600	nA
R _{DS(on)} (Chip)	Static drain-source	I _D =540A V _{GS} =+15V	T _j =25°C	-	3.5	-	mΩ
			T _j =175°C	-	5.0	-	mΩ
	On-state resistance	I _D =540A V _{GS} =+18V	T _j =25°C	-	2.9	-	mΩ
			T _j =175°C	-	4.3	-	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =540A V _{GS} =+15V	T _j =25°C	-	1.89	-	V
			T _j =175°C	-	2.70	-	V
	On-state Voltage	I _D =540A V _{GS} =+18V	T _j =25°C	-	1.57	-	V
			T _j =175°C	-	2.32	-	V
C _{iss}	Input Capacitance	V _D =800V, V _{GS} =0V f =100kHz, V _{AC} =25mV		-	34890	-	pF
C _{oss}	Output Capacitance			-	1062	-	pF
C _{rss}	Reverse transfer Capacitance			-	86	-	pF
R _{Gint}	Internal gate resistor	f =100kHz, V _{AC} =25mV		-	1.1	-	Ω
Q _g	Total gate charge	V _{DD} =800V, I _D =360A, V _{GS} =+18/-4V		-	1260	-	nC
t _{d(on)}	Turn-on delay time	V _{DD} =600V I _D =540A V _{GS} =+18/-4V R _{gon} /R _{goff} =3.3Ω/3.3Ω Inductive load switching operation	T _j =25°C	-	90	-	ns
			T _j =150°C	-	77	-	
t _r	Rise time		T _j =25°C	-	55	-	ns
			T _j =150°C	-	47	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	171	-	ns
			T _j =150°C	-	199	-	
t _f	Fall time		T _j =25°C	-	12	-	ns
			T _j =150°C	-	21	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	16.6	-	mJ
			T _j =150°C	-	15.9	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	18.4	-	mJ
			T _j =150°C	-	20.1	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.07	-	°C /W

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} = -5V I _{SD} = 540A	T _j = 25°C T _j = 175°C	- 6.0 5.3	- - -	V
T _{rr}	Reverse recovery time	V _{DD} = 600V I _D = 540A	T _j = 25°C T _j = 150°C	- 31 44	- - -	ns
Q _{rr}	Reverse recovery charge	V _{GS} = +18/-4V R _{gon} /R _{goff} = 3.3Ω/3.3Ω	T _j = 25°C T _j = 150°C	- 1.92 5.79	- - -	uC
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j = 25°C T _j = 150°C	- 0.53 1.86	- - -	mJ

Test Conditions

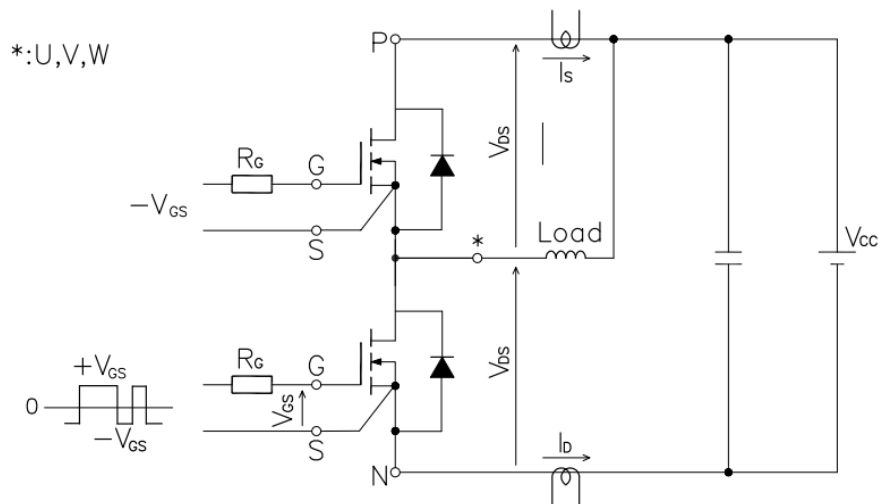


Figure 3. Switching time measure circuit

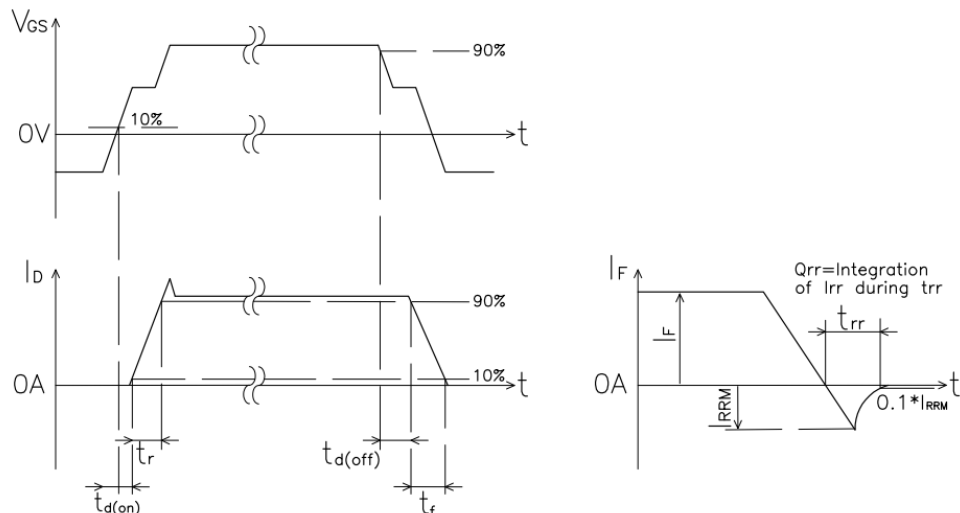


Figure 4. Switching time definition

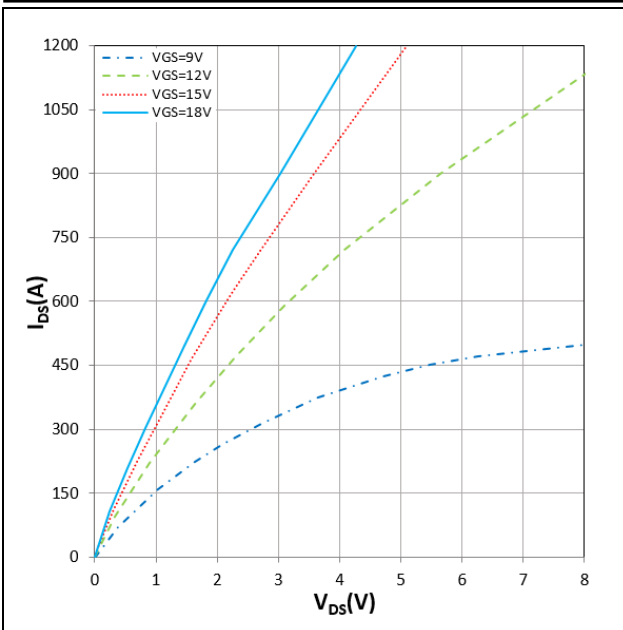


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

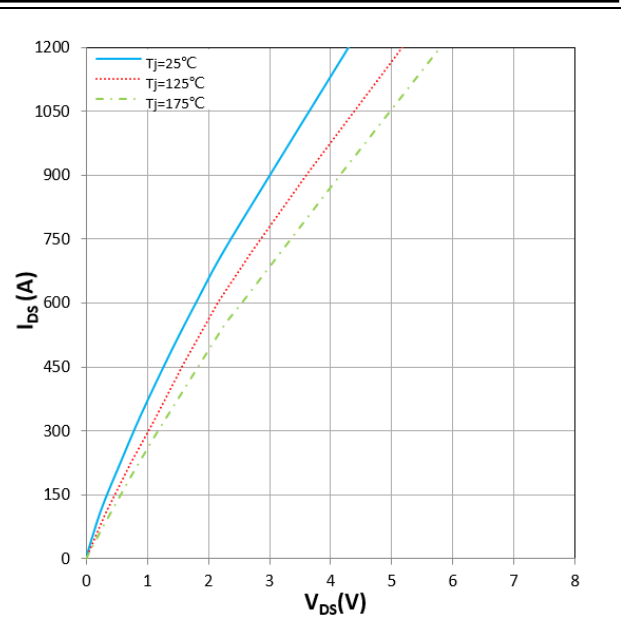


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = +18\text{V}$

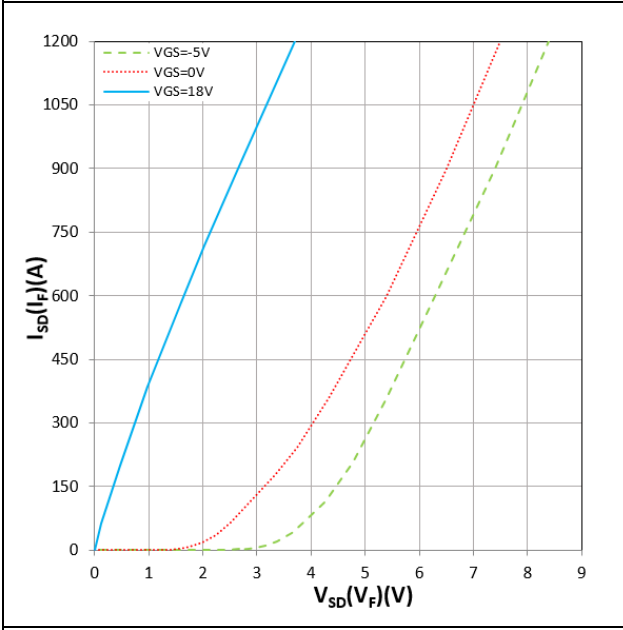


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

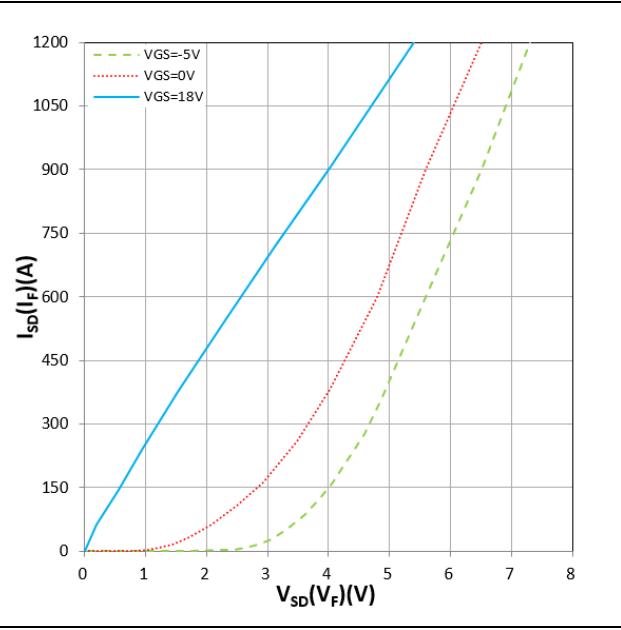


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

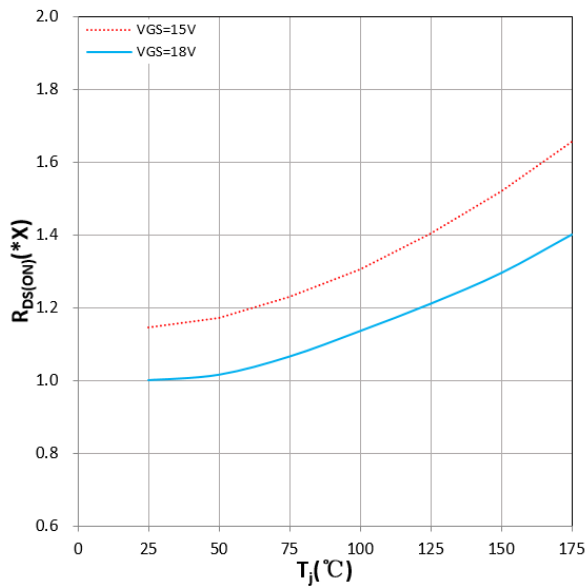


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +15V/+18V$, $I_D = 540A$, $1.0X = 2.9m\Omega$

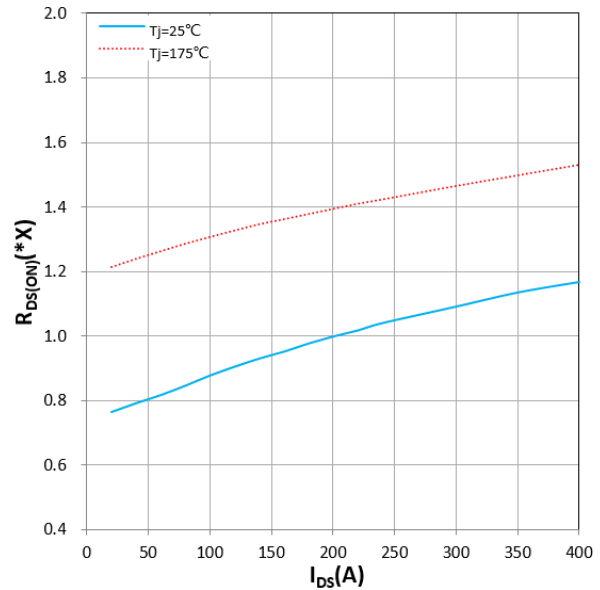


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +18V$, $1.0X = 2.9m\Omega$

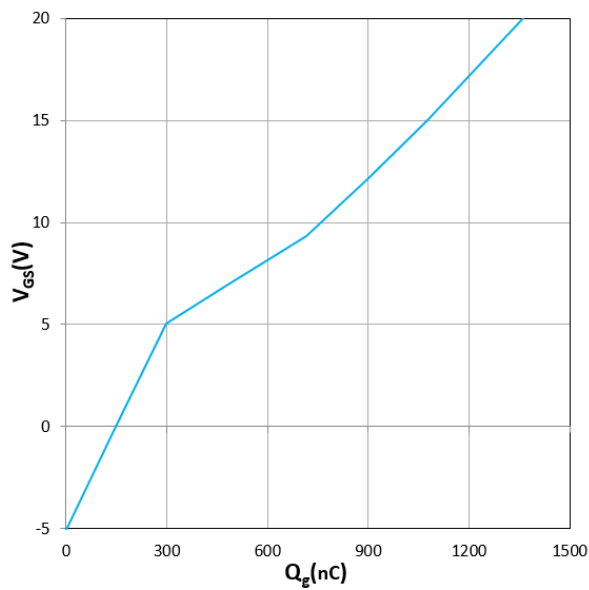


Figure 11. V_{GS} vs Q_g
 $V_{DS} = 800V$, $I_D = 360A$, $T_j = 25^\circ C$

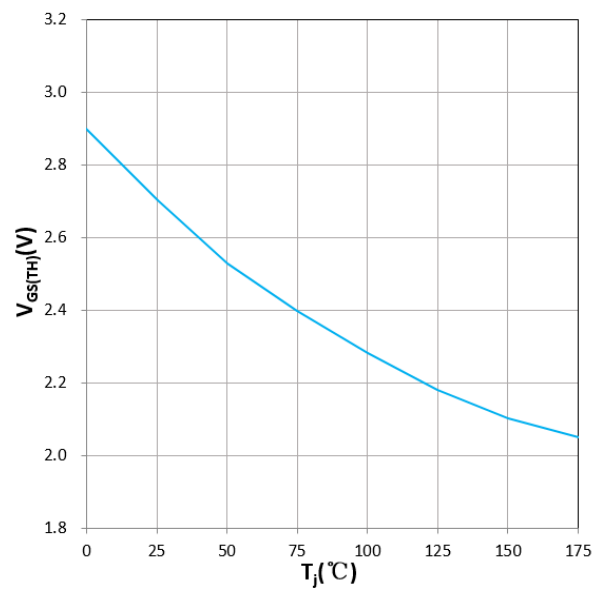


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 210mA$

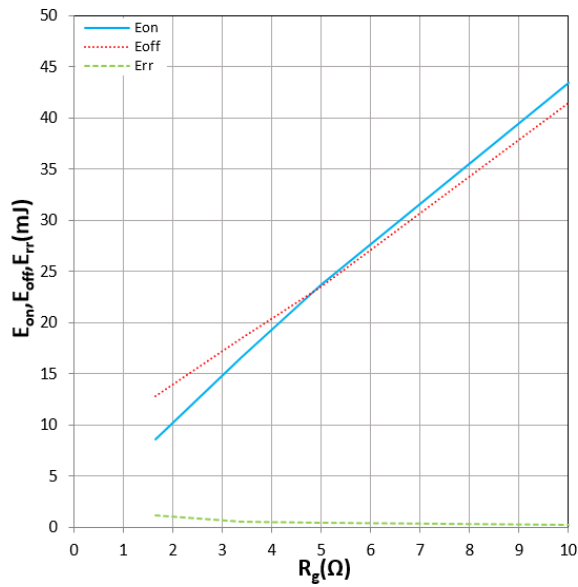


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=25^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-4\text{V}$, $I_D=540\text{A}$
 Inductive Load

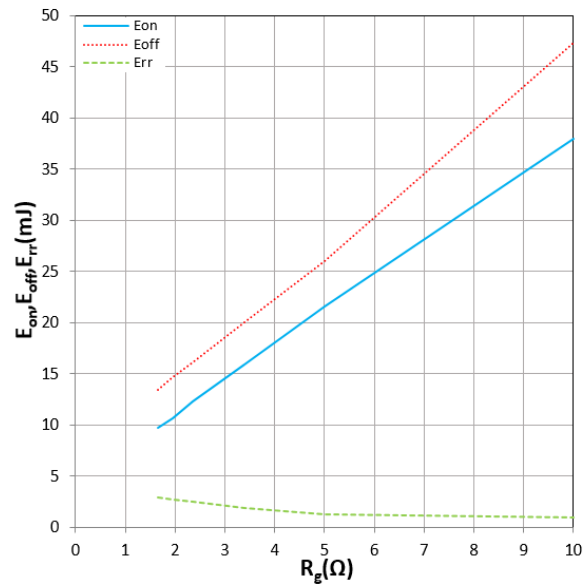


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=150^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-4\text{V}$, $I_D=540\text{A}$
 Inductive Load

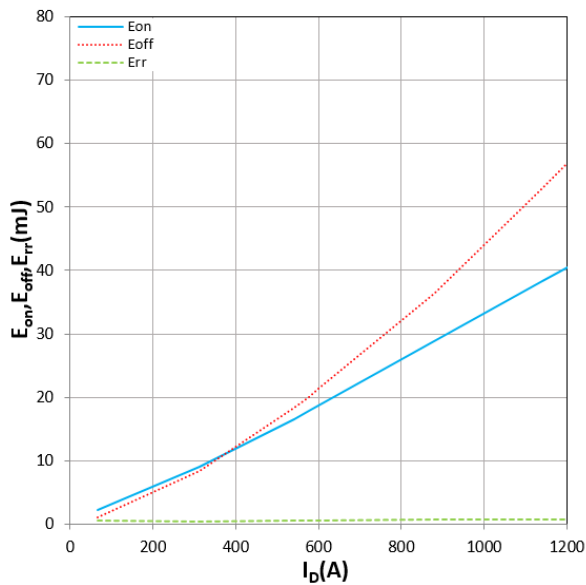


Figure 15. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j=25^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-4\text{V}$
 $R_{gon}/R_{goff}=3.3\Omega/3.3\Omega$, Inductive Load

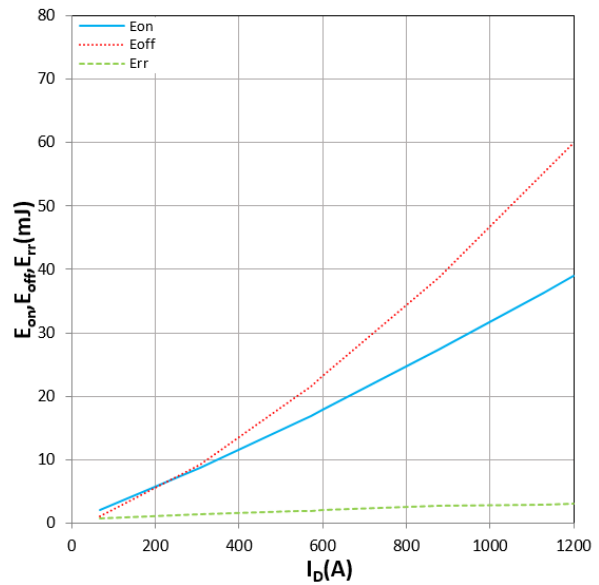


Figure 16. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j=150^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-4\text{V}$
 $R_{gon}/R_{goff}=3.3\Omega/3.3\Omega$, Inductive Load

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