DFS400HF17DFC1

1700V/400A Half Bridge SiC MOSFET Module

Description

The DFS400HF17DFC1 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips and SiC Diode designed for the applications such as Motor drives and Renewable energy.

Features

- Blocking voltage:1700V
- $R_{ds(on)}$ =4.3mΩ
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- 62mm half bridge module

Applications

- Motor Drives
- Solar and Wind inverter Systems
- Renewable energy
- UPS

Circuit diagram

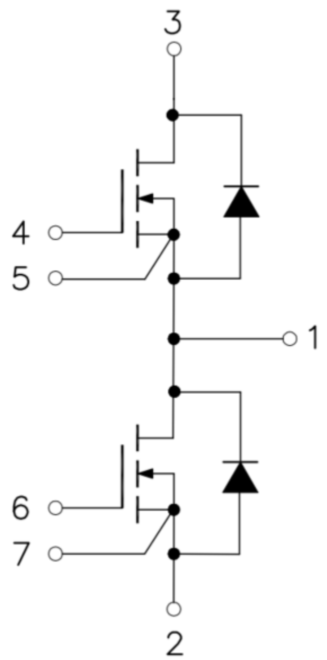

Figure 1. Out drawing & circuit diagram for DFS400HF17DFC1

Pin Configuration and Marking Information

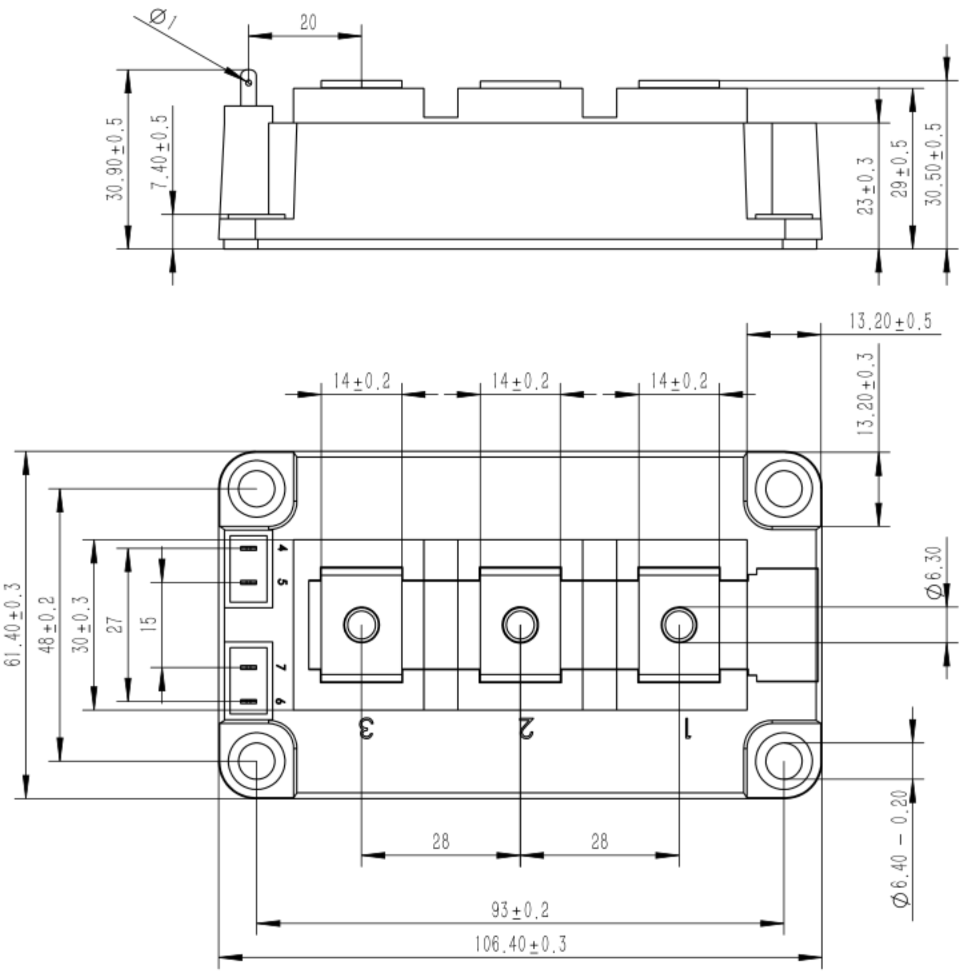

Figure 2. Pin configuration

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 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
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	Condition	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1700	V
V_{GSS}	Gate-Sourse Voltage	D-S Short, AC frequency ⩾1Hz, Note1	-10 to 20	V
I_{DS}	DC Continuous Drain Current	T_C =25°C , V_{GS} =+15V	500	A
I_{DS}	DC Continuous Drain Current	T_C =80°C , V_{GS} =+15V	400	A
I_{SD}	Source-Drain Current(diode)	T_C =25°C, with ON signal	500	A
I_{SD}	Source-Drain Current(diode)	T_C =80°C, with ON signal	400	A
I_{DSM}	Pulse Drain Current	T_C =25°C, Pulse width =1ms, V_{GS} =+15V, Note2	800	A
P_{tot}	Total Power Dissipation	T_C =25°C	2020	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

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

Note2: Pulse width limited by maximum junction temperature

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_F	Diode Forward Voltage	I_F =400A, V_{GS} =0V	T_j =25°C	-	1.65	-	V
			T_j =175°C	-	2.55	-	
t_{rr}	Diode Reverse Recovery Time	(Switch side) V_{DD} =900V, I_D =400A V_{GS} =+15V/-4V R_{gon}/R_{goff} =2.2Ω/2.2Ω (FRD side) V_{RR}=900V, I_F=400A V_{GE}=+15V/-4V Inductive load switching operation	T_j =25°C	-	27	-	ns
			T_j =150°C	-	38	-	
I_{RM}	Peak reverse recovery Current		T_j =25°C	-	77	-	A
			T_j =150°C	-	165	-	
Q_{rr}	Recovered charge		T_j=25°C	-	1.18	-	uC
			T_j =150°C	-	3.12	-	
E_{rr}	Reverse recovered energy		T_j =25°C	-	0.4	-	mJ
			T_j =150°C	-	0.6	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-	0.056	-	°C/W

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 =400μA		1700	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS} =1200V, V_{GS} =0V		-	4	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D =240mA, V_{DS} =V_{GS}	T_j =25°C	1.8	2.7	-	V
			T_j =175°C	-	1.9	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V	T_j =25°C	-	25	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =400A V_{GS} =15V	T_j =25°C	-	4.3	-	mΩ
			T_j =175°C	-	7.1	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =400A V_{GS} =15V	T_j =25°C	-	1.72	-	V
			T_j =175°C	-	2.84	-	V
C_{iss}	Input Capacitance	V_D =1000V, V_{GS} =0V f =1MHz, V_{AC} =25mV		-	30480	-	pF
C_{oss}	Output Capacitance			-	820	-	pF
C_{rss}	Reverse transfer Capacitance			-	151	-	pF
R_{Gint}	Internal gate resistor	f =1MHz, V_{AC} =25mV		-	1.7	-	Ω
Q_g	Total gate charge	V_{DD} =1000V, I_D =300A, V_{GS} =+15/-4V		-	1030	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD} =900V I_D =400A V_{GS} =+15/-4V R_{gon}/R_{goff} =2.2Ω/2.2Ω Inductive load switching operation	T_j =25°C	-	118	-	ns
			T_j =150°C	-	108	-	
t_r	Rise time		T_j =25°C	-	68	-	ns
			T_j =150°C	-	58	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	232	-	ns
			T_j =150°C	-	261	-	
t_f	Fall time		T_j =25°C	-	60	-	ns
			T_j =150°C	-	64	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	27.9	-	mJ
			T_j =150°C	-	23.7	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	12.9	-	mJ
			T_j =150°C	-	13.6	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.074	-	°C /W

Test Conditions

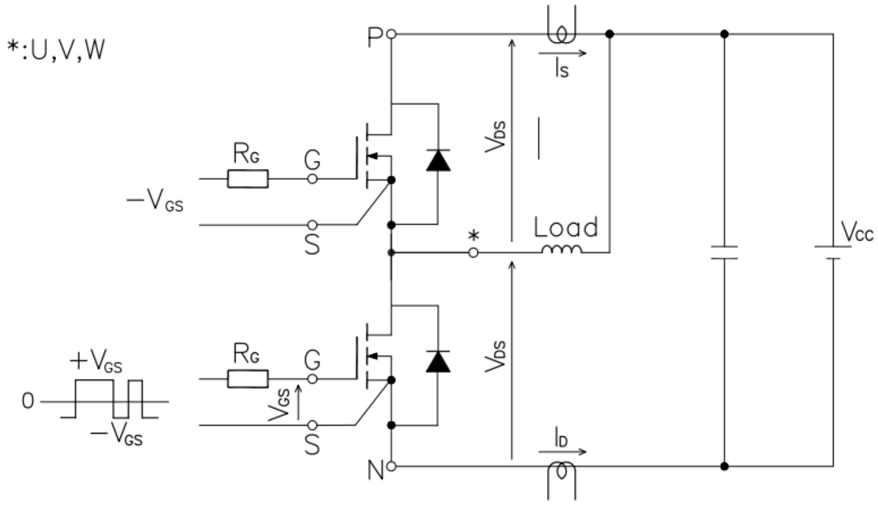

Figure 3. Switching time measure circuit

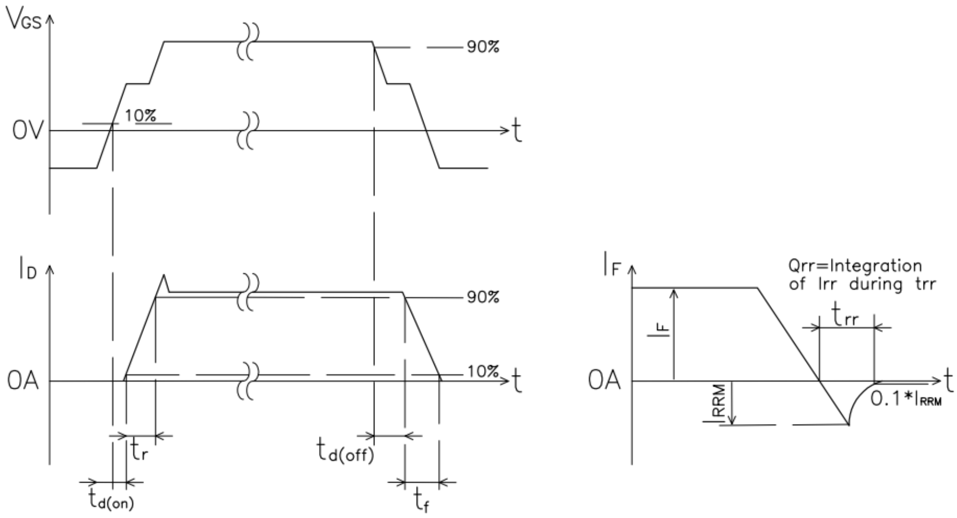

Figure 4. Switching time definition

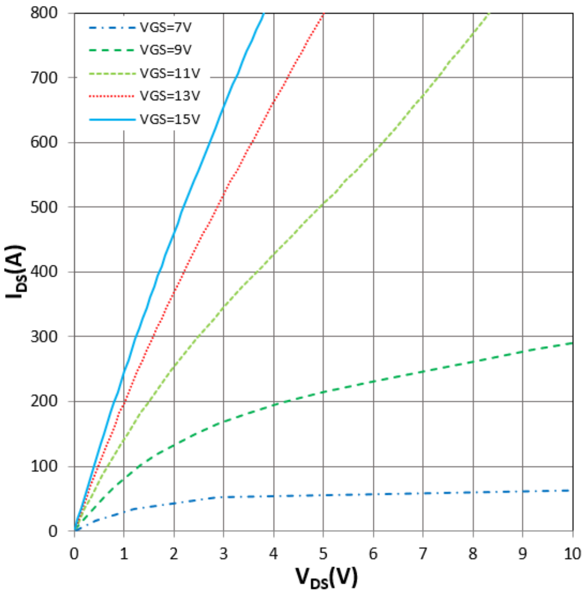

Figure 5. I_{DS} vs V_{DS}

T_j =25°C

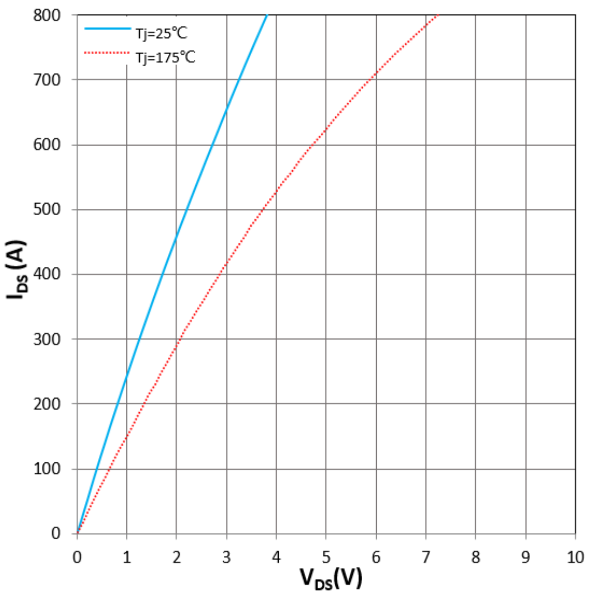

Figure 6. I_{DS} vs V_{DS}

V_{GS} =+15V

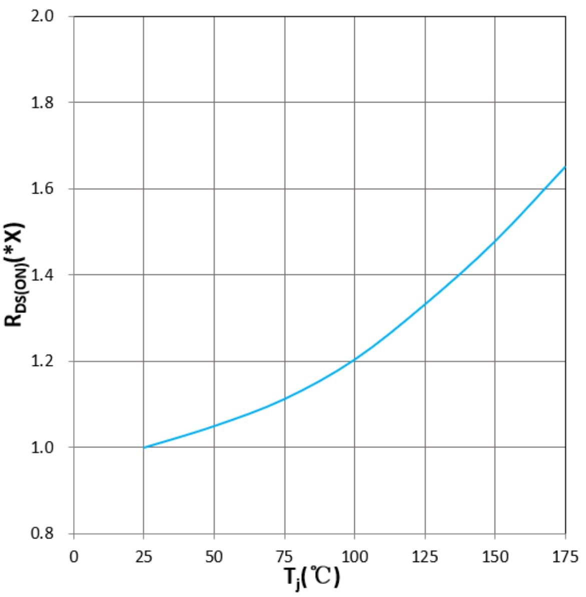

Figure 7. $R_{DS(ON)}$ vs T_j

V_{GS} =+15V, I_D =400A, 1.0X =4.3mΩ

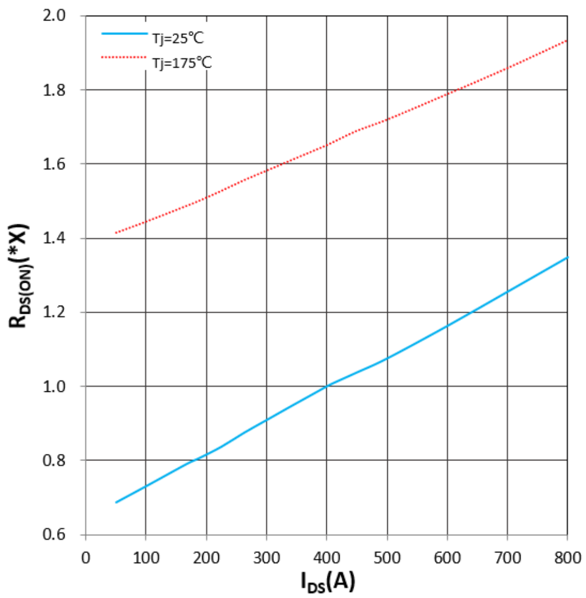

Figure 8. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+15V, 1.0X =4.3mΩ

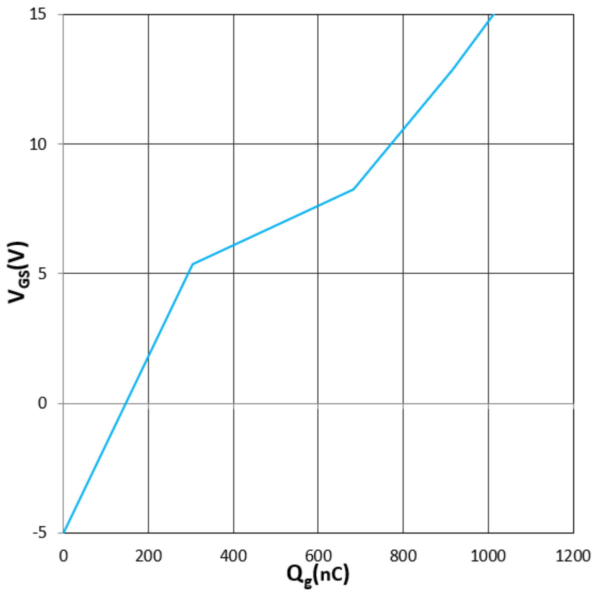

Figure 9. V_{GS} vs Q_g

V_{DS} =1000V, I_D =300A, T_j =25℃

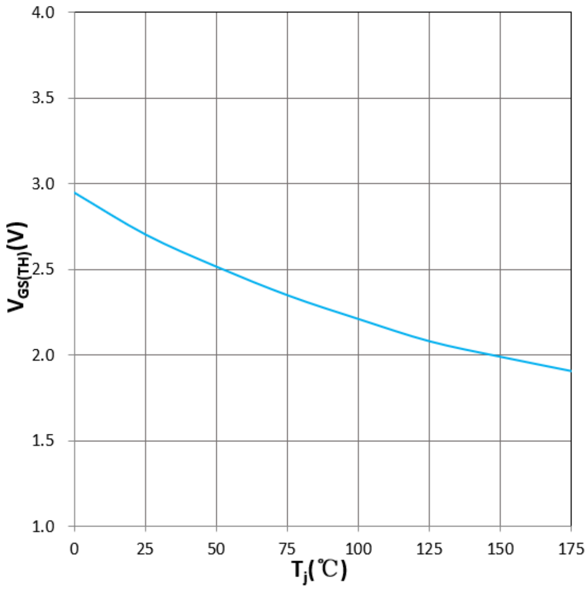

Figure 10. $V_{GS(TH)}$ vs T_j

V_{GS} =V_{DS}, I_D =240mA

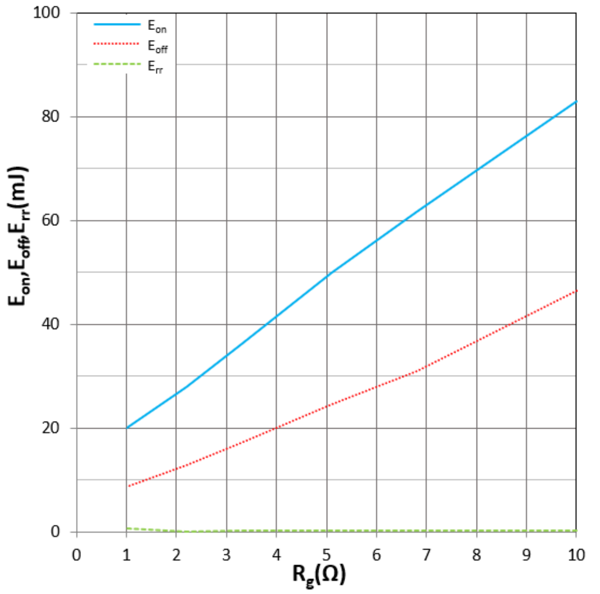

Figure 11. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{DD} =900V, V_{GS} =+15V/-4V, I_D =400A

Inductive Load

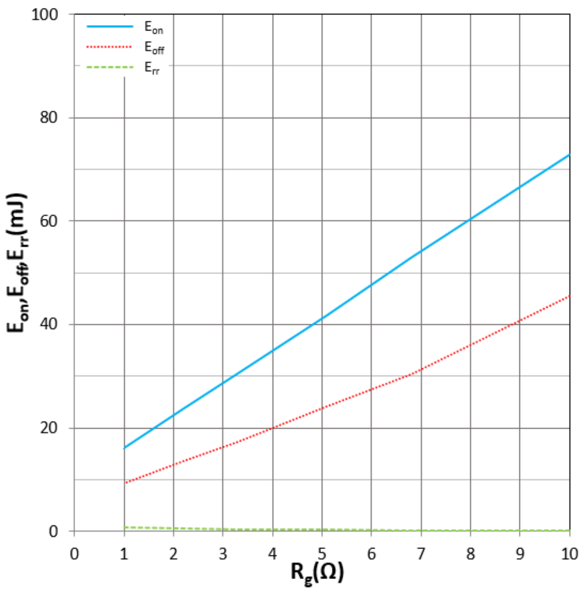

Figure 12. E_{on}, E_{off}, E_{rr} vs R_g

T_j =150°C, V_{DD} =900V, V_{GS} =+15V/-4V, I_D =400A

Inductive Load

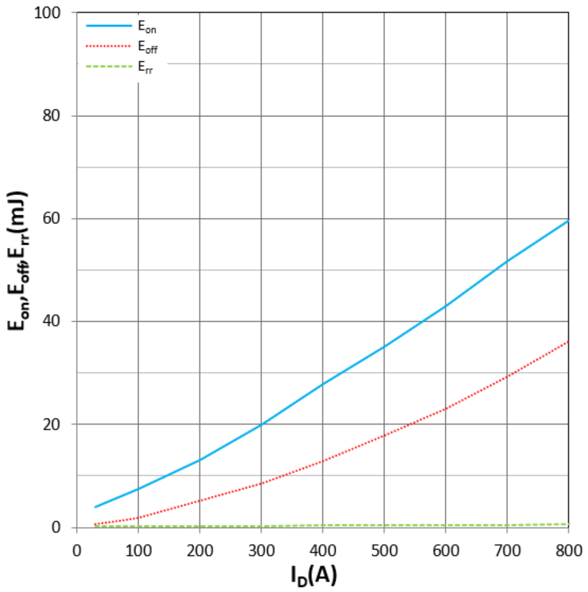

Figure 13. E_{on}, E_{off}, E_{rr} vs I_{DS}

T_j =25°C, V_{DD} =900V, V_{GS} =+15V/-4V

R_{gon}/R_{goff} =2.2Ω/2.2Ω, Inductive Load

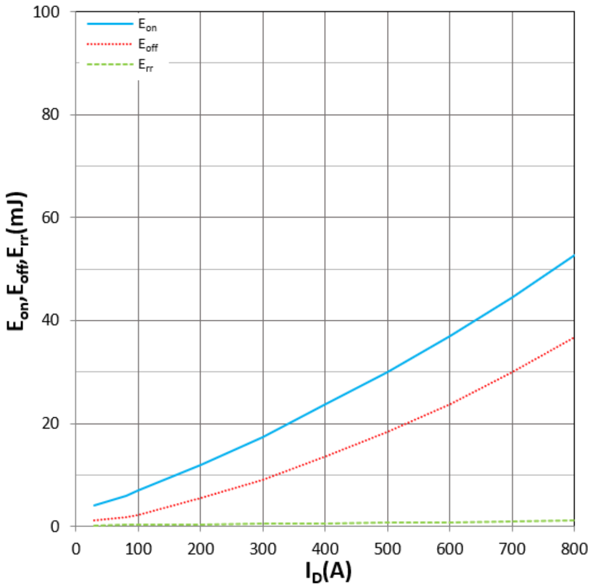

Figure 14. E_{on}, E_{off}, E_{rr} vs I_{DS}

T_j =150°C, V_{DD}=900V, V_{GS} =+15V/-4V

R_{gon}/R_{goff} =2.2Ω/2.2Ω, Inductive Load

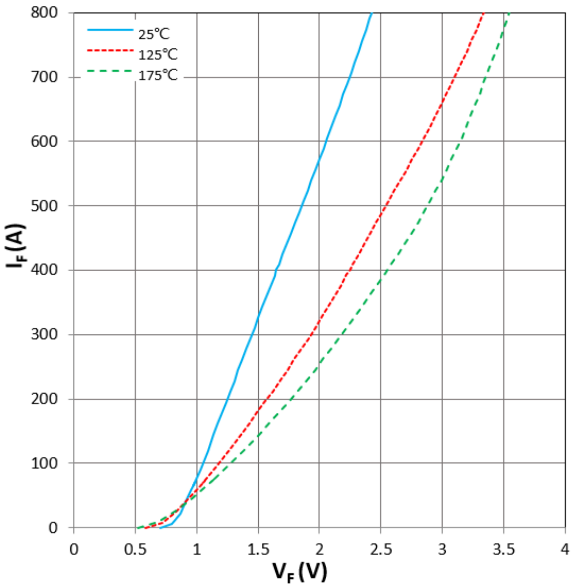

Figure 15. I_F vs V_F

V_{GS} =0V

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