

Description

The DFS200X2CU12I3B3 is a dual chopper SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Converter and Renewable energy.



Features

- 1200V/6.7mΩ
- Low thermal resistance with Si₃N₄ AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside
- Copper base size: 79mm*62mm

Applications

- xEV Applications
- Converter
- Vehicle Fast Chargers
- Renewable energy

Circuit diagram

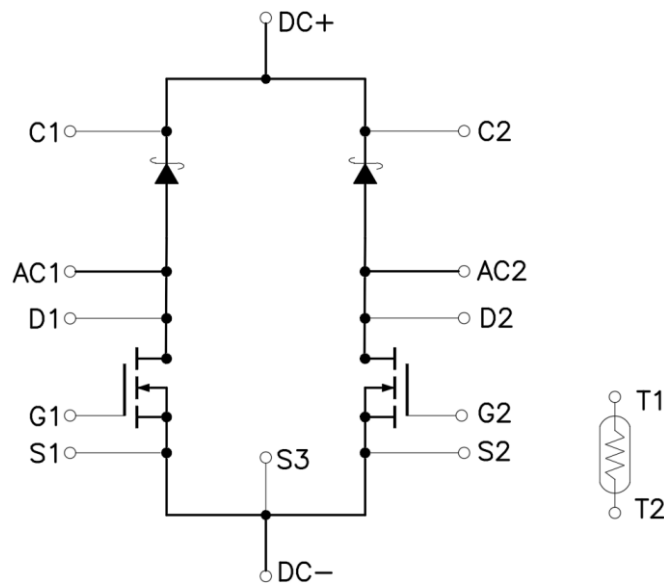


Figure 1. Out drawing & circuit diagram for DFS200X2CU12I3B3

Pin Configuration and Marking Information

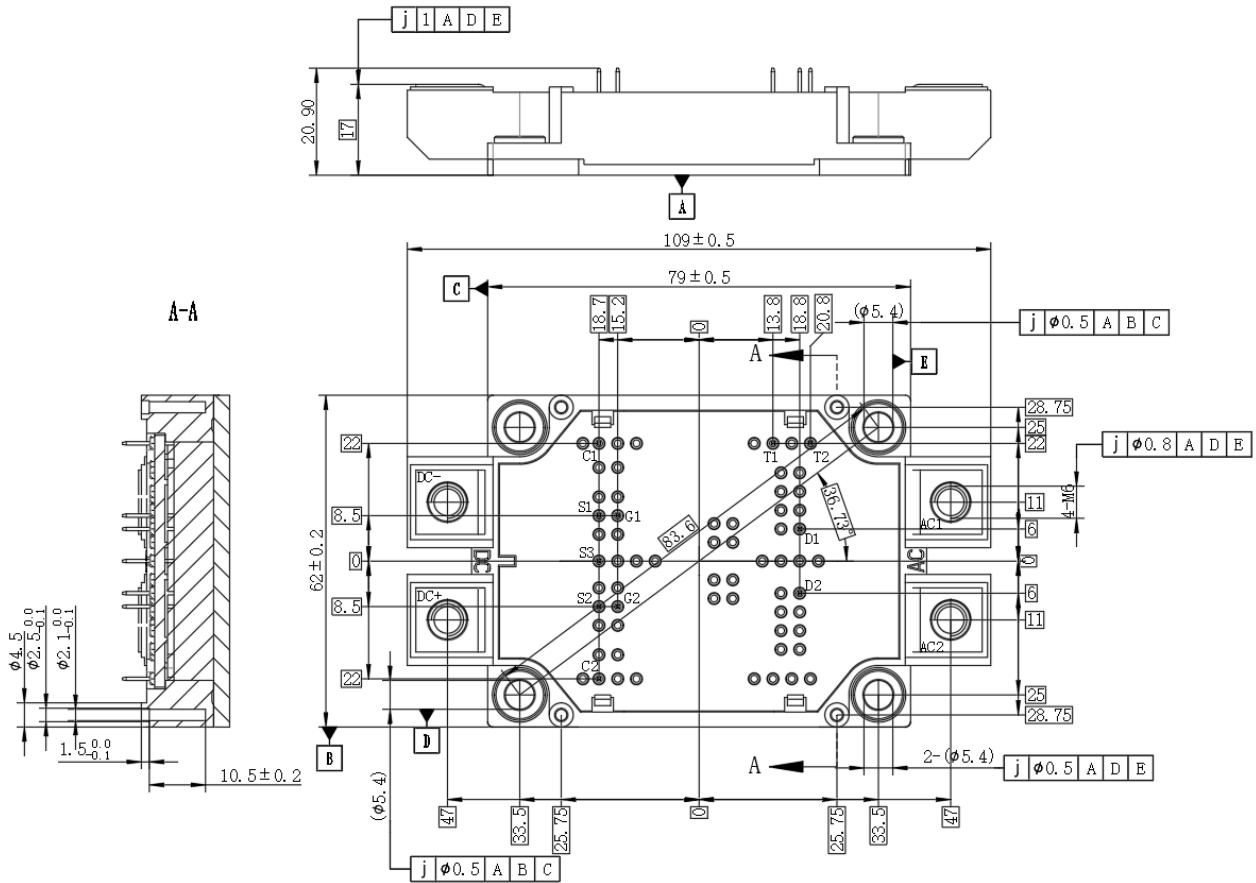


Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, $f=50\text{Hz}$, $t=1\text{min}$	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	-	>400	-
Module lead resistance, terminals – chip	$T_C=25^\circ\text{C}$	0.3	$\text{m}\Omega$
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	250	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 _{RRM}	Repetitive Reverse Voltage	Clamp Diode	1200	V
V _{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥ 1Hz, Note1	-11 to 23	V
I _{DS}	DC Continuous Drain Current	T _C = 25°C, V _{GS} = 18V	195	A
I _{DS}	DC Continuous Drain Current	T _C = 85°C, V _{GS} = 18V	150	A
I _{DSM}	Pulse Drain Current	T _C = 85°C, Pulse width = 1ms, V _{GS} = 18V, Note2	400	A
I _F	Forward Current (Diode)	T _C = 25°C	300	A
I _F	Forward Current (Diode)	T _C = 85°C	220	A
I _{FRM}	Pulse Forward Current (Diode)	T _C = 85°C, Pulse width = 1ms, Note2	400	A
P _{tot(MOS)}	Total Power Dissipation (MOS)	T _C = 25°C	630	W
P _{tot(SBD)}	Total Power Dissipation (SBD)	T _C = 25°C	1070	W
T _{jmax}	Max Junction Temperature	-	175	°C
T _{jop}	Operating junction Temperature	-	-40 to 150	°C
T _{stg}	Storage Temperature	-	-40 to 125	°C

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

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 R100	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 =20uA	1200	-	-	V	
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V	-	-	20	μA	
V _{GS(th)}	Gate-source threshold Voltage	I _D =20mA, V _{DS} =V _{GS}	T _j =25°C	2.1	3.2	5.8	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V	T _j =25°C	-	-	40	nA
R _{DS(on)} (Chip)	Static drain-source	I _D =200A V _{GS} =18V	T _j =25°C	4.3	6.7	9.0	mΩ
	On-state resistance		T _j =175°C	10.4	16.0	21.6	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =200A V _{GS} =18V	T _j =25°C	-	1.34	1.84	V
	On-state Voltage		T _j =175°C	-	3.24	4.33	V
C _{iss}	Input Capacitance	V _D =850V, V _{GS} =0V, f =100kHz	-	8	-	nF	
C _{oss}	Output Capacitance		-	0.46	-	nF	
C _{rss}	Reverse transfer Capacitance		-	0.044	-	nF	
Q _g	Total gate charge	V _{DD} =850V, I _D =200A, V _{GS} =-5/+18V	-	380	-	nC	
t _{d(on)}	Turn-on delay time	V _{DD} =600V I _D =200A V _{GS} =+15/-4V R _{G(on)} =6.8Ω R _{G(off)} =6.8Ω Inductive load switching operation	T _j =25°C	-	81	-	ns
			T _j =150°C	-	70	-	ns
t _r	Rise time		T _j =25°C	-	64	-	ns
			T _j =150°C	-	61	-	ns
t _{d(off)}	Turn-off delay time		T _j =25°C	-	210	-	ns
			T _j =150°C	-	221	-	ns
t _f	Fall time		T _j =25°C	-	45	-	ns
			T _j =150°C	-	51	-	ns
E _{on}	Turn-on power dissipation		T _j =25°C	-	3.42	-	mJ
			T _j =150°C	-	3.54	-	mJ
E _{off}	Turn-off power dissipation	T _j =25°C	-	2.93	-	mJ	
		T _j =150°C	-	3.75	-	mJ	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case	-	0.24	-	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	
I _{RRM}	Reverse Current	V _{RRM} =1200V	-	-	300	uA
V _F	Forward Voltage	I _F =200A	T _j =25°C	1.8	2.3	V
			T _j =175°C	2.9	-	
T _{rr}	Reverse recovery time	V _{RR} =600V, I _F =200A MOSFET side:	T _j =25°C	31	-	ns
			T _j =150°C	33	-	
Q _{rr}	Reverse recovery charge	V _{GS} =+15/-4V R _{G(on)} =R _{G(off)} =6.8Ω	T _j =25°C	0.89	-	uC
			T _j =150°C	0.97	-	
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j =25°C	0.27	-	mJ
			T _j =150°C	0.31	-	
R _{th(j-c)}	SiC SBD Thermal Resistance	Junction to Case	-	0.14	-	K/W
R _{th(c-f)}	Contact thermal Resistance	With thermal conductive grease, Note4	-	0.015	-	K/W

Note4: Assumes Thermal Conductivity of grease is 0.9W/m·K and thickness is 50um.

Test Conditions

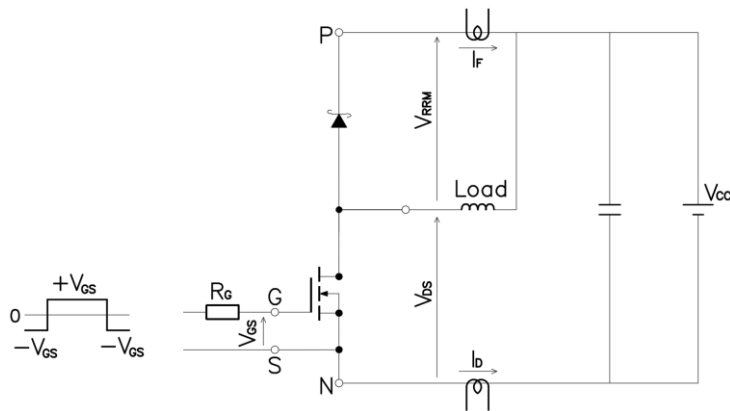


Figure 3. Switching time measure circuit

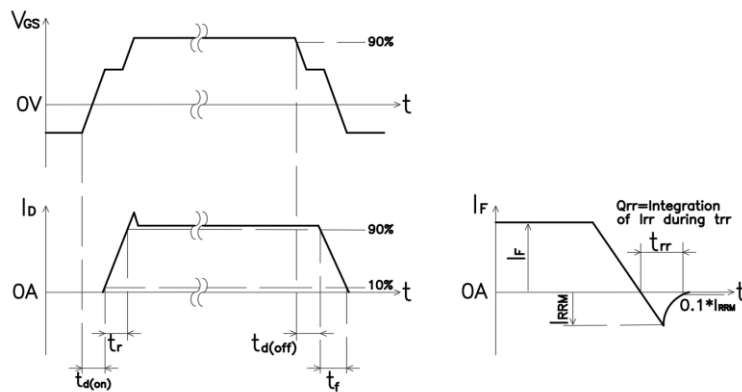


Figure 4. Switching time definition

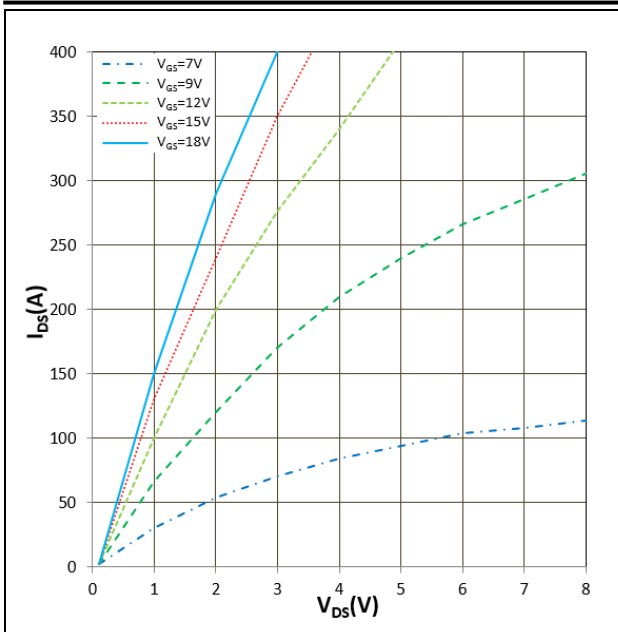


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

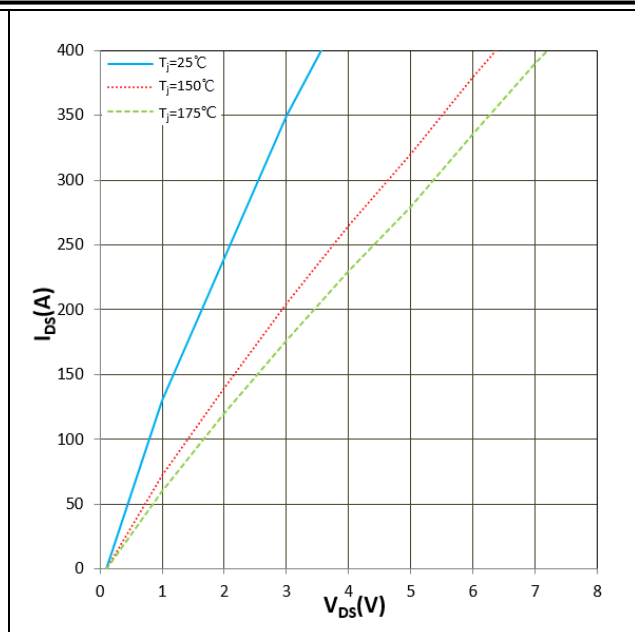


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$

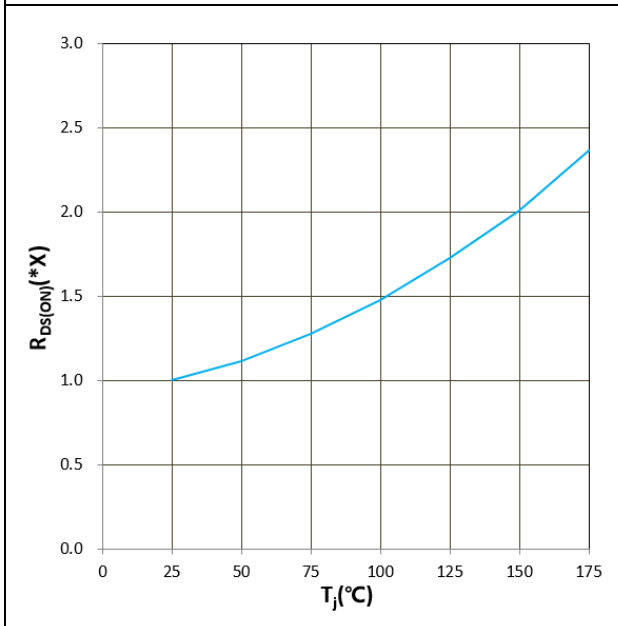


Figure 7. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +18\text{V}$, $I_D = 200\text{A}$, $1.0X = 6.7\text{m}\Omega$

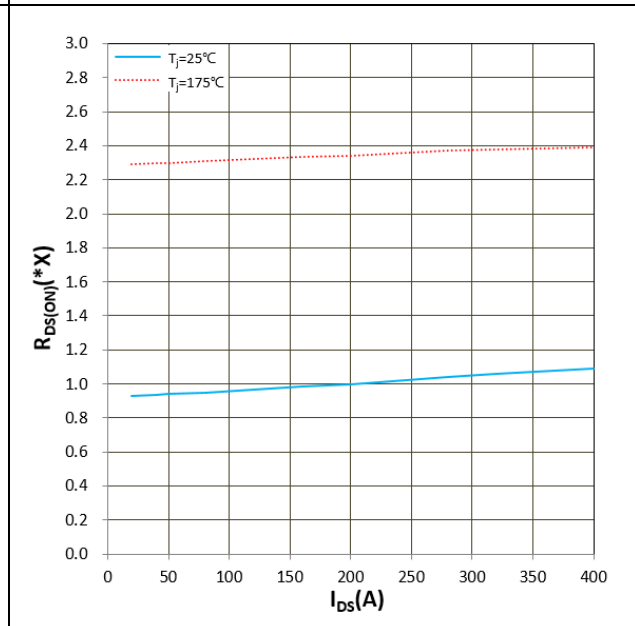


Figure 8. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +18\text{V}$, $I_D = 200\text{A}$, $1.0X = 6.7\text{m}\Omega$

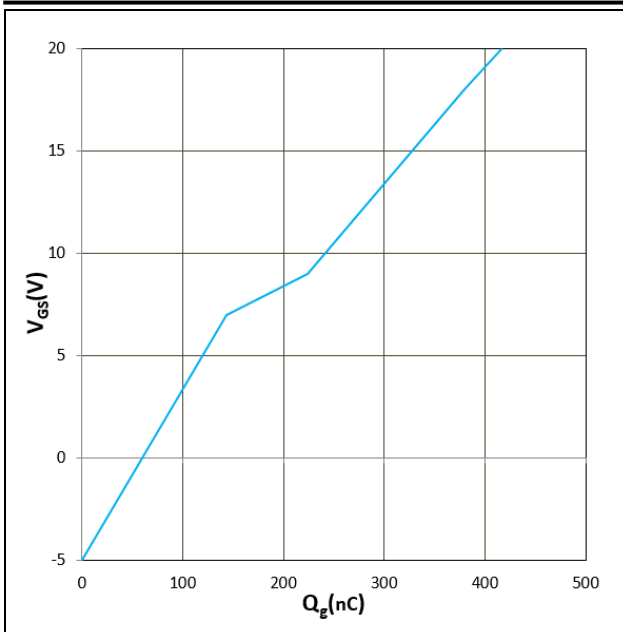


Figure 9. V_{GS} vs Q_g
 $T_j = 25^\circ\text{C}$, $I_{GS} = 2\text{mA}$

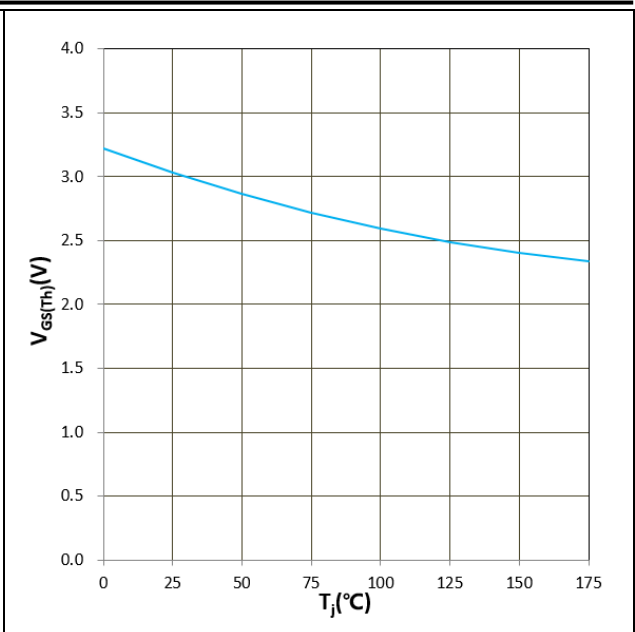


Figure 10. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 20\text{mA}$

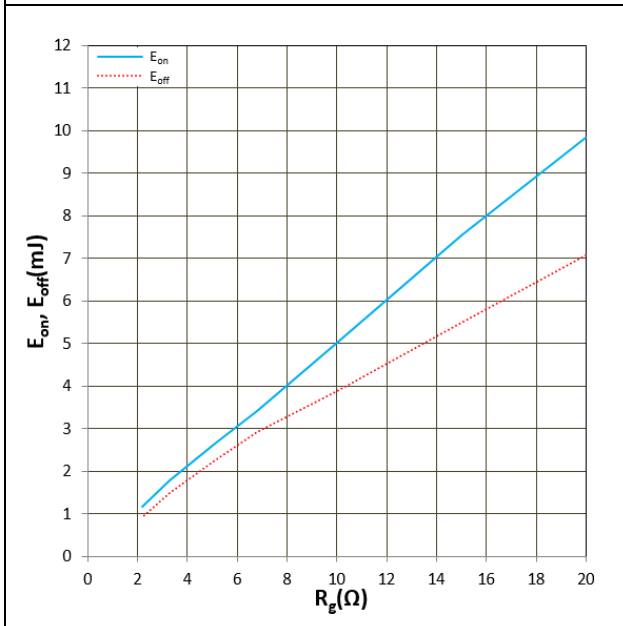


Figure 11. E_{on} , E_{off} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$, $I_D = 200\text{A}$
 Inductive Load

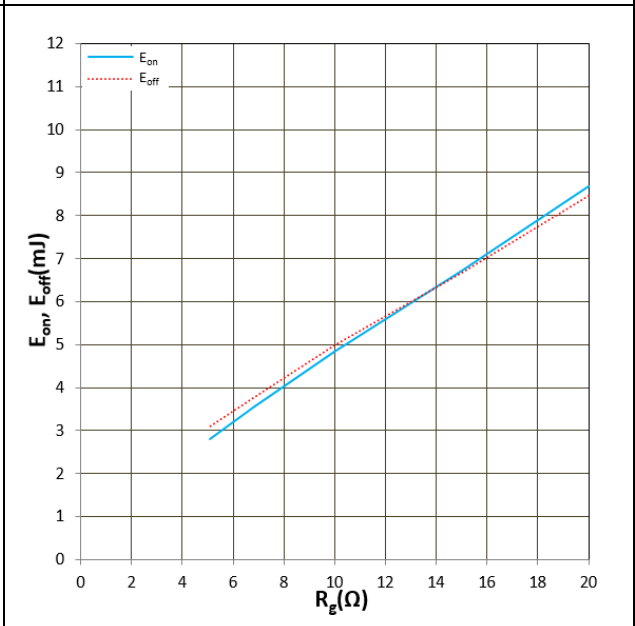


Figure 12. E_{on} , E_{off} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$, $I_D = 200\text{A}$
 Inductive Load

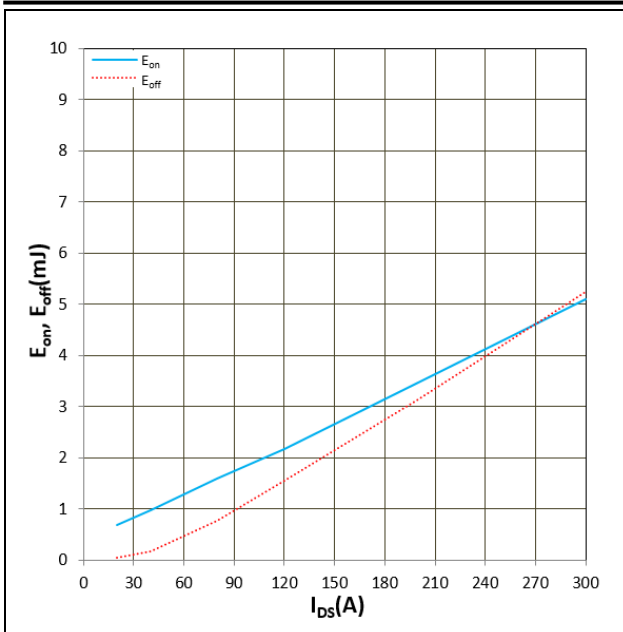


Figure 13. E_{on} , E_{off} vs I_{DS}
 $T_j=25^\circ\text{C}$, $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

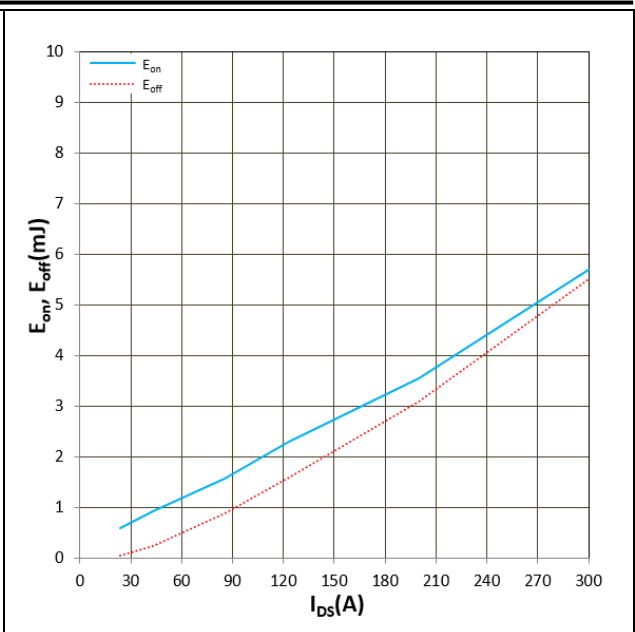


Figure 14. E_{on} , E_{off} vs I_{DS}
 $T_j=150^\circ\text{C}$, $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

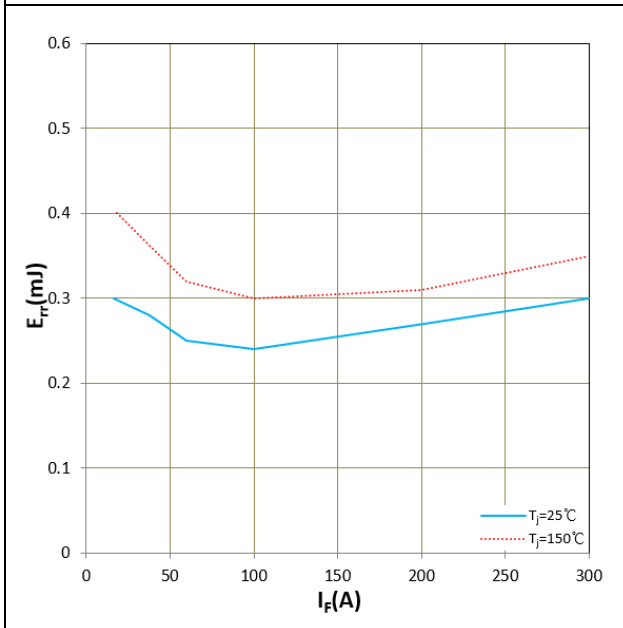


Figure 15. E_{rr} vs I_F
 $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

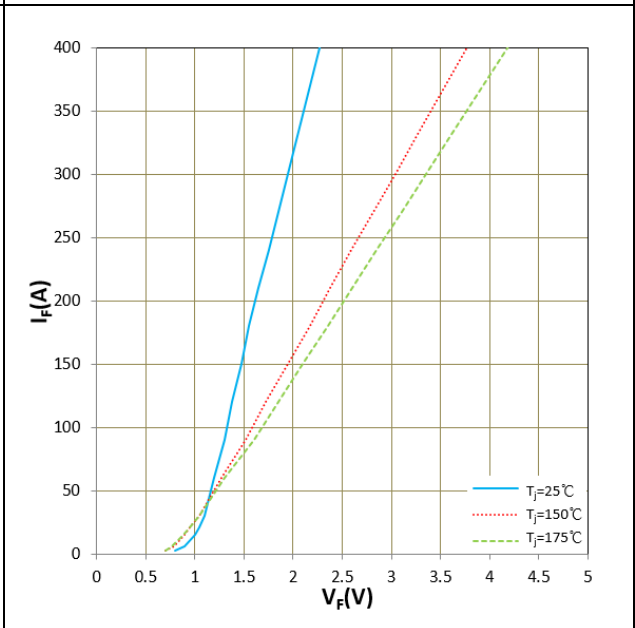


Figure 16. I_F vs V_F

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