

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

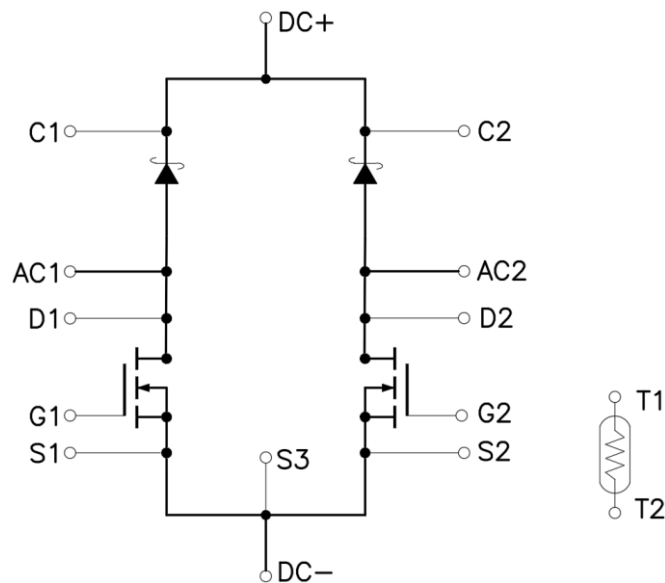


Figure 1. Out drawing & circuit diagram for DFS200X2CU12I3B3

Pin Configuration and Marking Information

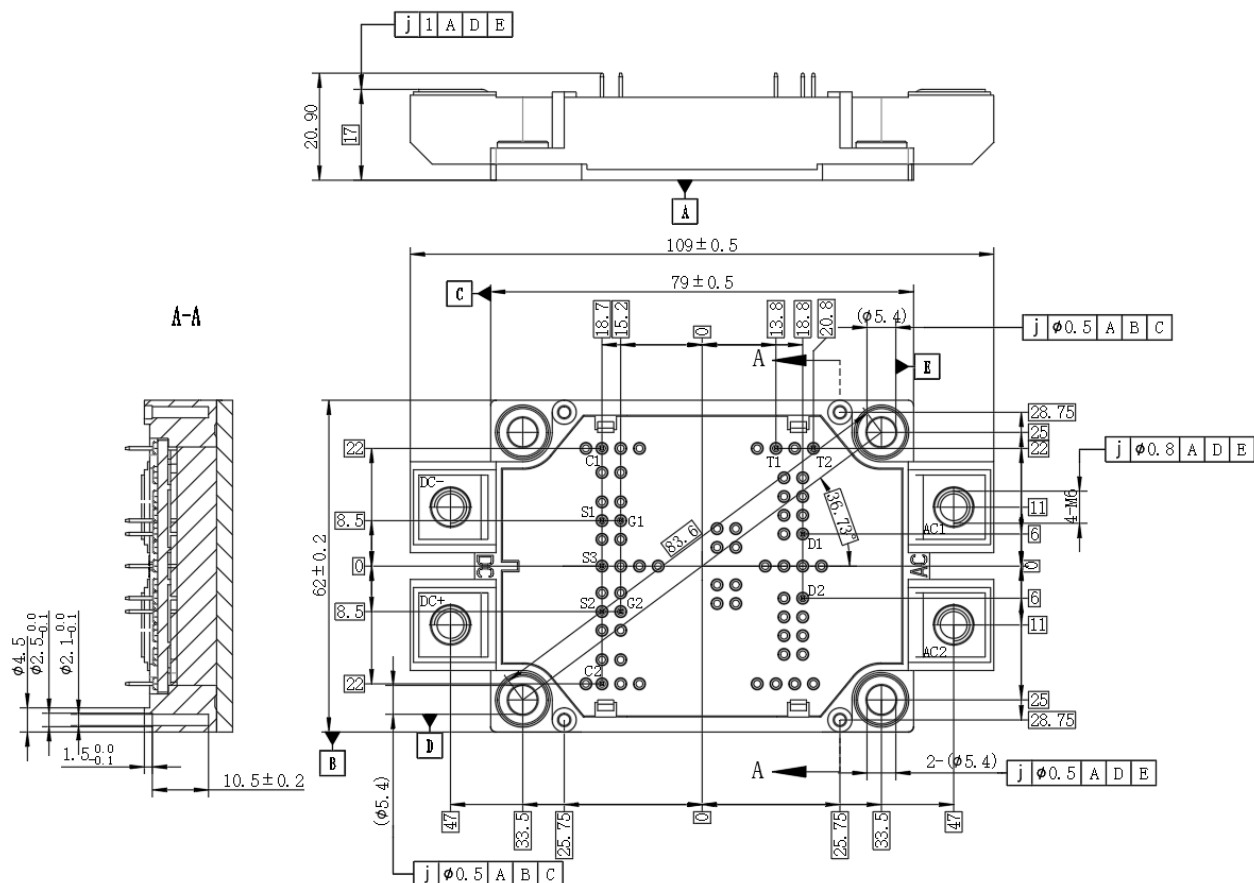


Figure 2. Pin configuration

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 ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DS}	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 $\geq 1\text{Hz}$, Note1	-11 to 23	V
I_{DS}	DC Continuous Drain Current	$T_c = 25^\circ\text{C}$, $V_{GS} = 18\text{V}$	195	A
I_{DS}	DC Continuous Drain Current	$T_c = 85^\circ\text{C}$, $V_{GS} = 18\text{V}$	150	A
I_{DSM}	Pulse Drain Current	$T_c = 85^\circ\text{C}$, Pulse width = 1ms, $V_{GS} = 18\text{V}$, Note2	400	A
I_F	Forward Current (Diode)	$T_c = 25^\circ\text{C}$	300	A
I_F	Forward Current (Diode)	$T_c = 85^\circ\text{C}$	220	A
I_{FRM}	Pulse Forward Current (Diode)	$T_c = 85^\circ\text{C}$, Pulse width = 1ms, Note2	400	A
$P_{tot(MOS)}$	Total Power Dissipation (MOS)	$T_c = 25^\circ\text{C}$	630	W
$P_{tot(SBD)}$	Total Power Dissipation (SBD)	$T_c = 25^\circ\text{C}$	1070	W
T_{jmax}	Max Junction Temperature	-	175	$^\circ\text{C}$
T_{jop}	Operating junction Temperature	-	-40 to 150	$^\circ\text{C}$
T_{stg}	Storage Temperature	-	-40 to 125	$^\circ\text{C}$

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	$T_c = 25^\circ\text{C}$	-	5	-	$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_c = 100^\circ\text{C}$, $R_{100} = 493\Omega$	5	-	5	%
P_{25}	Power dissipation	$T_c = 25^\circ\text{C}$	-	-	20	mW
$B_{25/50}$	B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	K
$B_{25/80}$	B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3411	-	K
$B_{25/100}$	B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	-	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	T _j =25°C	4.3	6.7	9.0	mΩ
	On-state resistance	V _{GS} =18V	T _j =175°C	10.4	16.0	21.6	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =200A	T _j =25°C	-	1.34	1.84	V
	On-state Voltage	V _{GS} =18V	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	-	
t _r	Rise time		T _j =25°C	-	64	-	ns
			T _j =150°C	-	61	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	210	-	ns
			T _j =150°C	-	221	-	
t _f	Fall time		T _j =25°C	-	45	-	ns
			T _j =150°C	-	51	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	3.42	-	mJ
			T _j =150°C	-	3.54	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	2.93	-	mJ
			T _j =150°C	-	3.75	-	
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 50μm.

SiC SBD Electrical characteristics ($T_j=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit
			Min.	Typ.	Max	
I_{RRM}	Reverse Current	$V_{RRM}=1200\text{V}$	-	-	300	μA
V_F	Forward Voltage	$I_F=200\text{A}$	$T_j=25^\circ\text{C}$	-	1.8	V
			$T_j=175^\circ\text{C}$	-	2.9	
T_{rr}	Reverse recovery time	$V_{RR}=600\text{V}, I_F=200\text{A}$ MOSFET side:	$T_j=25^\circ\text{C}$	-	31	ns
			$T_j=150^\circ\text{C}$	-	33	
Q_{rr}	Reverse recovery charge	$V_{GS}=+15/-4\text{V}$ $R_{G(on)}=R_{G(off)}=6.8\Omega$	$T_j=25^\circ\text{C}$	-	0.89	μC
			$T_j=150^\circ\text{C}$	-	0.97	
E_{rr}	Diode switching power dissipation	Inductive load switching operation	$T_j=25^\circ\text{C}$	-	0.27	mJ
			$T_j=150^\circ\text{C}$	-	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 $0.9\text{W/m}\cdot\text{K}$ and thickness is $50\mu\text{m}$.

Test Conditions

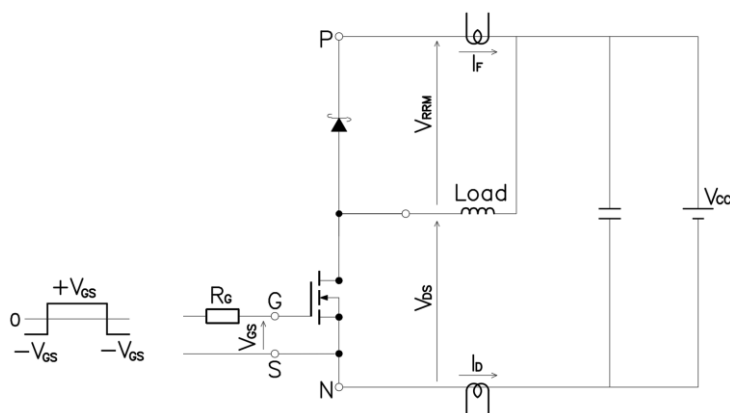


Figure 3. Switching time measure circuit

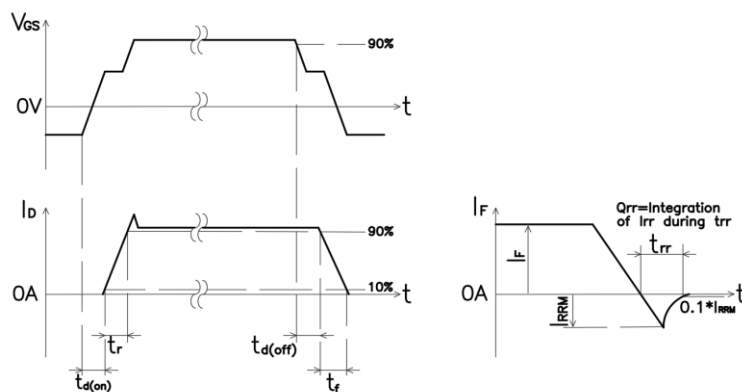


Figure 4. Switching time definition

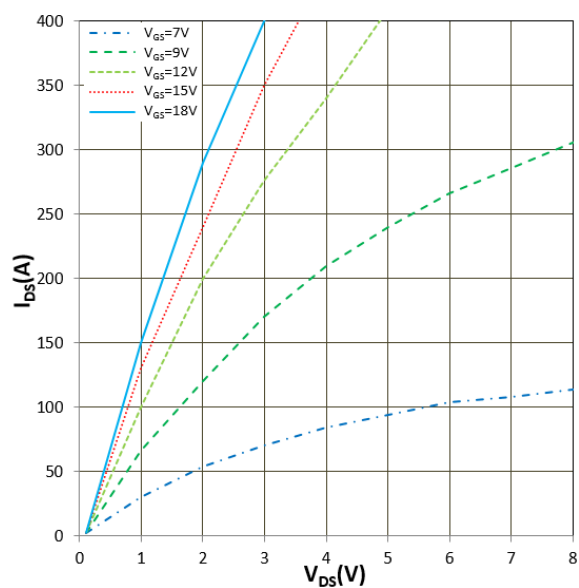


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

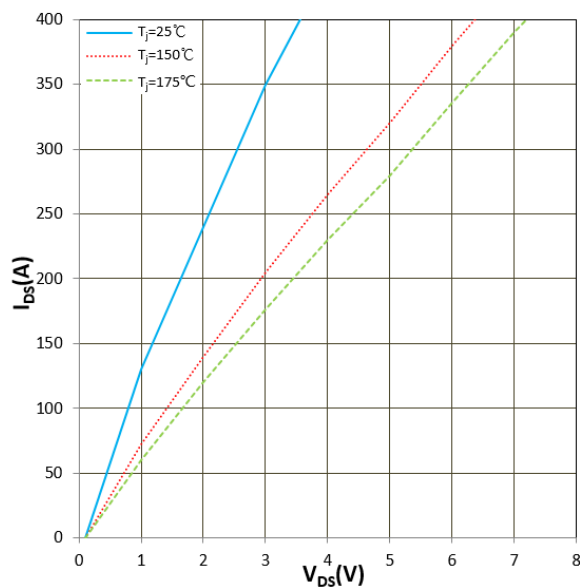


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$

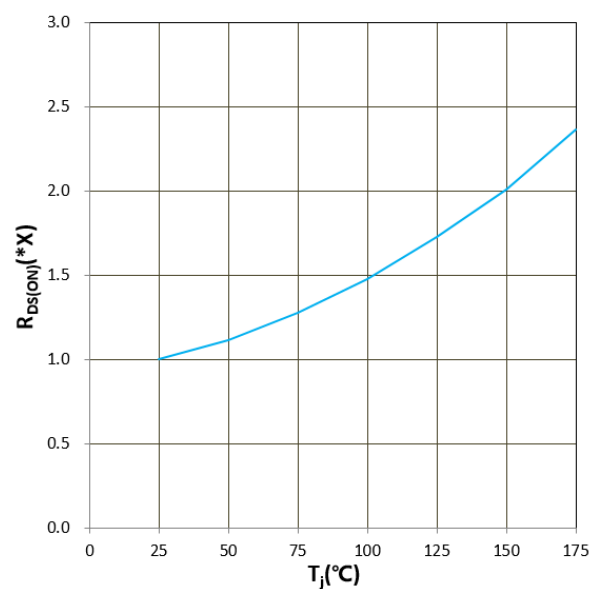


Figure 7. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +18\text{V}$, $I_D = 200\text{A}$, $1.0X = 6.7\text{m}\Omega$

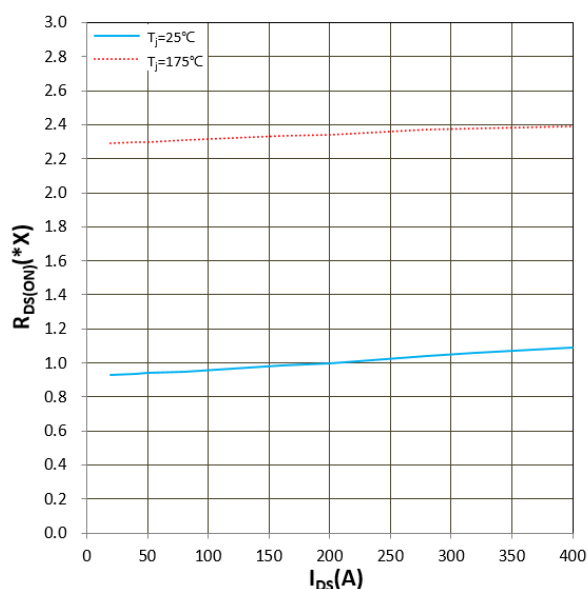


Figure 8. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +18\text{V}$, $I_D = 200\text{A}$, $1.0X = 6.7\text{m}\Omega$

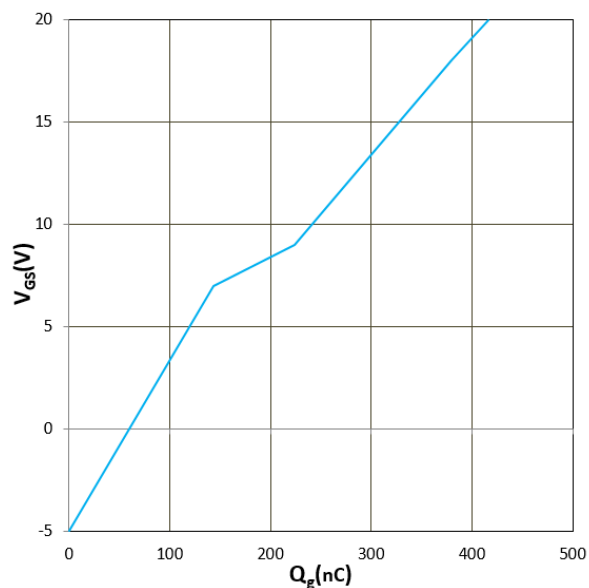


Figure 9. V_{GS} vs Q_g
 $T_j = 25^\circ\text{C}$, $I_{GS} = 2\text{mA}$

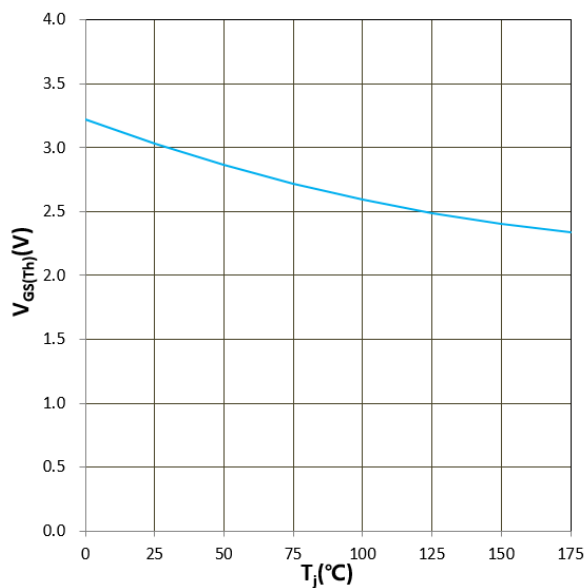


Figure 10. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 20\text{mA}$

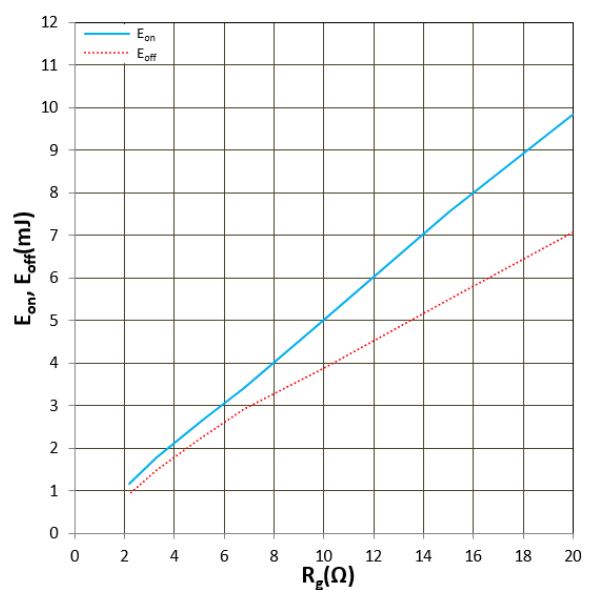


Figure 11. E_{on} , E_{off} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$, $I_D = 200\text{A}$
Inductive Load

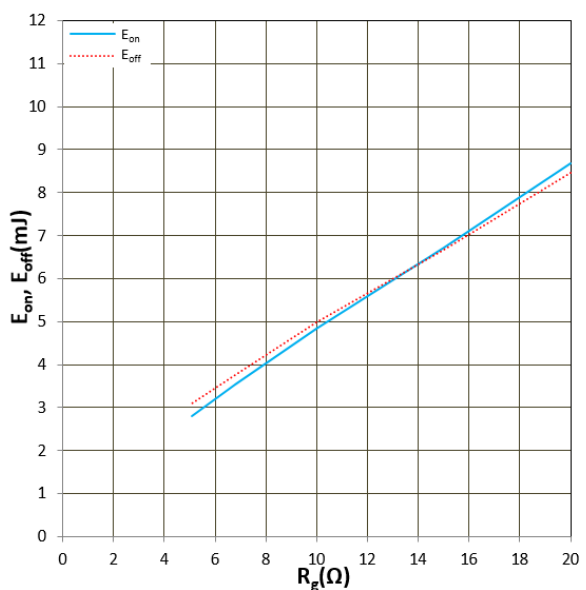


Figure 12. E_{on} , E_{off} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$, $I_D = 200\text{A}$
Inductive Load

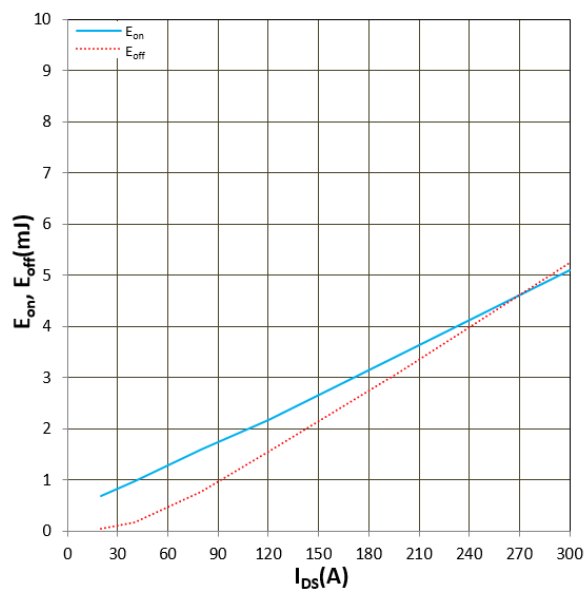


Figure 13. E_{on} , E_{off} vs I_{DS}
 $T_j=25^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

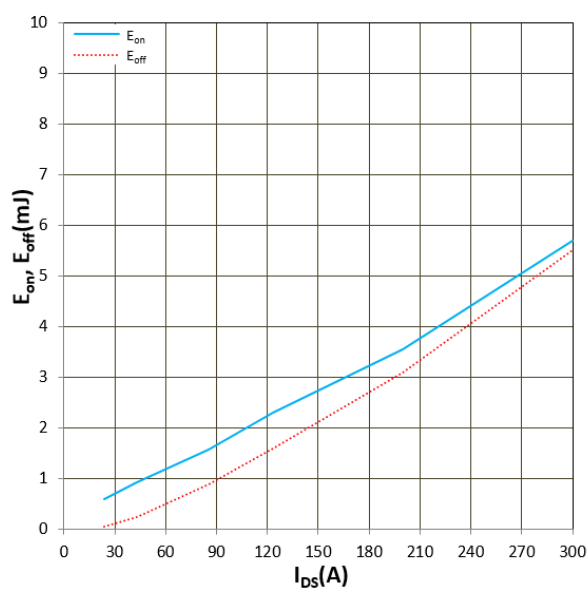


Figure 14. E_{on} , E_{off} vs I_{DS}
 $T_j=150^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

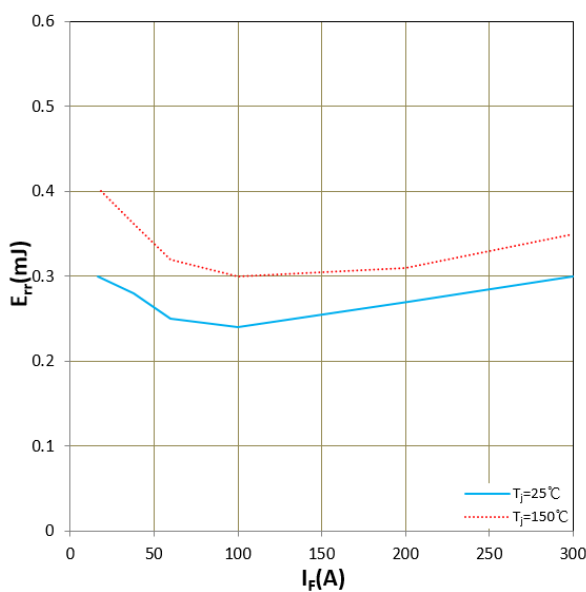


Figure 15. E_{rr} vs I_F
 $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

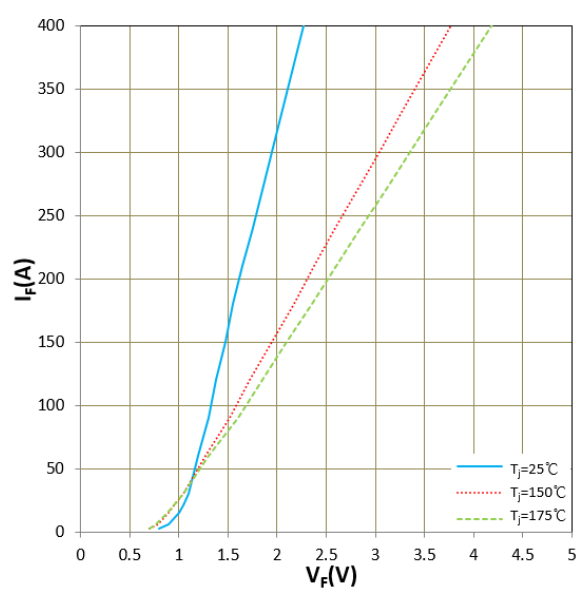


Figure 16. I_F vs V_F

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