DFS300X2CU12I3B2

1200V/300A dual Chopper SiC MOSFET Module

Description

The DFS300X2CU12I3B2 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/4.5mΩ
- Low thermal resistance with Si_3N_4 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

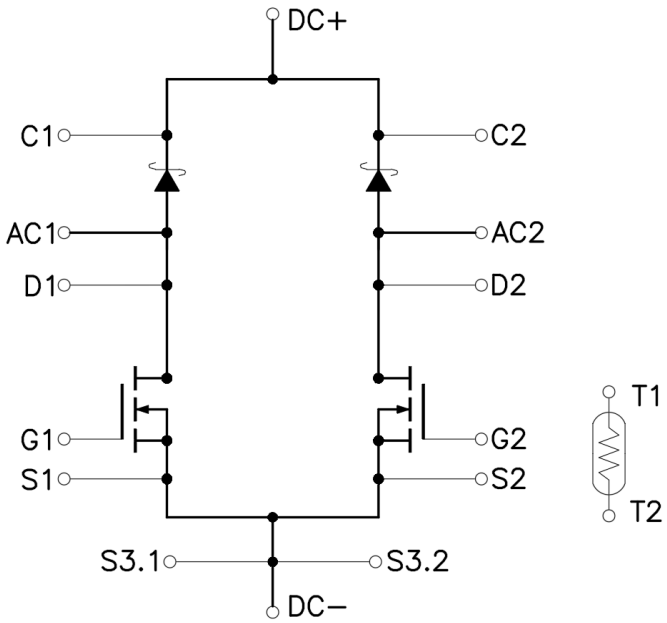

Figure 1. Out drawing & circuit diagram for DFS300X2CU12I3B2

Pin Configuration and Marking Information

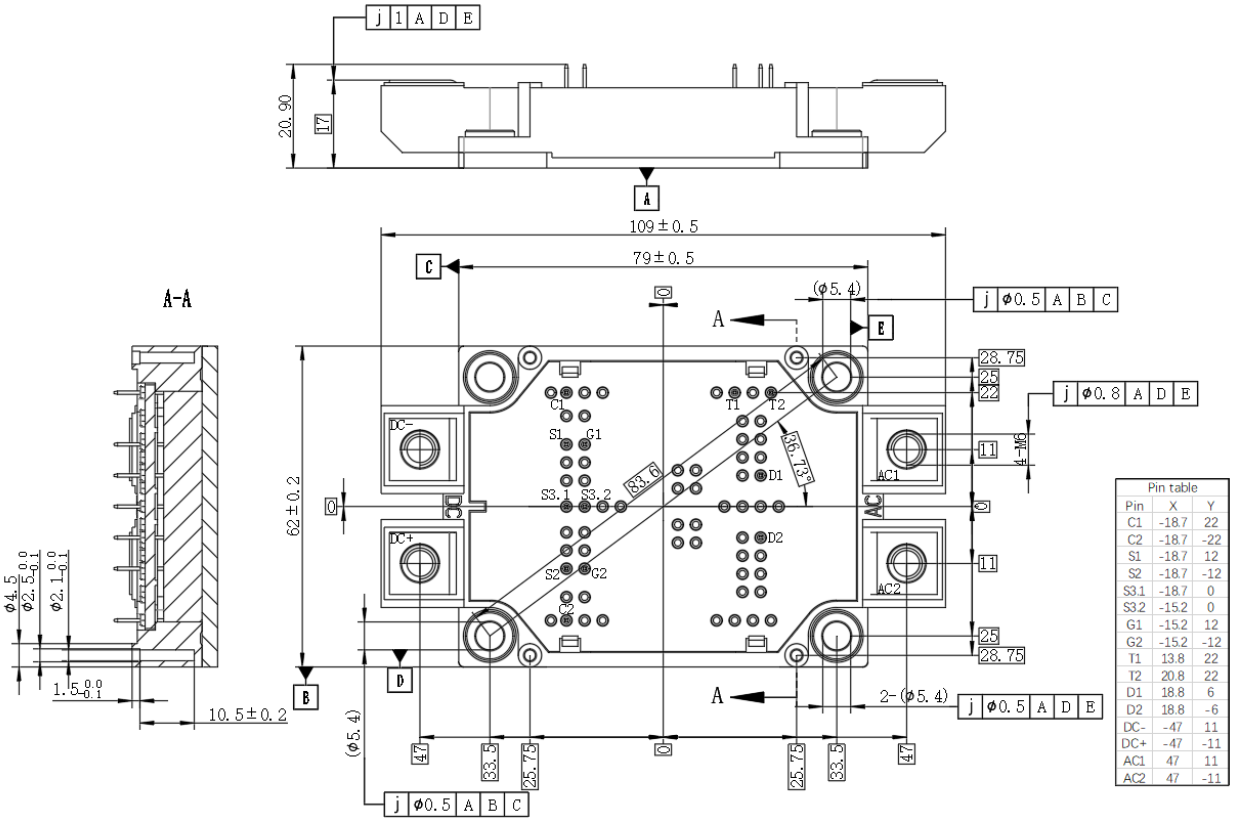

Figure 2. Pin configuration

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	-	>400	-
Module lead resistance, terminals – chip	T_C =25°C	0.3	mΩ
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-Sourse 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	295	A
I_{DS}	DC Continuous Drain Current	T_C =65°C , V_{GS} =18V	255	A
I_{DSM}	Pulse Drain Current	T_C =65°C, Pulse width =1ms, V_{GS} =18V, Note2	600	A
I_F	Forward Current (Diode)	T_C =25°C	210	A
I_F	Forward Current (Diode)	T_C =65°C	170	A
I_{FRM}	Pulse Forward Current (Diode)	T_C =65°C, Pulse width =1ms, Note2	600	A
$P_{tot(MOS)}$	Total Power Dissipation (MOS)	T_C =25°C	937	W
$P_{tot(SBD)}$	Total Power Dissipation (SBD)	T_C =25°C	715	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	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 (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=3mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V		-	-	30	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=30mA, 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	-	-	60	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=300A, V_{GS}=18V	T_j=25°C	2.9	4.5	6	mΩ
			T_j=175°C	6.9	10.7	14.4	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=300A, V_{GS}=18V	T_j=25°C	0.87	1.35	1.80	V
			T_j=175°C	2.07	3.21	4.32	V
C_{iss}	Input Capacitance	V_D=850V, V_{GS}=0V, f=100kHz		-	12	-	nF
C_{oss}	Output Capacitance			-	0.69	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.066	-	nF
Q_g	Total gate charge	V_{DD}=850V, I_D=300A, V_{GS}=-5/+18V		-	540	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD}=600V, I_D=300A, V_{GS}=+15/-4V, $R_{G(on)}$=5.1Ω, $R_{G(off)}$=3.3Ω, Inductive load switching operation	T_j=25°C	-	90	-	ns
			T_j=150°C	-	79	-	
t_r	Rise time		T_j=25°C	-	70	-	ns
			T_j=150°C	-	65	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	198	-	ns
			T_j=150°C	-	201	-	
t_f	Fall time		T_j=25°C	-	39	-	ns
			T_j=150°C	-	41	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	5.86	-	mJ
			T_j=150°C	-	5.82	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	3.64	-	mJ
			T_j=150°C	-	3.83	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.16	-	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	-	-	-	200	uA
V_F	Forward Voltage	I_F =200A	T_j =25°C	-	2.1	2.6	V
			T_j =175°C	-	3.8	-	
T_{rr}	Reverse recovery time	V_{RR} =600V, I_F =200A MOSFET side: V_{GS} =+15/-4V $R_{G(on)}$ =5.1Ω, $R_{G(off)}$=3.3Ω Inductive load switching operation	T_j =25°C	-	30	-	ns
			T_j =150°C	-	32	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	0.74	-	uC
			T_j =150°C	-	0.83	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.14	-	mJ
			T_j =150°C	-	0.23	-	
$R_{th(j-c)}$	SiC SBD Thermal Resistance	Junction to Case		-	0.21	-	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

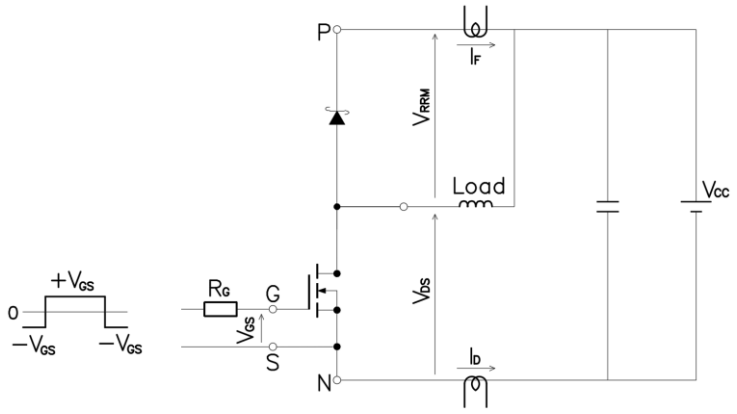

Figure 3. Switching time measure circuit

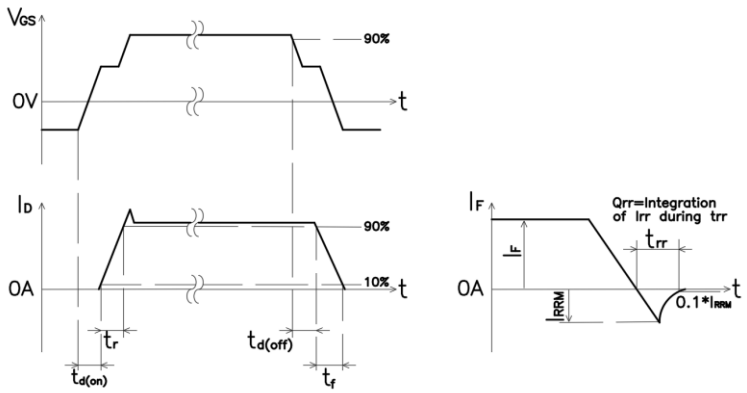

Figure 4. Switching time definition

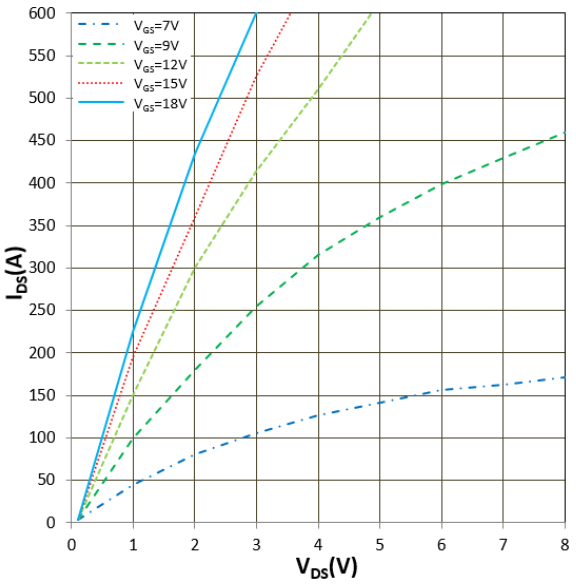

Figure 5. I_{DS} vs V_{DS}
T_j =25°C

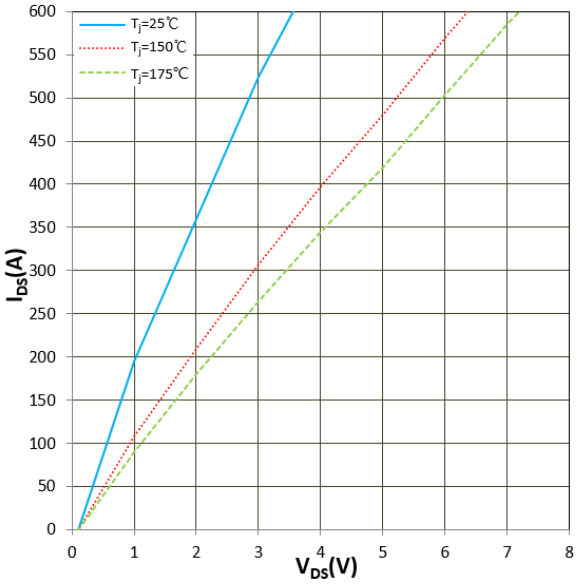

Figure 6. I_{DS} vs V_{DS}
V_{GS} =15V

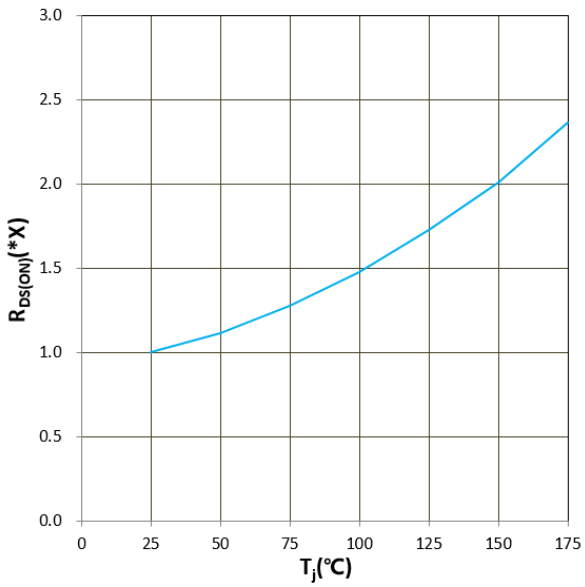

Figure 7. $R_{DS(ON)}$ vs T_j
V_{GS} =+18V, I_D =300A, 1.0X =4.5mΩ

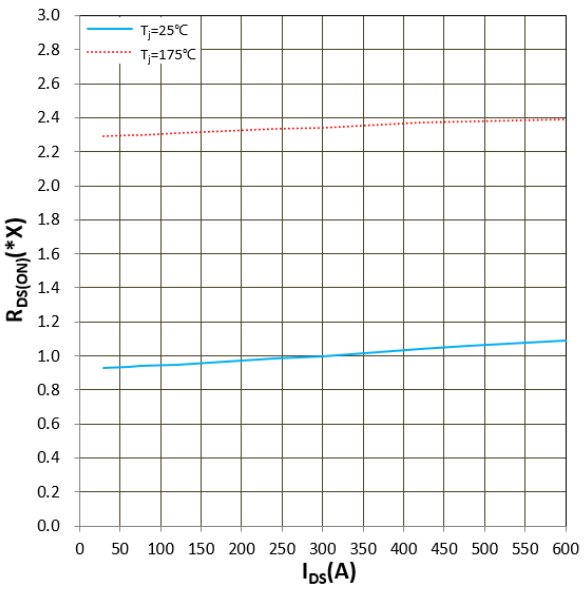

Figure 8. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V, I_D =300A, 1.0X =4.5mΩ

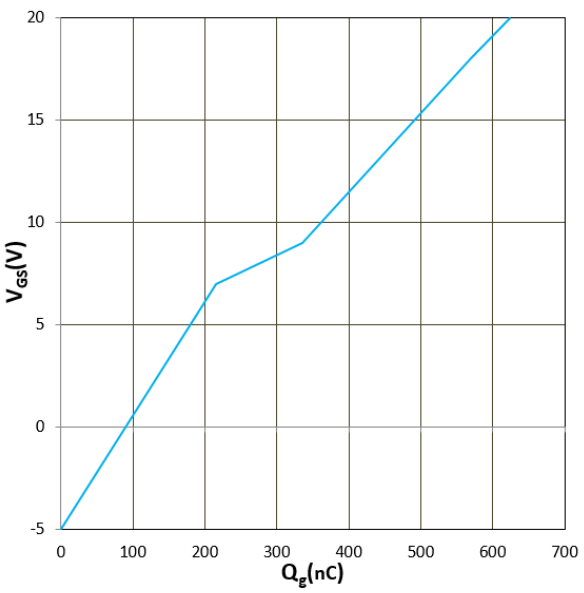

Figure 9. V_{GS} vs Q_g
T_j =25℃, I_{GS} =3mA

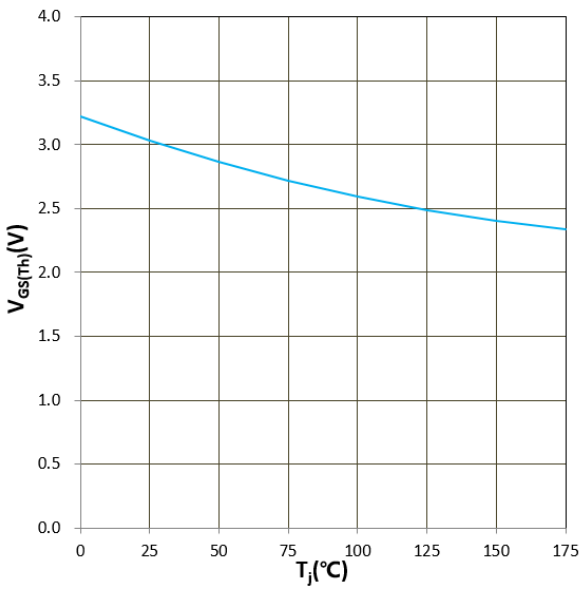

Figure 10. $V_{GS(TH)}$ vs T_j
V_{GS} =V_{DS}, I_D =30mA

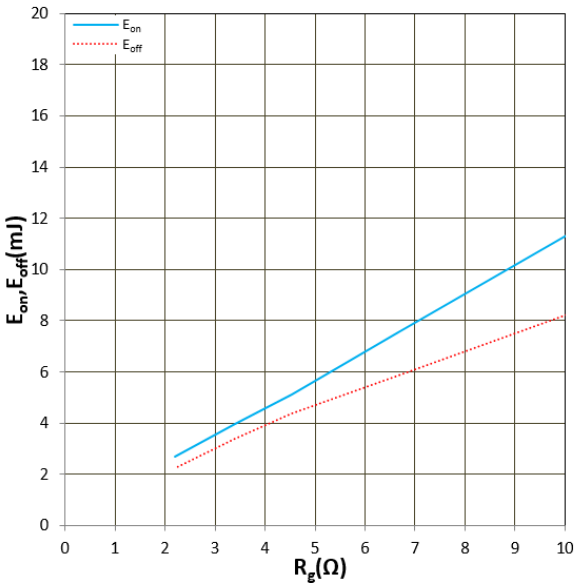

Figure 11. E_{on}, E_{off} vs R_g
T_j =25°C, V_{CC} =600V, V_{GS} =+15V/-4V, I_D =300A
Inductive Load

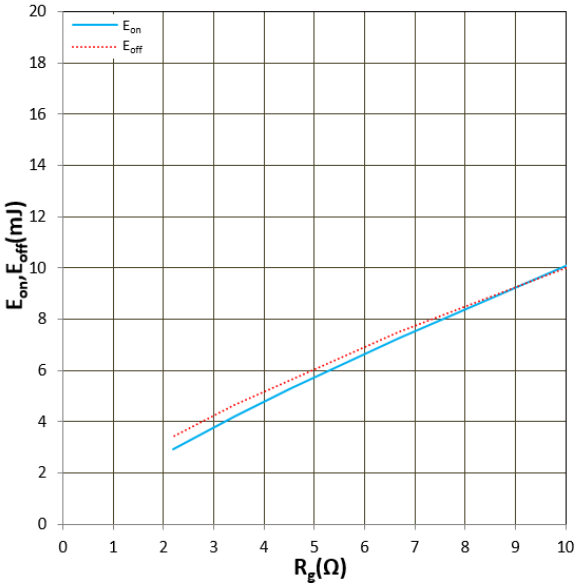

Figure 12. E_{on}, E_{off} vs R_g
T_j =150°C, V_{CC} =600V, V_{GS} =+15V/-4V, I_D =300A
Inductive Load

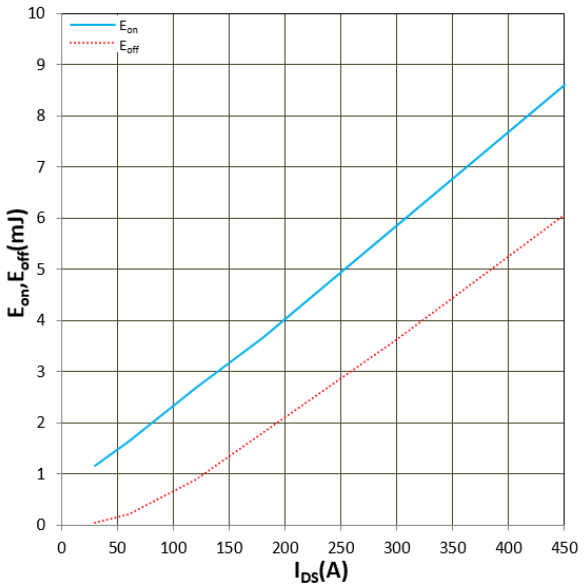

Figure 13. E_{on}, E_{off} vs I_{DS}
T_j =25°C, V_{CC} =600V, V_{GS} =+15V/-4V
$R_{G(on)}$ =5.1Ω, $R_{G(off)}$ =3.3Ω, Inductive Load

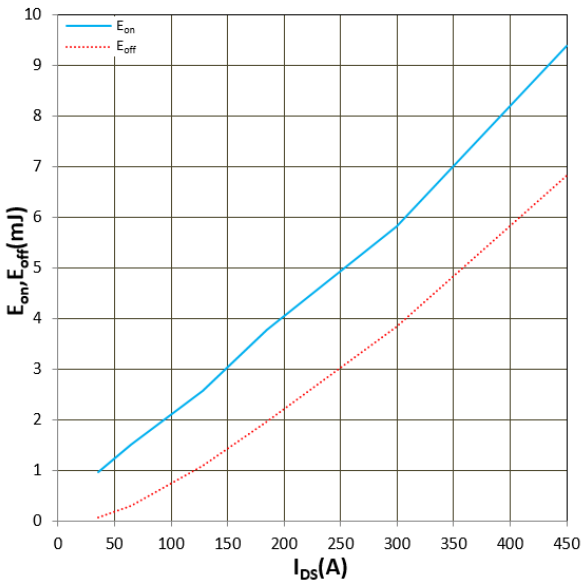

Figure14. E_{on}, E_{off} vs I_{DS}
T_j =150°C, V_{CC} =600V, V_{GS} =+15V/-4V
$R_{G(on)}$ =5.1Ω, $R_{G(off)}$ =3.3Ω, Inductive Load

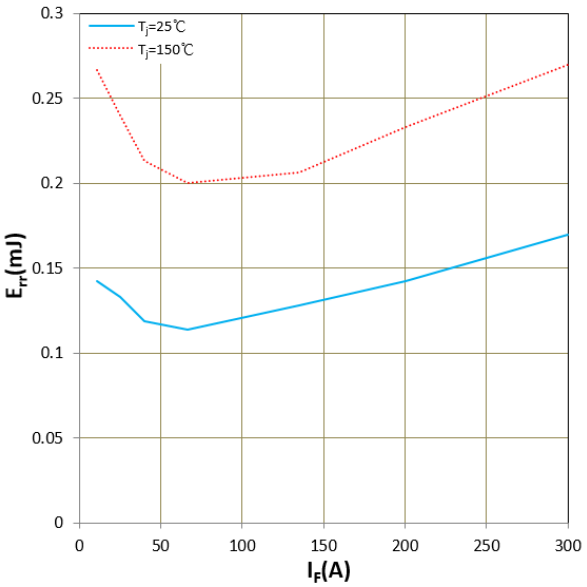

Figure 15. E_{rr} vs I_F
V_{CC} =600V, V_{GS} =+15V/-4V
$R_{G(on)}$ =5.1Ω, $R_{G(off)}$ =3.3Ω, Inductive Load

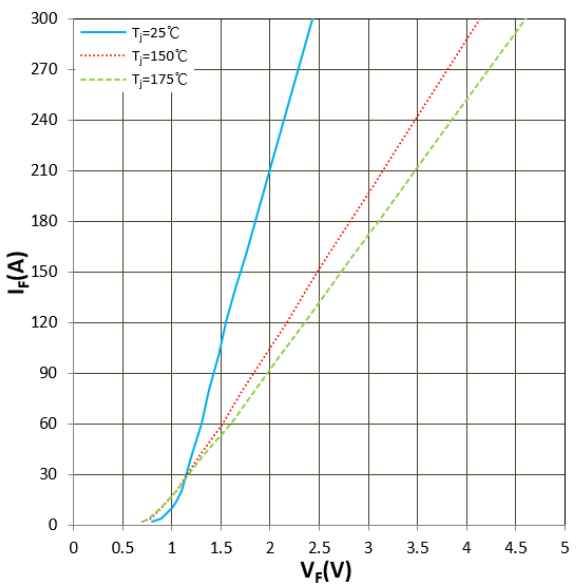

Figure 16. I_F vs V_F

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