

### Description

The DFS360HF12DFC1 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
- $R_{ds(on)}=4.3m\Omega$
- Low thermal resistance with Si<sub>3</sub>N<sub>4</sub> AMB
- 175°C maximum junction temperature
- 62mm half bridge module

### Applications

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

### Circuit diagram

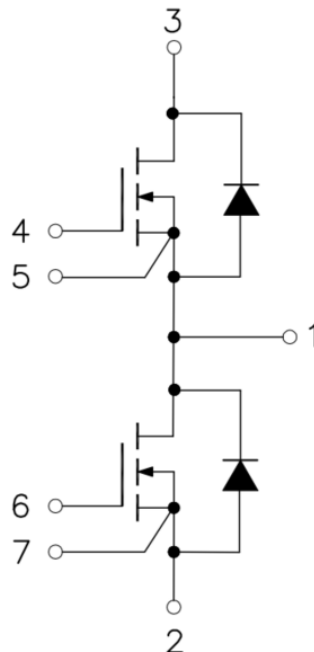


Figure 1. Out drawing & circuit diagram for DFS360HF12DFC2

**Pin Configuration and Marking Information**

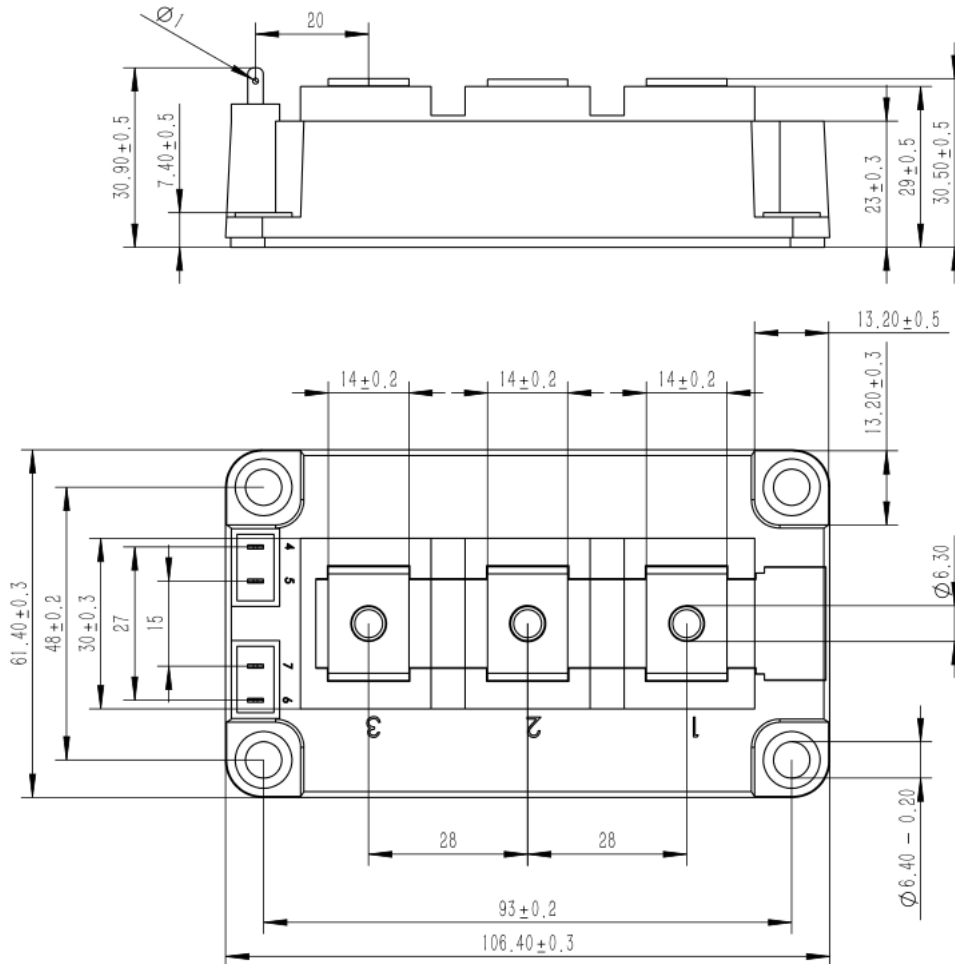


Figure 2. Pin configuration

### 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 <sub>C</sub> =25°C	0.6	mΩ
Mounting torque for module mounting	M6	4 to 6	Nm
Weight	-	320	g

### Maximum Ratings (T<sub>j</sub> =25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>DSS</sub>	Drain-Source Voltage	G-S Short	1200	V
V <sub>GSS</sub>	Gate-Source Voltage	D-S Short, AC frequency ≥ 1Hz, Note1	-10 to 22	V
I <sub>DS</sub>	DC Continuous Drain Current	T <sub>C</sub> =25°C , V <sub>GS</sub> =18V	480	A
I <sub>DS</sub>	DC Continuous Drain Current	T <sub>C</sub> =80°C , V <sub>GS</sub> =18V	360	A
I <sub>SD</sub>	Source-Drain Current(diode)	T <sub>C</sub> =25°C, with ON signal	480	A
I <sub>SD</sub>	Source-Drain Current(diode)	T <sub>C</sub> =80°C, with ON signal	360	A
I <sub>DSM</sub>	Pulse Drain Current	T <sub>C</sub> =25°C, Pulse width =1ms, V <sub>GS</sub> =18V, Note2	800	A
P <sub>tot</sub>	Total Power Dissipation	T <sub>C</sub> =25°C	1500	W
T <sub>jmax</sub>	Max Junction Temperature	-	175	°C
T <sub>stg</sub>	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<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =400uA	1200	-	-	V	
I <sub>DSS</sub>	Zero gate voltage drain Current	V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V	-	4	-	μA	
V <sub>GS(th)</sub>	Gate-source threshold Voltage	I <sub>D</sub> =140mA, V <sub>DS</sub> =V <sub>GS</sub>	T <sub>j</sub> =25°C	1.8	2.7	-	V
			T <sub>j</sub> =175°C	-	2.05	-	V
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =20V, V <sub>DS</sub> =0V	T <sub>j</sub> =25°C	-	-	400	nA
R <sub>DS(on)</sub> (Chip)	Static drain-source On-state resistance	I <sub>D</sub> =360A V <sub>GS</sub> =+15V	T <sub>j</sub> =25°C	-	5.3	-	mΩ
			T <sub>j</sub> =175°C	-	7.5	-	mΩ
	On-state resistance	I <sub>D</sub> =360A V <sub>GS</sub> =+18V	T <sub>j</sub> =25°C	-	4.3	-	mΩ
			T <sub>j</sub> =175°C	-	6.4	-	mΩ
V <sub>DS(on)</sub> (Chip)	Static drain-source On-state Voltage	I <sub>D</sub> =360A V <sub>GS</sub> =+15V	T <sub>j</sub> =25°C	-	1.91	-	V
			T <sub>j</sub> =175°C	-	2.70	-	V
	On-state Voltage	I <sub>D</sub> =360A V <sub>GS</sub> =+18V	T <sub>j</sub> =25°C	-	1.55	-	V
			T <sub>j</sub> =175°C	-	2.30	-	V
C <sub>iss</sub>	Input Capacitance	V <sub>D</sub> =800V, V <sub>GS</sub> =0V f=100kHz, V <sub>AC</sub> =25mV	-	23260	-	pF	
C <sub>oss</sub>	Output Capacitance		-	708	-	pF	
C <sub>rss</sub>	Reverse transfer Capacitance		-	57	-	pF	
R <sub>Gint</sub>	Internal gate resistor	f=100kHz, V <sub>AC</sub> =25mV	-	1.6	-	Ω	
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> =800V, I <sub>D</sub> =240A, V <sub>GS</sub> =+18/-4V	-	840	-	nC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> =600V I <sub>D</sub> =360A V <sub>GS</sub> =+18/-4V R <sub>gon</sub> /R <sub>goff</sub> =5.0Ω/5.0Ω Inductive load switching operation	T <sub>j</sub> =25°C	-	97	-	ns
			T <sub>j</sub> =150°C	-	78	-	
t <sub>r</sub>	Rise time		T <sub>j</sub> =25°C	-	59	-	ns
			T <sub>j</sub> =150°C	-	48	-	
t <sub>d(off)</sub>	Turn-off delay time		T <sub>j</sub> =25°C	-	192	-	ns
			T <sub>j</sub> =150°C	-	204	-	
t <sub>f</sub>	Fall time		T <sub>j</sub> =25°C	-	58	-	ns
			T <sub>j</sub> =150°C	-	62	-	
E <sub>on</sub>	Turn-on power dissipation		T <sub>j</sub> =25°C	-	11.1	-	mJ
			T <sub>j</sub> =150°C	-	10.6	-	
E <sub>off</sub>	Turn-off power dissipation	T <sub>j</sub> =25°C	-	12.3	-	mJ	
		T <sub>j</sub> =150°C	-	13.4	-		
R <sub>th(j-c)</sub>	FET Thermal Resistance	Junction to Case	-	0.10	-	°C/W	

### Body Diode Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V <sub>SD</sub>	Body Diode Forward Voltage	V <sub>GS</sub> = -5V I <sub>SD</sub> = 360A	T <sub>j</sub> = 25°C	-	6.0	-	V
			T <sub>j</sub> = 175°C	-	5.3	-	
T <sub>rr</sub>	Reverse recovery time	V <sub>DD</sub> = 600V I <sub>D</sub> = 360A	T <sub>j</sub> = 25°C	-	51	-	ns
			T <sub>j</sub> = 150°C	-	98	-	
Q <sub>rr</sub>	Reverse recovery charge	V <sub>GS</sub> = +18/-4V R <sub>gon</sub> /R <sub>goff</sub> = 5.0Ω/5.0Ω	T <sub>j</sub> = 25°C	-	2.3	-	uC
			T <sub>j</sub> = 150°C	-	9.0	-	
E <sub>rr</sub>	Diode switching power dissipation	Inductive load switching operation	T <sub>j</sub> = 25°C	-	0.36	-	mJ
			T <sub>j</sub> = 150°C	-	1.24	-	

### Test Conditions

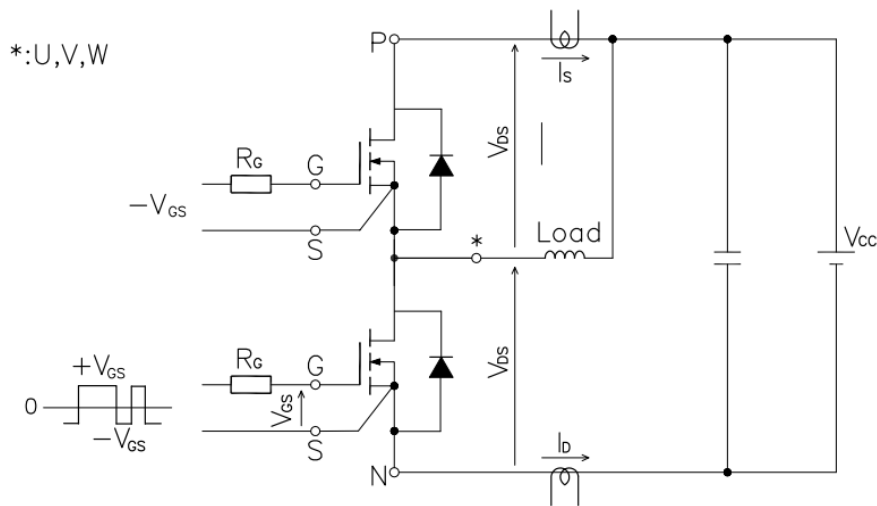


Figure 3. Switching time measure circuit

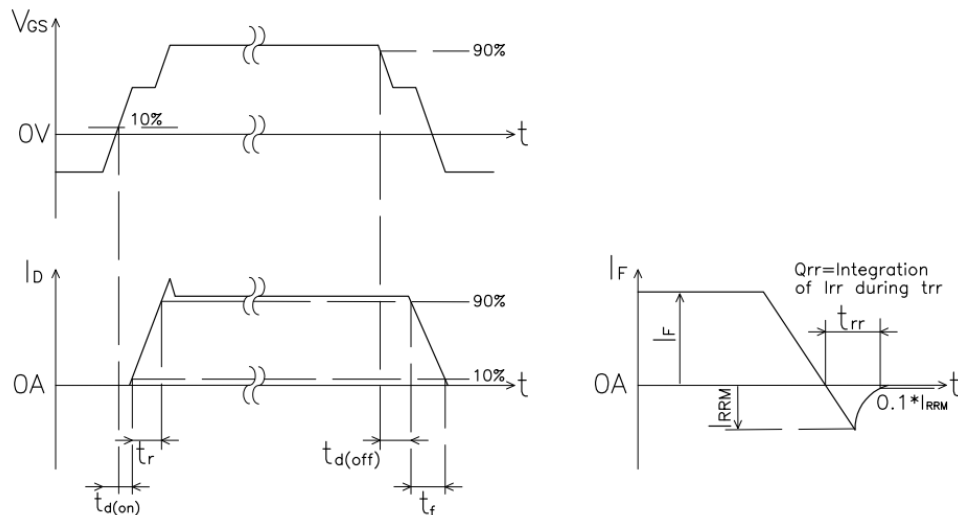


Figure 4. Switching time definition

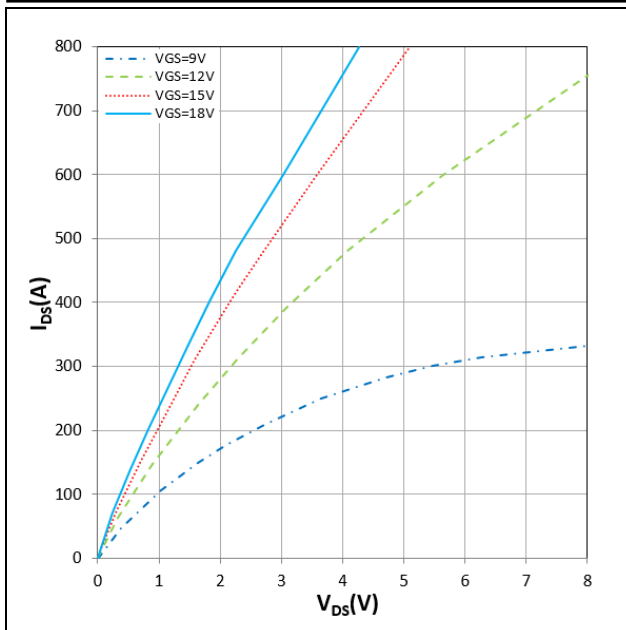


Figure 5.  $I_{DS}$  vs  $V_{DS}$   
 $T_j = 25^\circ\text{C}$

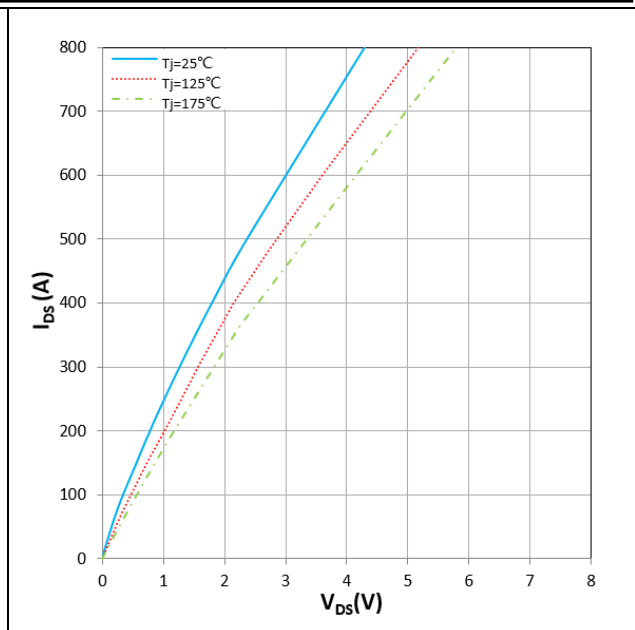


Figure 6.  $I_{DS}$  vs  $V_{DS}$   
 $V_{GS} = +18\text{V}$

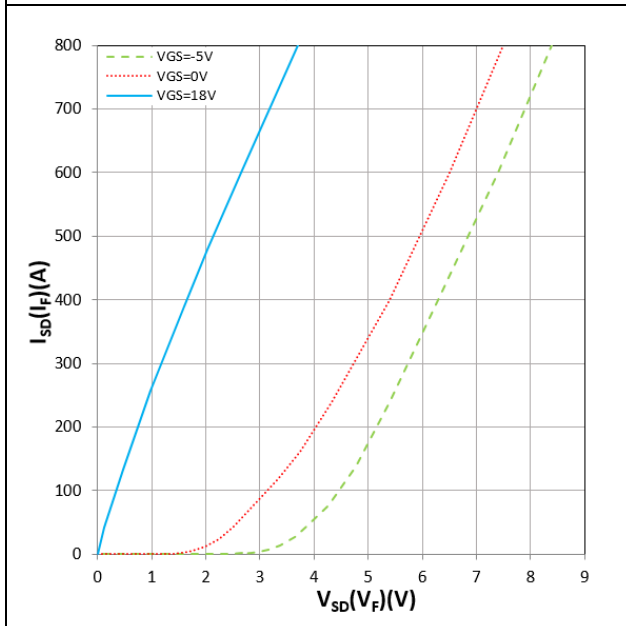


Figure 7.  $I_{SD}(I_F)$  vs  $V_{SD}(V_F)$   
 $T_j = 25^\circ\text{C}$ ,  $V_{GS}$  parameter

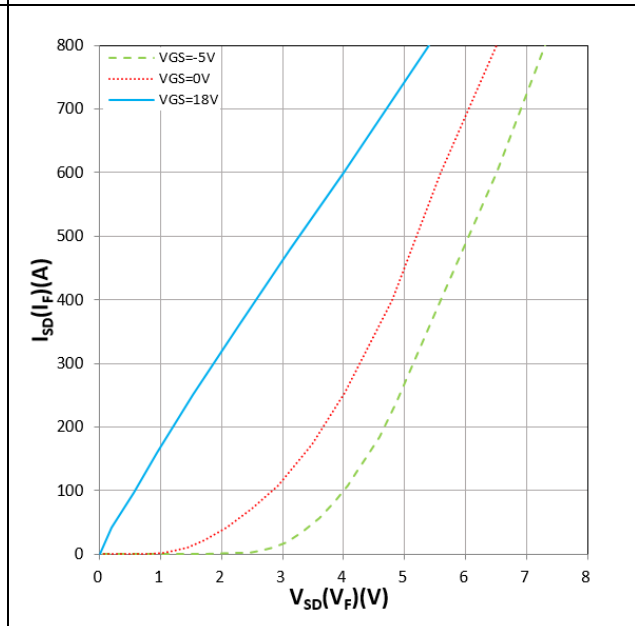


Figure 8.  $I_{SD}(I_F)$  vs  $V_{SD}(V_F)$   
 $T_j = 175^\circ\text{C}$ ,  $V_{GS}$  parameter

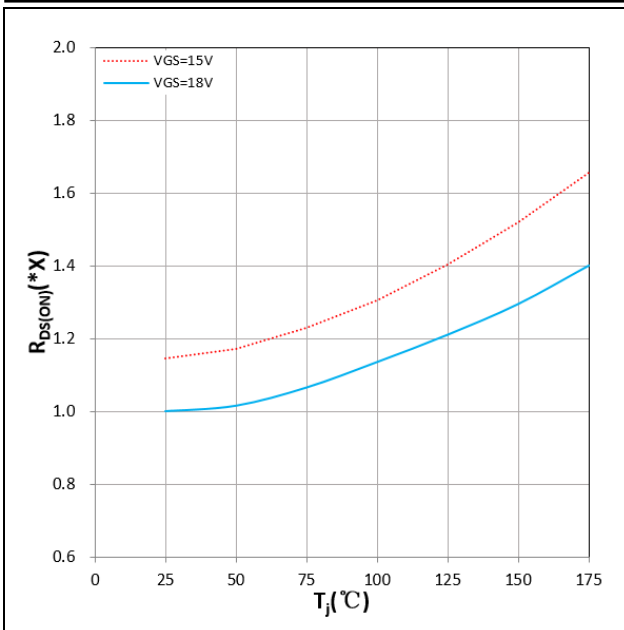


Figure 9. R<sub>DS(ON)</sub> vs T<sub>j</sub>  
V<sub>GS</sub> = +15V/+18V, I<sub>D</sub> = 360A, 1.0X = 4.3mΩ

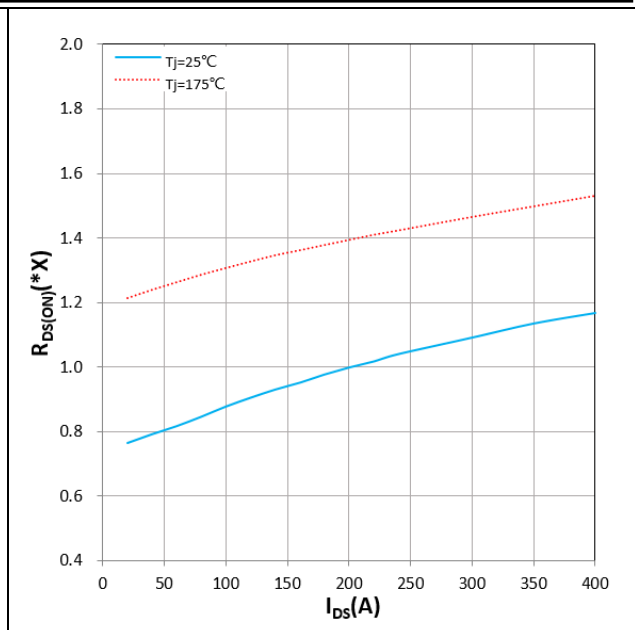


Figure 10. R<sub>DS(ON)</sub> vs I<sub>DS</sub>  
V<sub>GS</sub> = +18V, 1.0X = 4.3mΩ

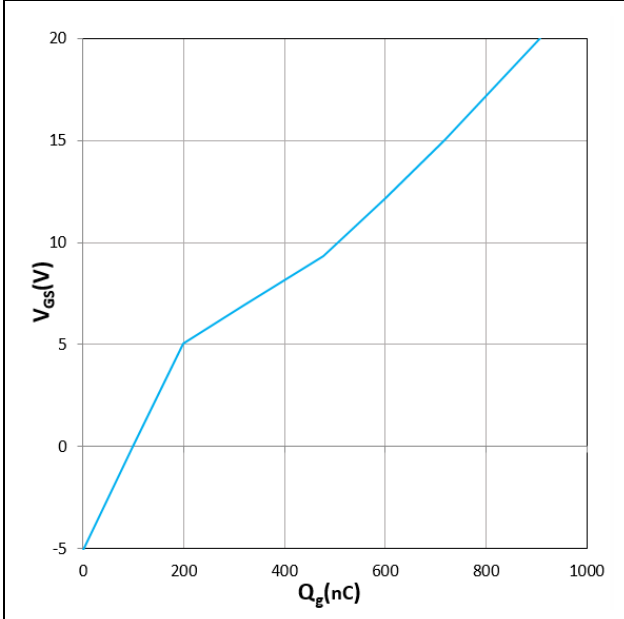


Figure 11. V<sub>GS</sub> vs Q<sub>g</sub>  
V<sub>DS</sub> = 800V, I<sub>D</sub> = 240A, T<sub>j</sub> = 25°C

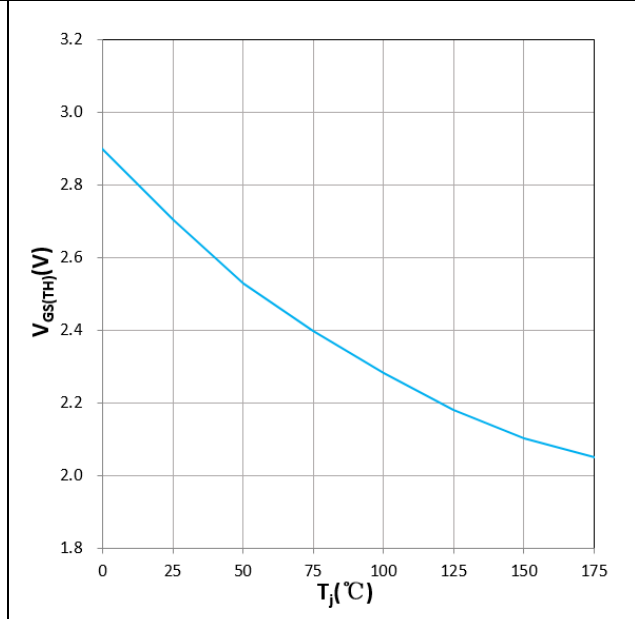


Figure 12. V<sub>GS(TH)</sub> vs T<sub>j</sub>  
V<sub>GS</sub> = V<sub>DS</sub>, I<sub>D</sub> = 140mA

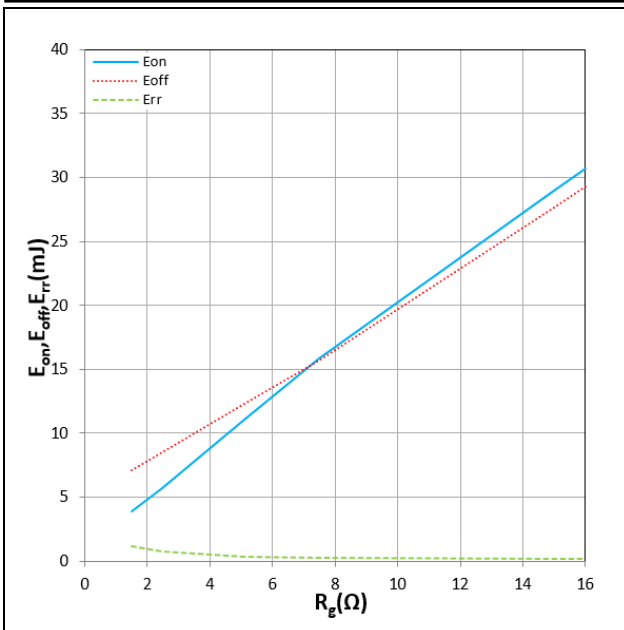


Figure 13.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $R_g$   
 $T_j=25^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+18\text{V}/-4\text{V}$ ,  $I_D=360\text{A}$   
 Inductive Load

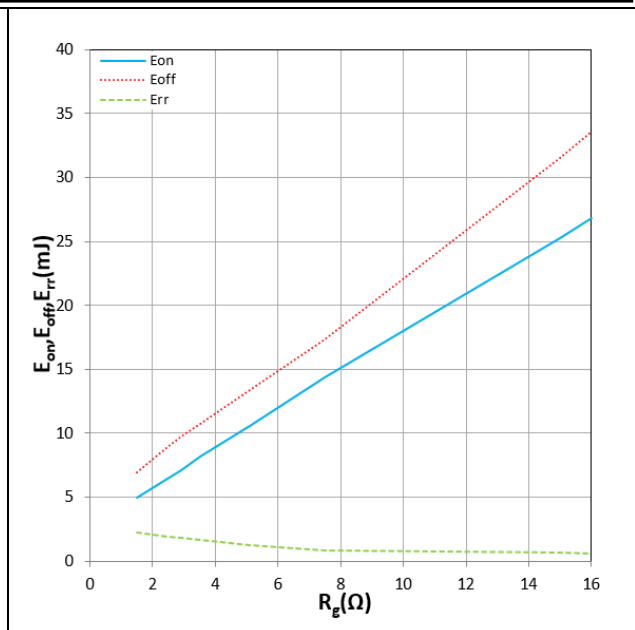


Figure 14.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $R_g$   
 $T_j=150^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+18\text{V}/-4\text{V}$ ,  $I_D=360\text{A}$   
 Inductive Load

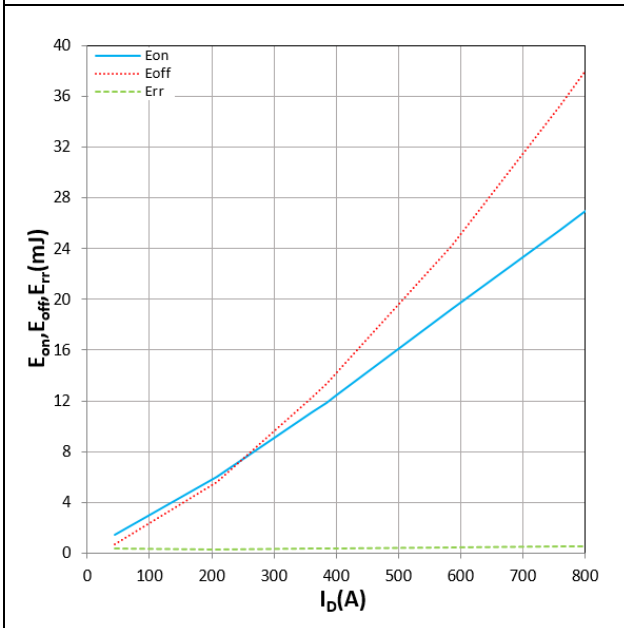


Figure 15.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $I_{DS}$   
 $T_j=25^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+18\text{V}/-4\text{V}$   
 $R_{gon}/R_{goff}=5.0\Omega/5.0\Omega$ , Inductive Load

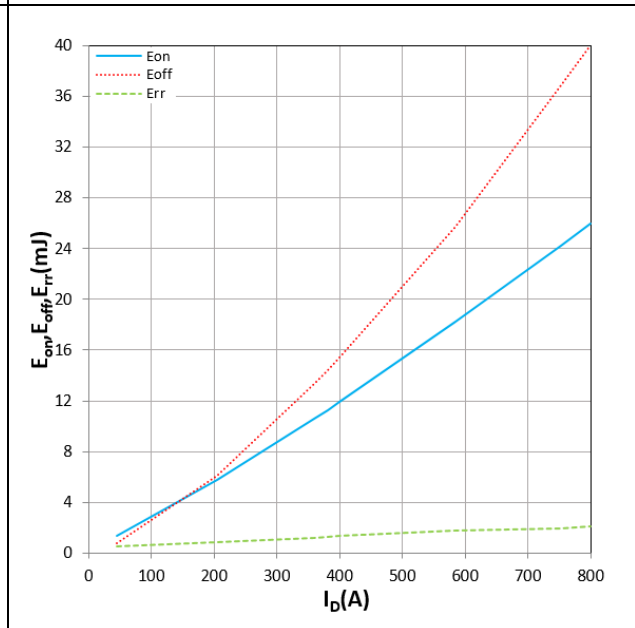


Figure 16.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $I_{DS}$   
 $T_j=150^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+18\text{V}/-4\text{V}$   
 $R_{gon}/R_{goff}=5.0\Omega/5.0\Omega$ , Inductive Load



### IMPORTANT NOTICE:

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