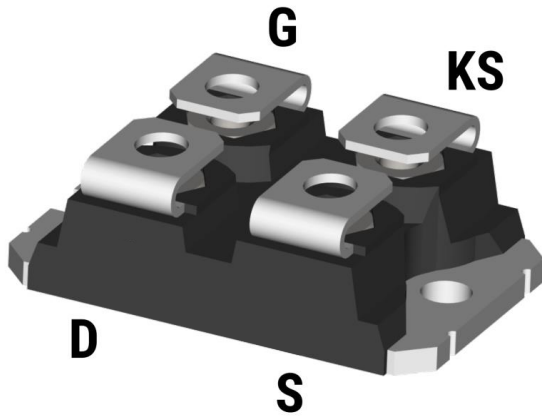


Description

The DFS09SU12Z7C1 is a Single Unit SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Motor drives and EV charging.

Features

- 1200V/9mΩ @ $T_j = 25^{\circ}\text{C}$, $V_{GS} = 18\text{V}$
- 175°C maximum junction temperature
- Low Device Capacitances(C_{oss} , C_{rss})
- Faster and More Efficient Switching



Applications

- UPS
- Motor Drive
- EV Charging
- High Voltage DC-DC Converters
- Induction Heating and Welding
- Smart Grid Transmission and Distribution

Circuit diagram

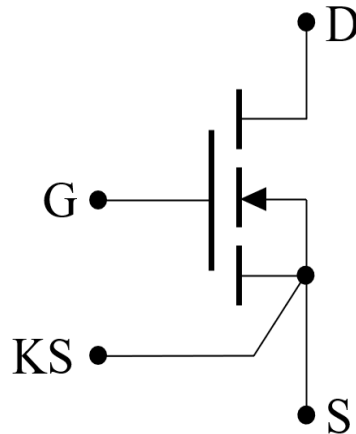


Figure 1. Out drawing & circuit diagram for DFS09SU12Z7C1

Pin Configuration and Marking Information

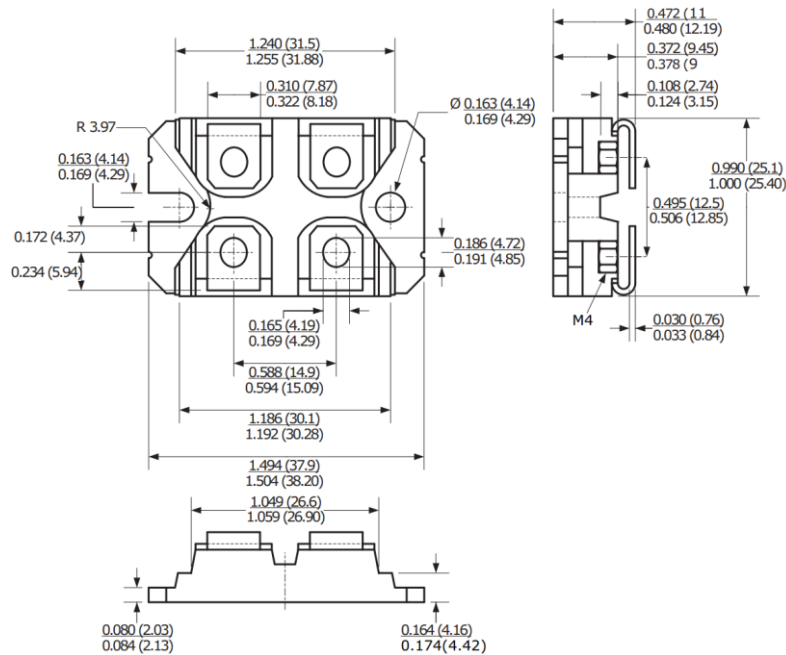


Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
CTI	-	>200	-
Mounting torque for module mounting	M4	1.5	Nm
Weight	-	28	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 _{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1		-10 to +22	V
I _{DS}	DC Continuous Drain Current	V _{GS} =+15V	T _C =25°C	200	A
I _{DS}	DC Continuous Drain Current		T _C =100°C	140	A
I _{DS}	DC Continuous Drain Current	V _{GS} =+18V	T _C =25°C	210	A
I _{DS}	DC Continuous Drain Current		T _C =100°C	150	A
I _{DSM}	Pulse Drain Current	Pulse width ≤3μs, V _{GS} =+15V, Note2		600	A
P _{tot}	Total Power Dissipation	T _C =25°C		484	W
T _{jmax}	Max Junction Temperature	-		175	°C
T _{stg}	Storage Temperature	-		-50 to 175	°C

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

Note2: Pulse width limited by maximum junction temperature

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 =100uA		1200	-	-	V
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V		-	2	-	μA
V _{GS(th)}	Gate-source threshold Voltage	I _D =70mA, V _{DS} =V _{GS}	T _j =25°C	1.8	2.7	-	V
			T _j =175°C	-	2.05	-	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =22V, V _{DS} =0V	T _j =25°C	-	-	200	nA
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =120A V _{GS} =+15V	T _j =25°C	-	10	-	mΩ
			T _j =175°C	-	14.5	-	mΩ
		I _D =120A V _{GS} =+18V	T _j =25°C	-	9	12	mΩ
			T _j =175°C	-	13	-	mΩ
V _{DS(on)} (Chip)	Static drain-source On-state Voltage	I _D =120A V _{GS} =+15V	T _j =25°C	-	1.20	-	V
			T _j =175°C	-	1.74	-	V
		I _D =120A V _{GS} =+18V	T _j =25°C	-	1.08	1.44	V
			T _j =175°C	-	1.56	-	V
C _{iss}	Input Capacitance	V _D =800V, V _{GS} =0V, f =1MHz, V _{AC} =25mV		-	11628	-	pF
C _{oss}	Output Capacitance			-	353	-	pF
C _{rss}	Reverse transfer Capacitance			-	28.5	-	pF
Q _g	Total gate charge	V _{DD} =800V, I _D =120A, V _{GS} =+15/-5V		-	360	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	0.65	-	Ω
t _{d(on)}	Turn-on delay time	V _{DD} =800V I _D =120A V _{GS} =+15/-4V R _{gon} =R _{goff} =1.0Ω Inductive load switching operation	T _j =25°C	-	48	-	ns
			T _j =150°C	-	41	-	
t _r	Rise time		T _j =25°C	-	21	-	ns
			T _j =150°C	-	17	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	23	-	ns
			T _j =150°C	-	27	-	
t _f	Fall time		T _j =25°C	-	14	-	ns
			T _j =150°C	-	38	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	976	-	μJ
			T _j =150°C	-	1324	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	410	-	μJ
			T _j =150°C	-	400	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.31	0.45	K/W

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V _{SD}	Body Diode Forward Voltage	V _{GS} = -5V I _{SD} =60A	T _J =25°C	-	4.6	-	V
			T _J =175°C	-	4.2	-	
T _{rr}	Reverse recovery time	V _{DD} =800V, I _D =120A V _{GS} =+15/-4V	T _J =25°C	-	38	-	ns
			T _J =150°C	-	49	-	
Q _{rr}	Reverse recovery charge	R _{gon} =R _{goff} =1.0Ω	T _J =25°C	-	245	-	nC
			T _J =150°C	-	480	-	
I _{rrm}	Reverse recovery current	Inductive load switching operation	T _J =25°C	-	28	-	A
			T _J =150°C	-	42	-	A

Test Conditions

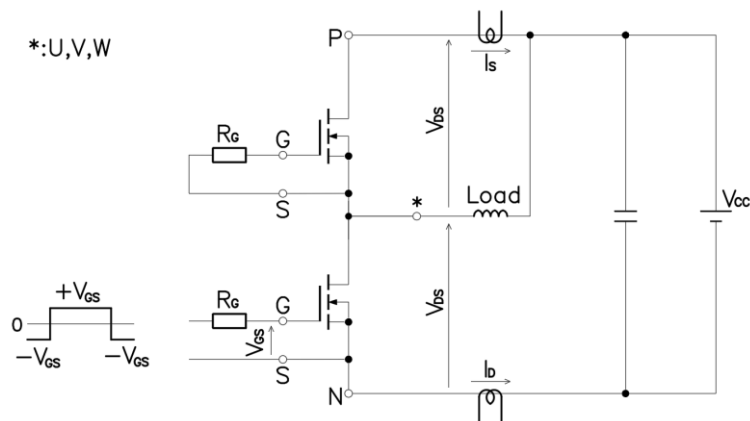


Figure 3. Switching time measure circuit

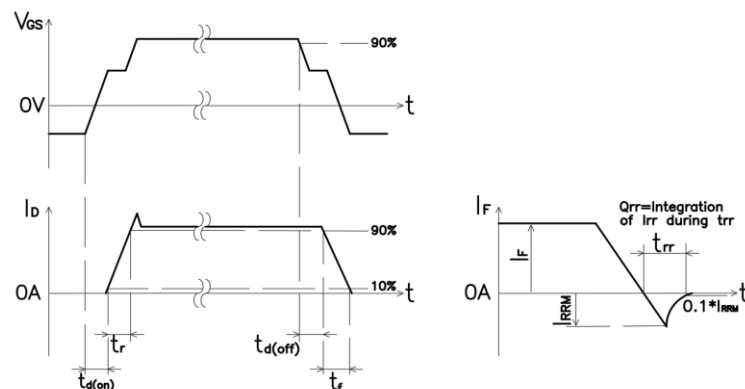


Figure 4. Switching time definition

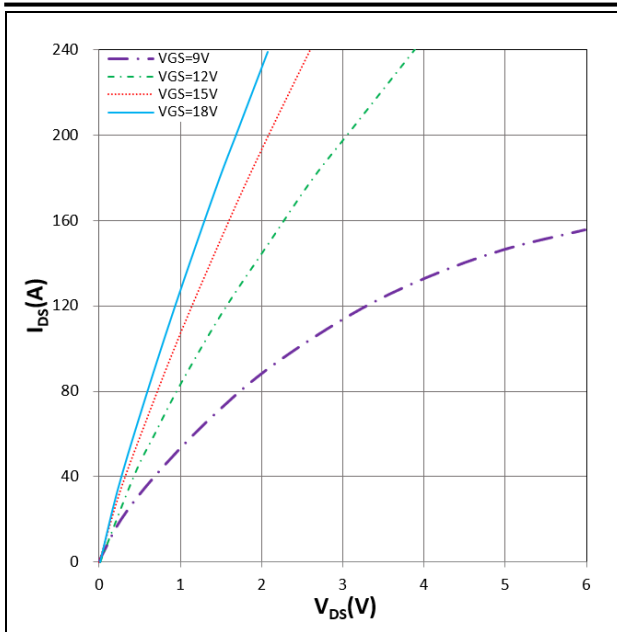


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

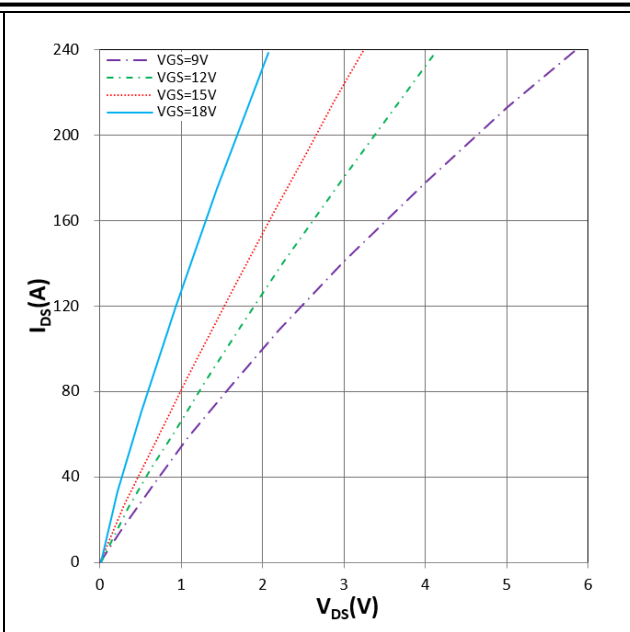


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$

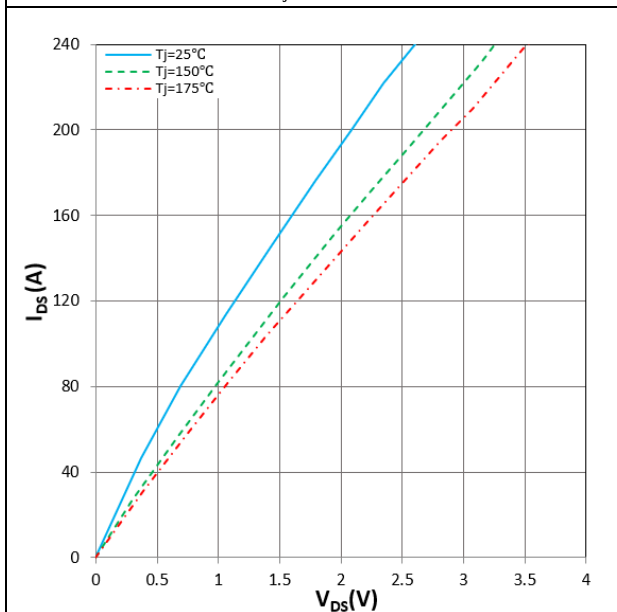


Figure 7. I_{DS} vs V_{DS}
 $V_{GS} = +15\text{V}$

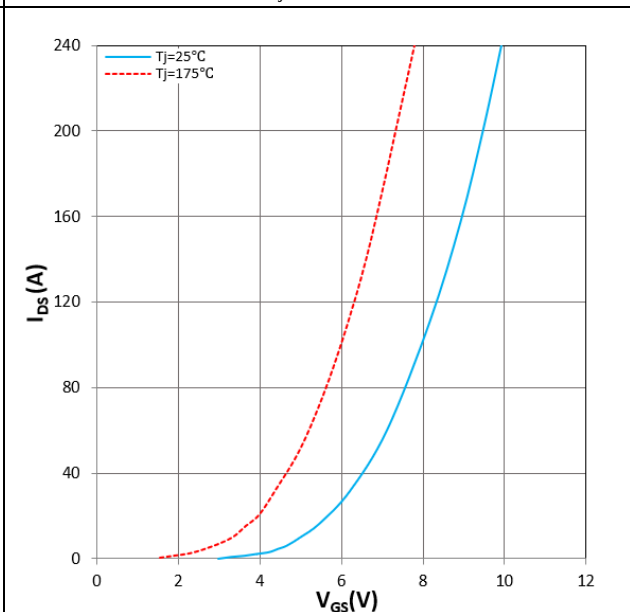


Figure 8. I_{DS} vs V_{GS}
 $V_{DS} = +10\text{V}$

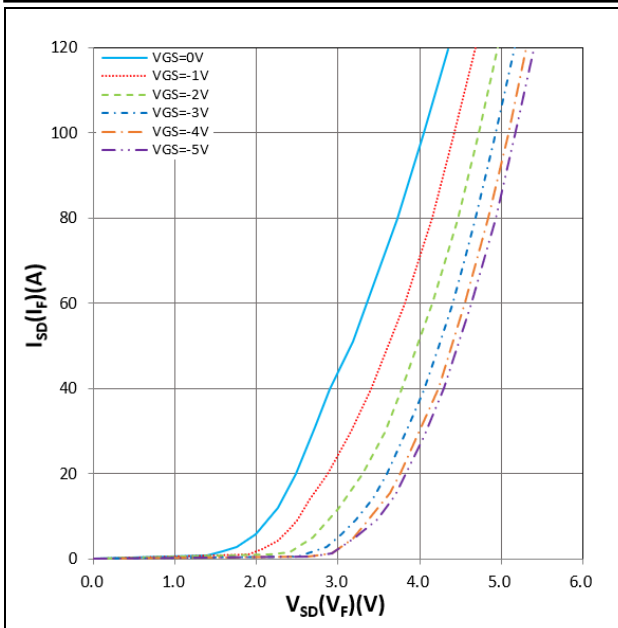


Figure 9. I_{SD} vs V_{SD} (V_F)
 $T_j = 25^\circ\text{C}$

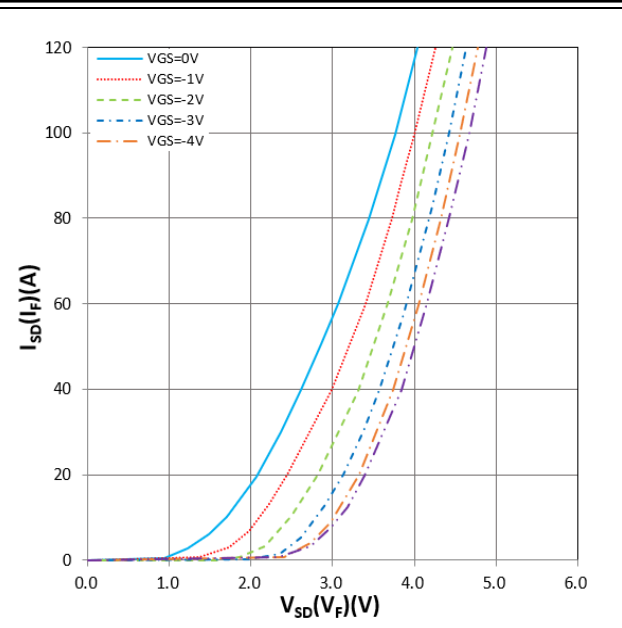


Figure 10. I_{SD} vs V_{SD} (V_F)
 $T_j = 175^\circ\text{C}$

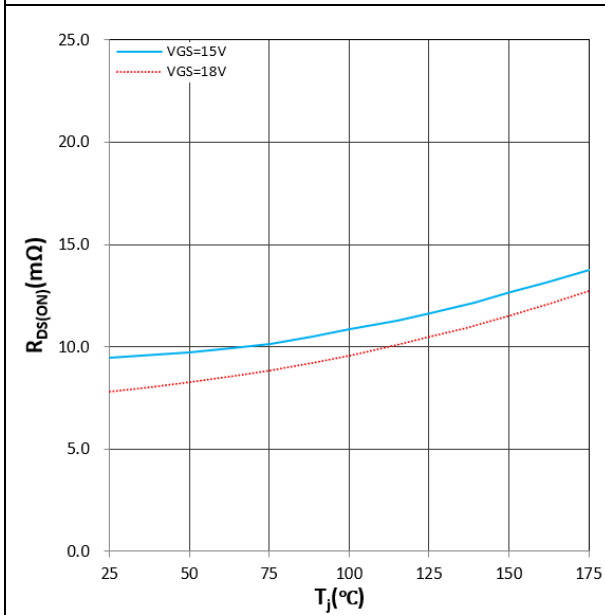


Figure 11. $R_{DS(ON)}$ vs T_j
 $I_D = 120\text{A}$

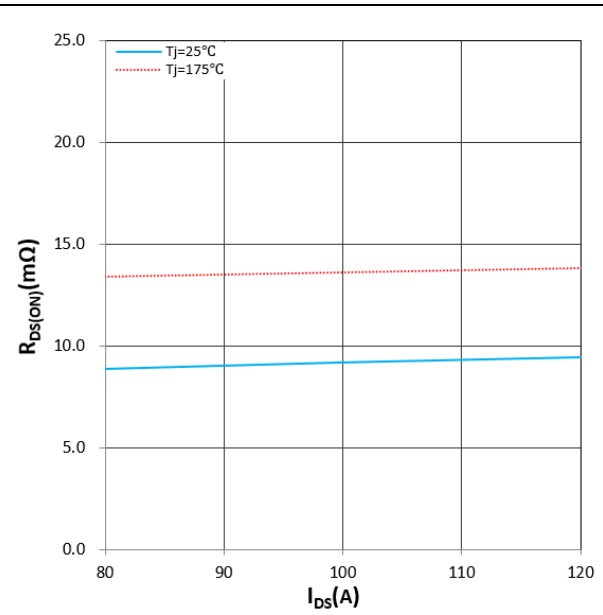


Figure 12. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +15\text{V}$

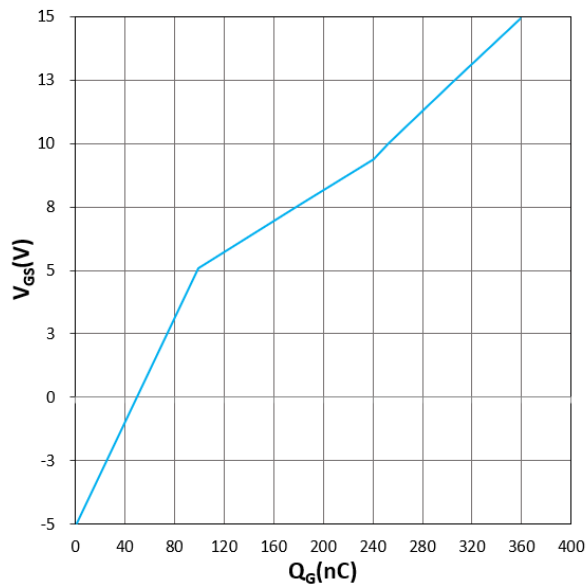


Figure 13. V_{GS} vs Q_g
 $V_{DS} = 800V$, $I_D = 120A$, $T_j = 25^\circ C$

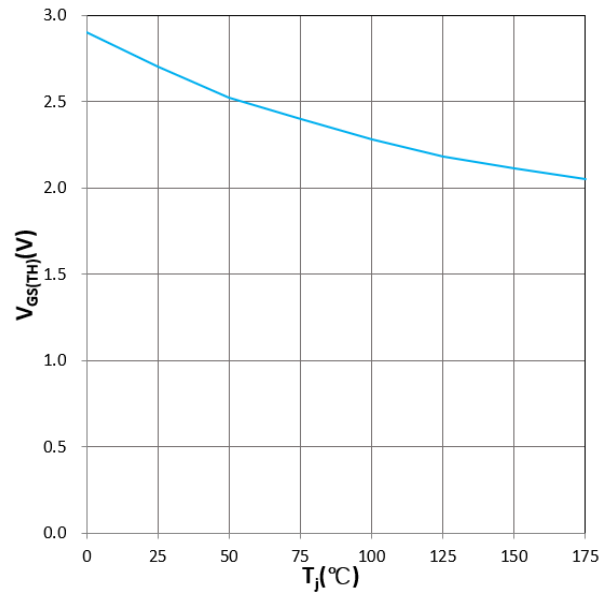


Figure 14. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 70mA$

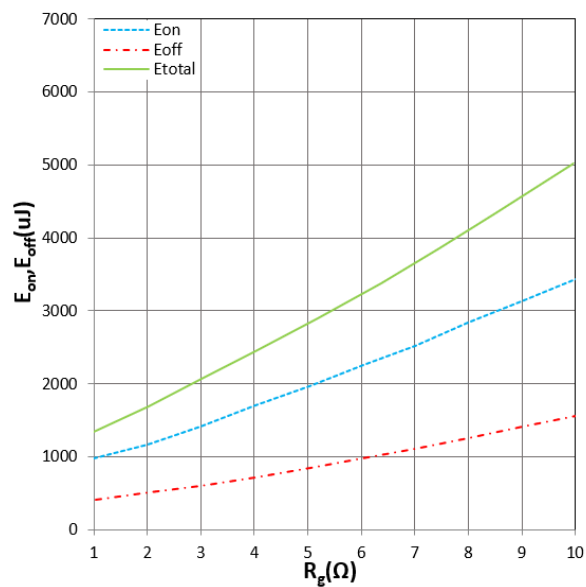


Figure 15. E_{on} , E_{off} vs R_g
 $T_j = 25^\circ C$, $V_{CC} = 800V$, $V_{GS} = +15V/-4V$, $I_D = 120A$
 Inductive Load

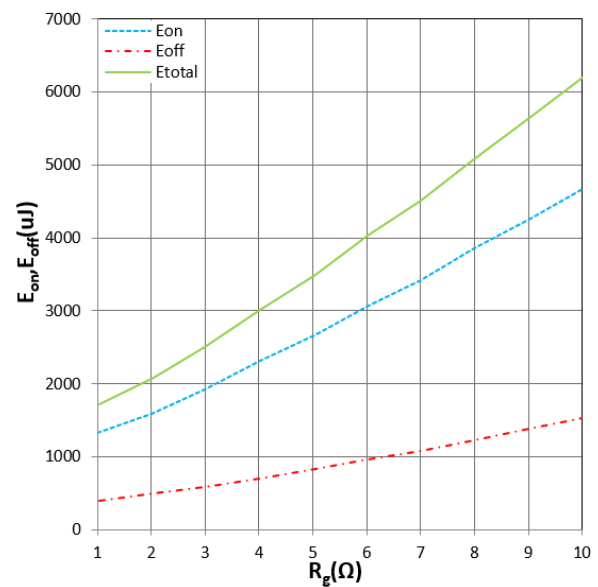


Figure 16. E_{on} , E_{off} vs R_g
 $T_j = 150^\circ C$, $V_{CC} = 800V$, $V_{GS} = +15V/-4V$, $I_D = 120A$
 Inductive Load

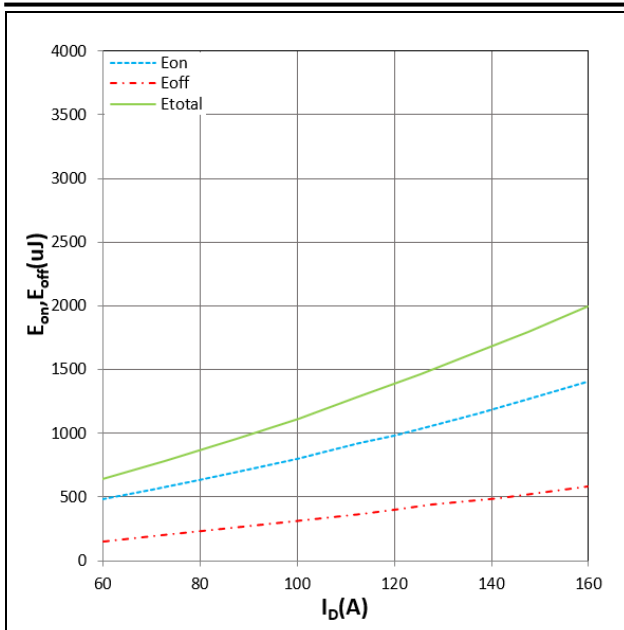


Figure 17. Eon, Eoff vs ID
Tj = 25°C, VCC = 800V, VGS = +15V/-4V
Rgon = Rgoff = 1.0Ω, Inductive Load

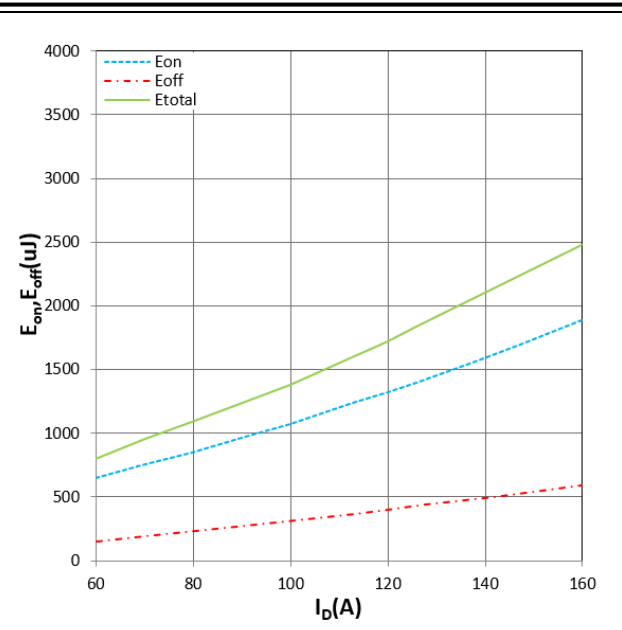


Figure 18. Eon, Eoff vs ID
Tj = 150°C, VCC = 800V, VGS = +15V/-4V
Rgon = Rgoff = 1.0Ω, Inductive Load

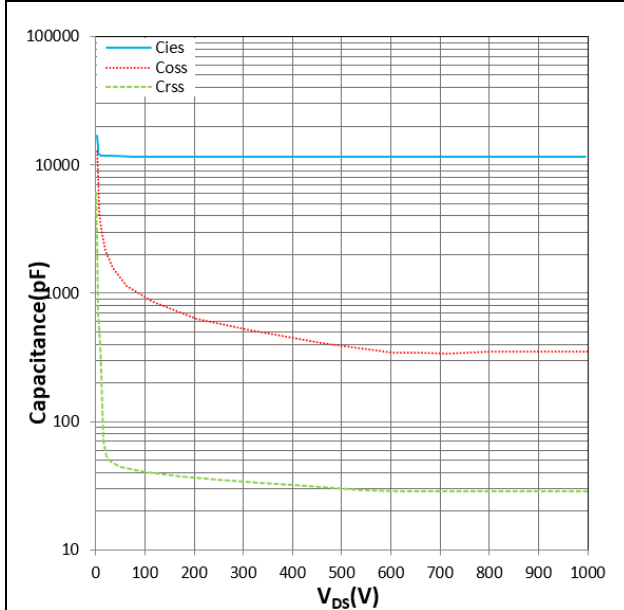


Figure 19. Ciss, Coss, Crss vs VDS
Tj = 25°C, f = 1MHz, VAC = 25mV

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