DFS30HH12EYA1

1200V/30mΩ H Bridge SiC MOSFET Module

Description

The DFS30HH12EYA1 is a H Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Solar Inverter, UPS, Fuel cell-DC/DC converter, Energy storage Systems.

Features

- Blocking voltage:1200V
- 30mΩ $R_{ds(on)}$@T_j =25°C
- 46mΩ $R_{ds(on)}$@T_j =175°C
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

Applications

- Solar Inverter
- UPS
- Fuel cell-DC/DC converter
- Energy Storage Systems

Circuit diagram

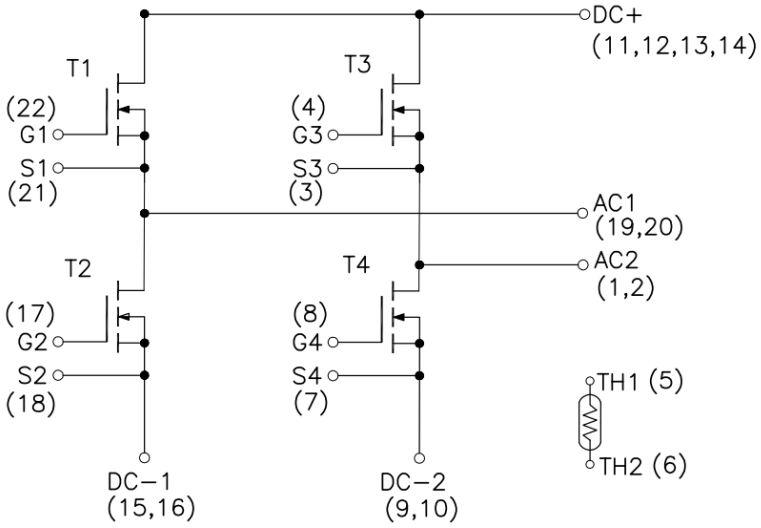


Figure 1. Out drawing & circuit diagram for DFS30HH12EYA1

Pin Configuration and Marking Information

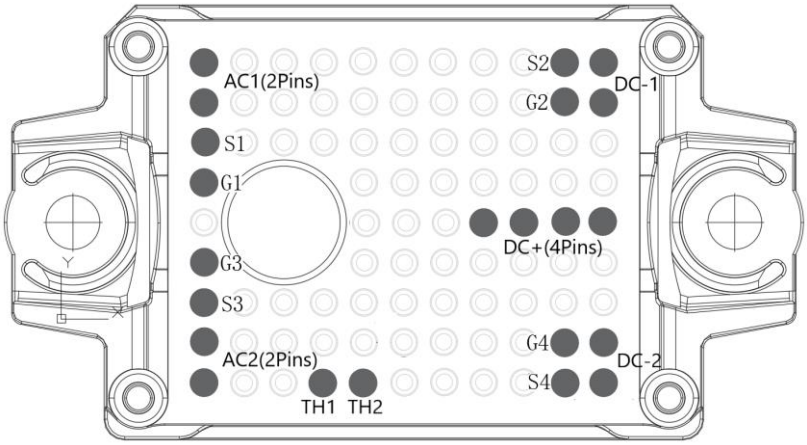


Figure 2. Pin configuration

PIN No.	Symbol	Description
1-2	AC2	Output terminal of half bridge
3	S3	T3 High side source signal terminal
4	G3	T3 High side gate signal terminal
5	TH1	Thermistor connection 1
6	TH2	Thermistor connection 2
7	S4	T4 Low side source signal terminal
8	G4	T4 Low side gate signal terminal
9-10	DC-2	DC – Bus connection
11-14	DC+	DC + Bus connection
15-16	DC-1	DC – Bus connection
17	G2	T2 Low side gate signal terminal
18	S2	T2 Low side source signal terminal
19-20	AC1	Output terminal of half bridge
21	G1	T1 High side gate signal terminal
22	S1	T1 High side source signal terminal

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
Clearance	Terminal to Terminal	5	mm
	Terminal to Heatsink	10	mm
Creepage distance	Terminal to Terminal	6.3	mm
	Terminal to Heatsink	12.7	mm
Comparative Tracking Index	-	600	-

Maximum Ratings (T_j =25°C unless otherwise specified)

Symbol	Parameter	Condition	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
$V_{GSSSurge}$	G-S Voltage(t_{surge}<300nsec)	D-S Short, Note1	-8 to 19	V
I_{DS}	DC Continuous Drain Current	T_C =25°C	70	A
I_{DS}	DC Continuous Drain Current	T_C=100°C	50	A
I_{SD}	Source (Body Diode) Current	T_C =25°C, with ON signal	70	A
I_{SD}	Source (Body Diode) Current	T_C=100°C, with ON signal	50	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	150	A
T_j	junction temperature	-	-40 to 175	℃
T_{stg}	Storage temperature	-	-40 to 125	℃

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

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 R_{100}	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 =100μA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS} =1200V, V_{GS} =0V		-	1	50	μA
$V_{GS(th)}$	Gate-Source threshold Voltage	I_D =13.5mA, V_{DS} =V_{GS}	T_j =25°C	1.8	2.8	3.7	V
			T_j =175°C	-	2.0	-	V
I_{GSS+}	Gate-Source Leakage Current	V_{GS} =+15V, V_{DS} =0V, T_j =25°C		-	-	200	nA
I_{GSS-}		V_{GS} =-4V, V_{DS} =0V, T_j =25°C		-200	-	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =40A V_{GS} =+15V	T_j =25°C	-	29.5	40.0	mΩ
			T_j =175°C	-	46.1	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =40A V_{GS} =+15V	T_j =25°C	-	1.18	1.60	V
			T_j =175°C	-	1.84	-	V
C_{iss}	Input Capacitance	V_{DS} =1000V, V_{GS} =0V, f =100kHz		-	3070	-	pF
C_{oss}	Output Capacitance			-	130	-	pF
C_{rss}	Reverse transfer Capacitance			-	10	-	pF
Q_G	Total gate charge	V_{DD} =800V, I_D =40A, V_{GS} =+15/-4V		-	134	-	nC
R_{Gint}	Internal Gate Resistance	T_j =25°C		-	1.0	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =800V I_D =40A V_{GS} =+15/-4V R_G =2.2Ω Inductive load switching operation	T_j =25°C	-	18	-	ns
			T_j =150°C	-	19	-	
t_r	Rise time		T_j =25°C	-	20	-	ns
			T_j =150°C	-	24	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	33	-	ns
			T_j =150°C	-	36	-	
t_f	Fall time		T_j =25°C	-	11	-	ns
			T_j =150°C	-	13	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	515	-	μJ
			T_j =150°C	-	726	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	26	-	μJ
			T_j =150°C	-	31	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	0.63	-	K/W
$R_{th(c-f)}$	Contact thermal resistance	With thermal conductive grease /MOSFET		-	0.55	-	K/W

Assumes Thermal Conductivity of grease is 2.8 W/m・K and thickness is 50um.

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-4V I_{SD} =40A	T_j =25°C	-	4.3	-	V
			T_j =175°C	-	3.8	-	
T_{rr}	Reverse recovery time	V_{DD} =800V I_D =40A V_{GS} =+15/-4V R_G =2.2Ω Inductive load switching operation	T_j =25°C	-	21	-	ns
			T_j =150°C	-	24	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	105	-	nC
			T_j =150°C	-	265	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	252	-	μJ
			T_j =150°C	-	328	-	

Test Conditions

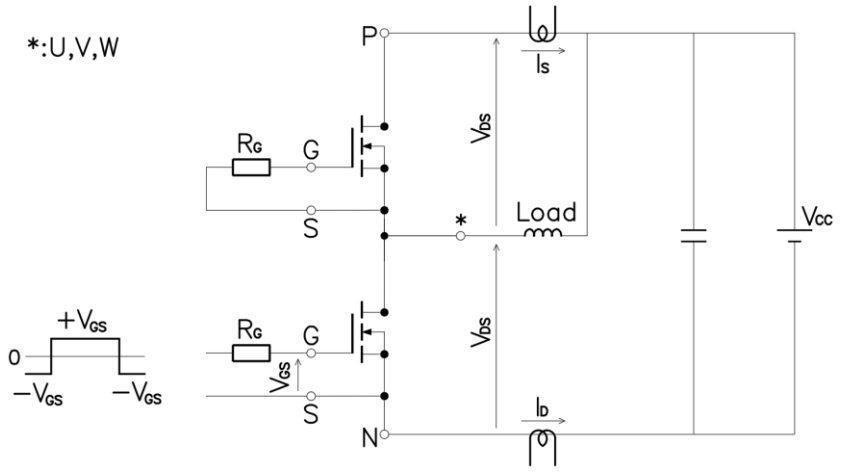


Figure 3. Switching time measure circuit

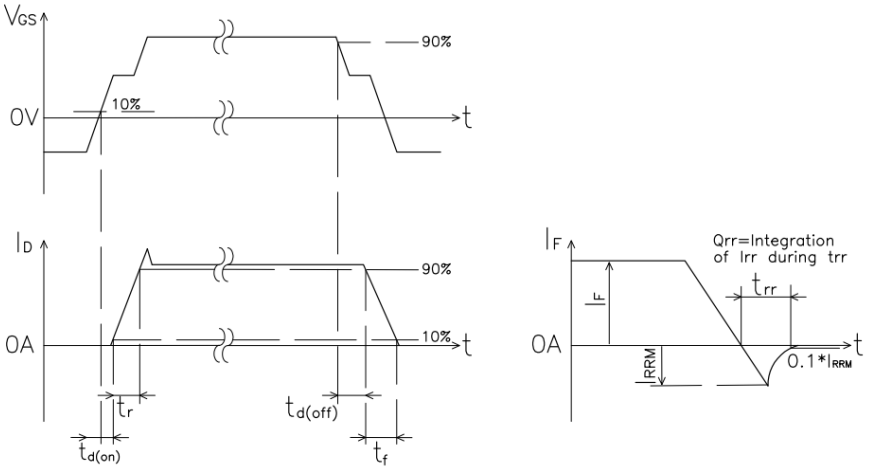


Figure 4. Switching time definition

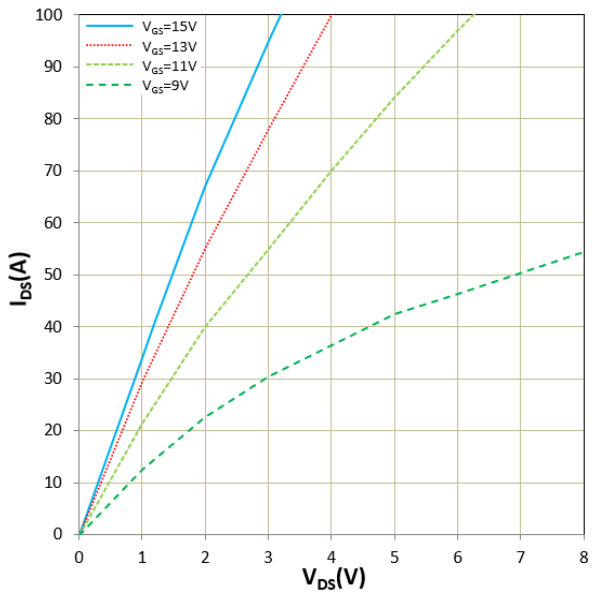


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

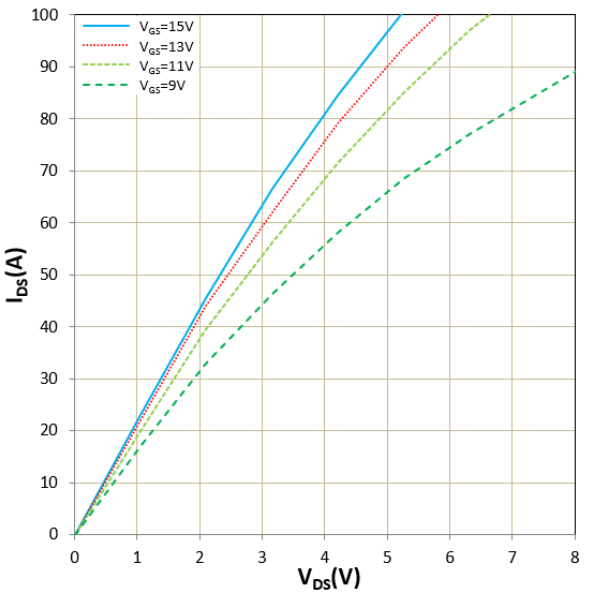


Figure 6. I_{DS} vs V_{DS}
T_j =175°C, V_{GS} parameter

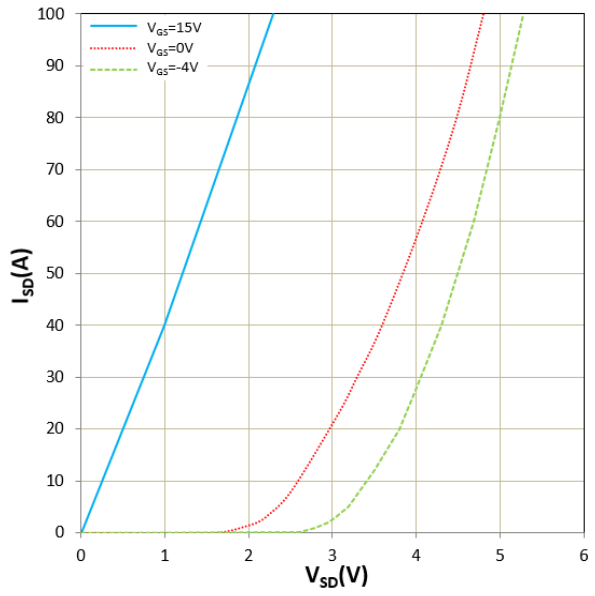


Figure 7. $I_{SD}(I_F)$ vs V_{SD} (V_F)
T_j =25°C, V_{GS} parameter

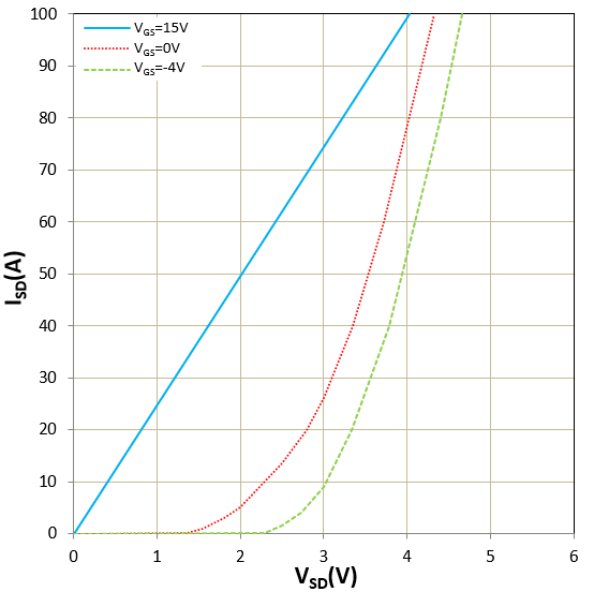


Figure 8. $I_{SD}(I_F)$ vs V_{SD} (V_F)
T_j =175°C, V_{GS} parameter

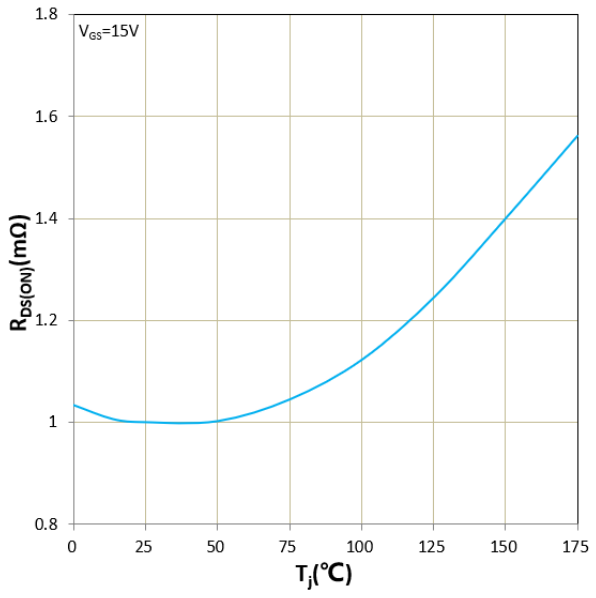


Figure 9. $R_{DS(ON)}$ vs T_J
V_{GS} =+15V, I_D =40A, 1.0X =29.5mΩ

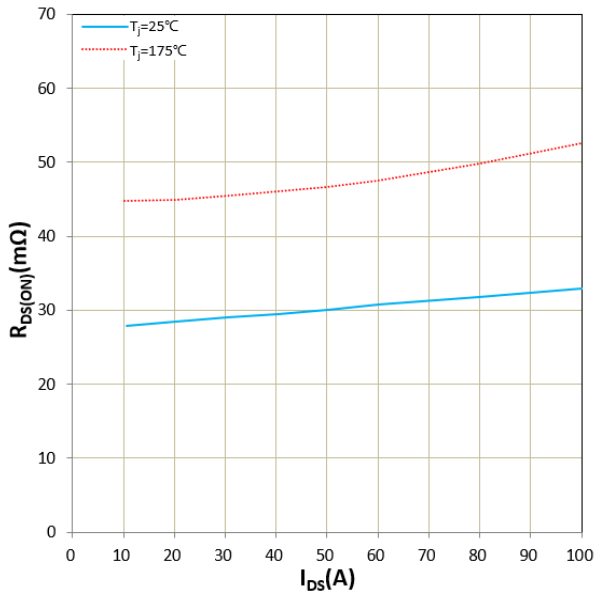


Figure 10. $R_{DS(ON)}$ vs I_{DS}
T_j =25℃/175℃,V_{GS} =+15V

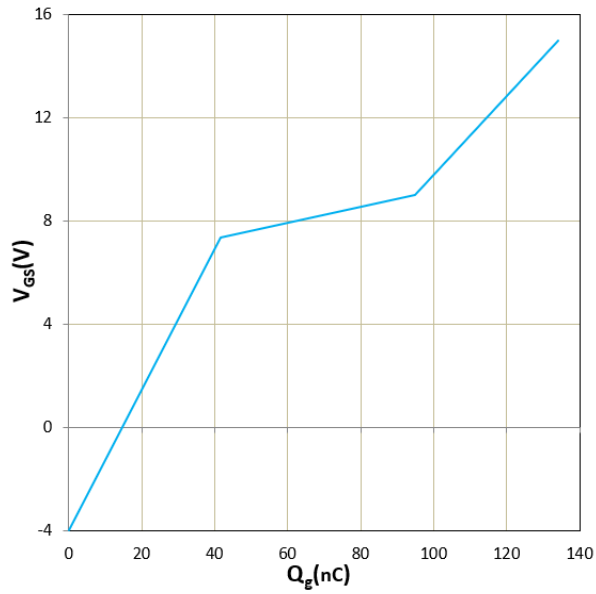


Figure 11. V_{GS} vs Q_g
T_j =25°C, V_{DS} =800V, I_D =40A

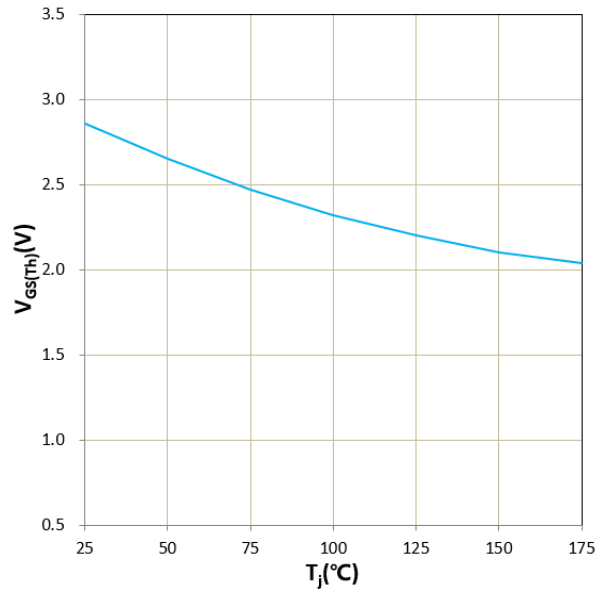


Figure 12. $V_{GS(TH)}$ vs T_j
V_{GS} =V_{DS}, I_D =13.5mA

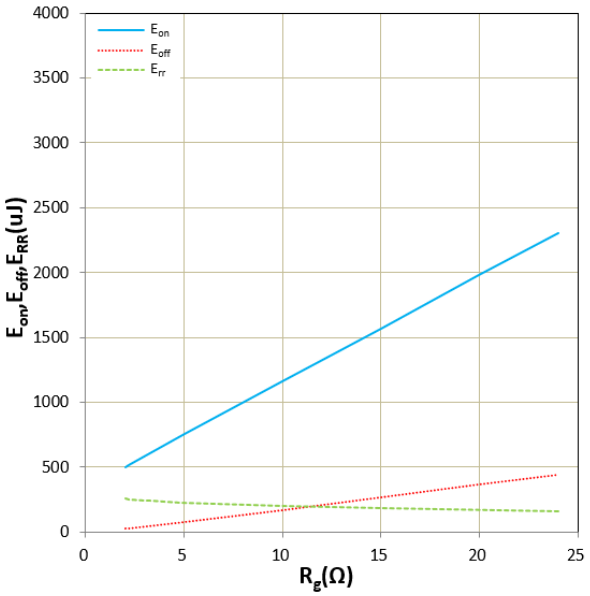


Figure 13. E_{on}, E_{off}, E_{rr} vs R_g
T_j =25°C, V_{DD} =800V, I_D =40A, V_{GS} =-4V/+15V
Inductive Load

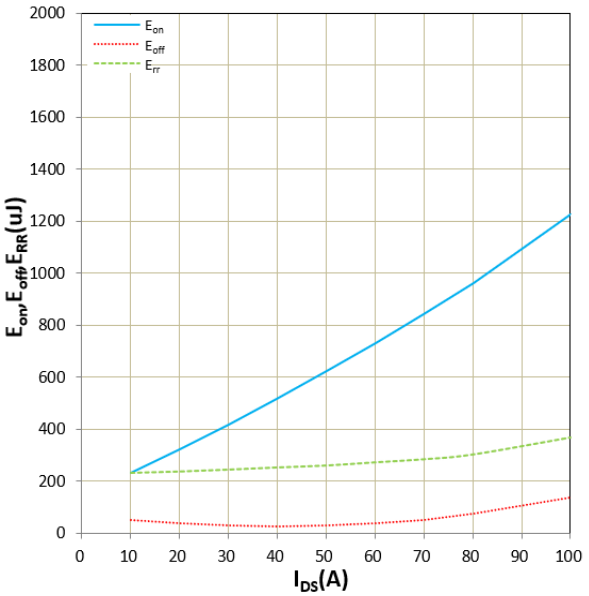


Figure 14. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j =25°C, V_{DD} =800V, R_g =2.2Ω, V_{GS} =-4V/+15V
Inductive Load

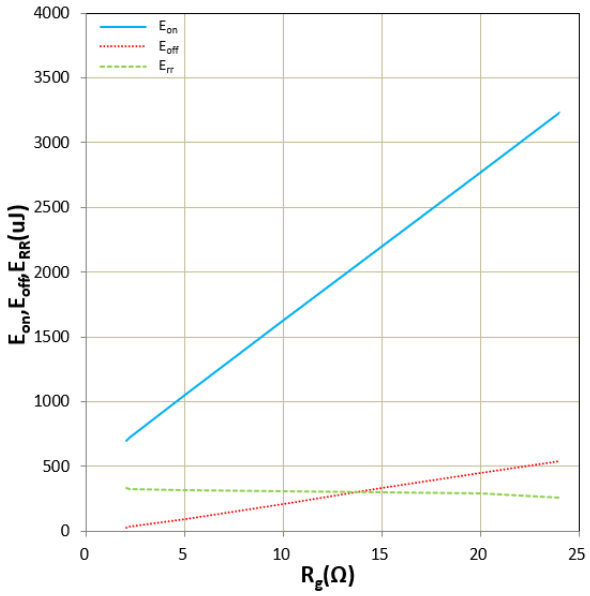


Figure 15. E_{on}, E_{off}, E_{rr} vs R_g
T_j =150°C, V_{DD} =800V, I_D =40A, V_{GS} =-4V/+15V
Inductive Load

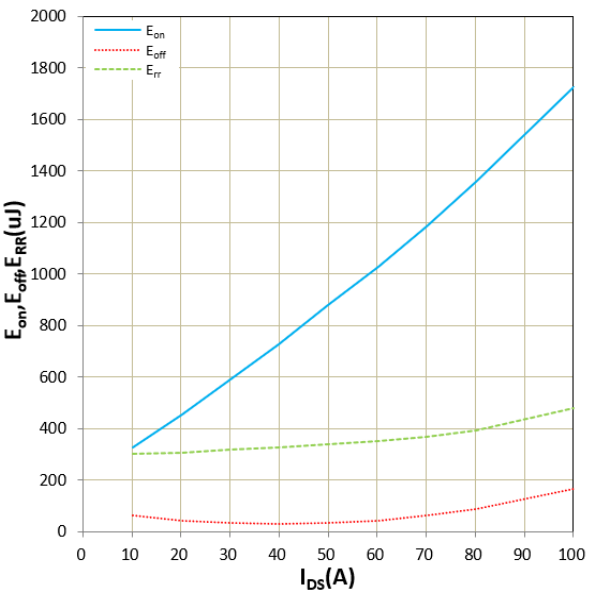


Figure 16. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j =150°C, V_{DD} =800V, R_g =2.2Ω, V_{GS} =-4V/+15V
Inductive Load

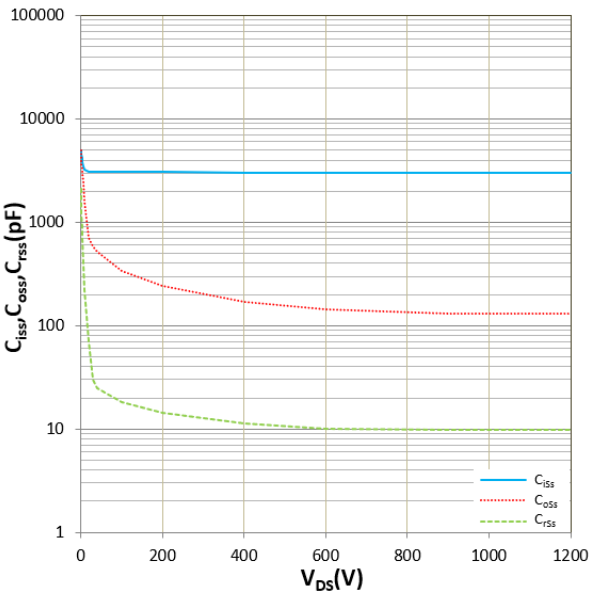
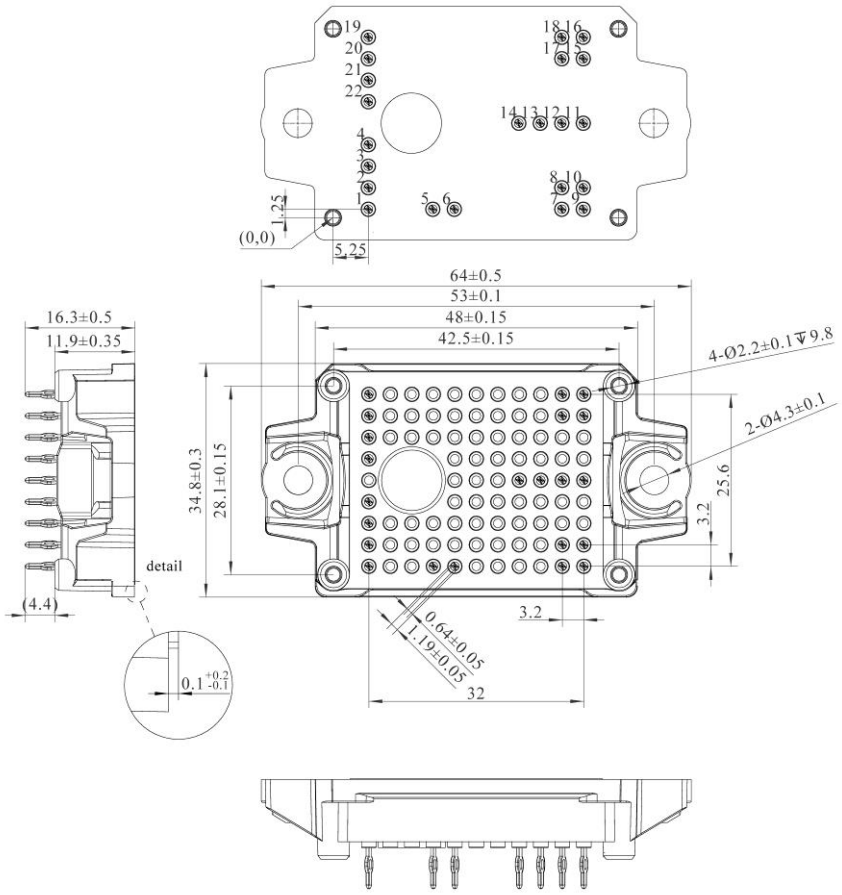


Figure 17. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
V_{GS} =0V, f =100kHz, T_j =25°C

Package dimensions



Pin table		
Pin	X	Y
1	5.25	1.25
2	5.25	4.45
3	5.25	7.65
4	5.25	10.85
5	14.85	1.25
6	18.05	1.25
7	34.05	1.25
8	34.05	4.45
9	37.25	1.25
10	37.25	4.45
11	37.25	14.05
12	34.05	14.05
13	30.85	14.05
14	27.65	14.05
15	37.25	23.65
16	37.25	26.85
17	34.05	23.65
18	34.05	26.85
19	5.25	26.85
20	5.25	23.65
21	5.25	20.45
22	5.25	17.25

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