DFS05HF12EZA1

1200V/5.0mΩ Half Bridge SiC MOSFET Module

Description

The DFS05HF12EZA1 is a Half Bridge SiC MOSFET half bridge 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
- 5.0mΩ $R_{ds(on)}$ / T_j =25°C, V_{gs} =18V
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

Applications

- Solar inverter Systems
- Fuel cell-DC/DC converter
- Uninterruptible Power Supplier
- Energy Storage Systems

Circuit diagram

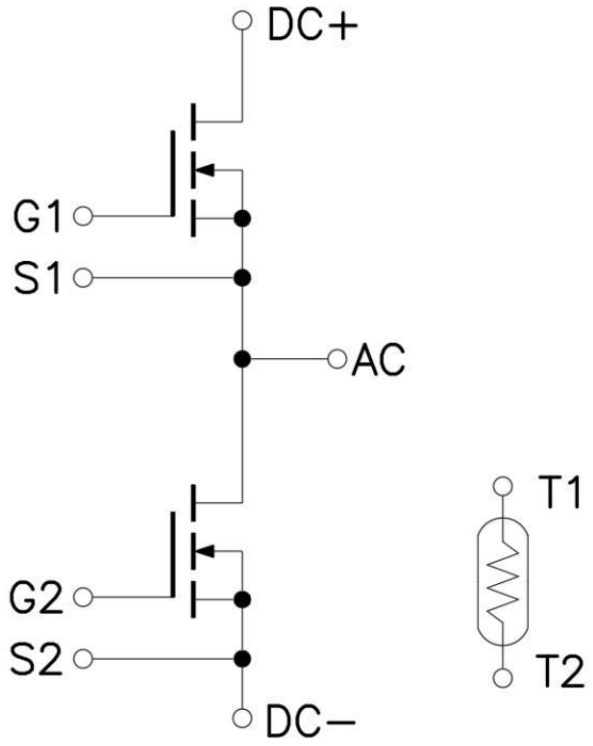


Figure 1. Out drawing & circuit diagram for DFS05HF12EZA1

Pin Configuration and Function Description

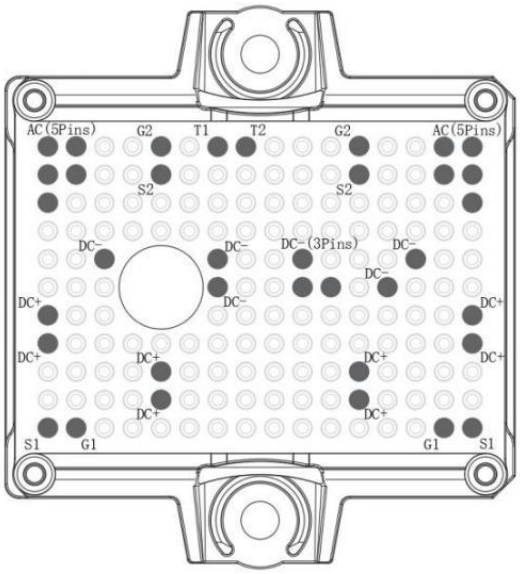


Figure 2. Pin configuration

PIN No.	Symbol	Description
1-5(5pins)	AC	Output terminal of half bridge
6	S2	Low side source signal terminal
7	G2	Low side gate signal terminal
8	TH1	Thermistor connection 1
9	TH2	Thermistor connection 2
10	S2	Low side source signal terminal
11	G2	Low side gate signal terminal
12-16(5pins)	AC	Output terminal of half bridge
17-24(8pins)	DC -	DC - Bus connection
25-32(8pins)	DC +	DC + Bus connection
33	S1	High side source signal terminal
34	G1	High side gate signal terminal
35	G1	High side gate signal terminal
36	S1	High side source signal terminal

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}	G-S Voltage	D-S Short, Note1	-10 to 23	V
I_{DS}	DC Continuous Drain Current	T_C=25°C	378	A
		T_C=100°C	240	
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	480	A
P_{tot}	Total Power Dissipation	T_C=25°C	1389	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

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

Note2: Pulse width limited by maximum junction temperature

Module

Parameter	Conditions	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
Stray inductance	-	7	μH
Comparative Tracking Index	-	200	-

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	$R2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\ K))]$	-	3375	-	K
$B_{25/80}$	B-value	$R2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\ K))]$	-	3411	-	K
$B_{25/100}$	B-value	$R2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\ K))]$	-	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 =0.3mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V, T_j =25°C		-	3	150	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=81mA, V_{DS}=V_{GS}	T_j =25°C	2.0	2.8	3.7	V
			T_j =150°C	-	2.1	-	
			T_j =175°C	-	2.0	-	
I_{GSS+}	Gate-Source Leakage Current	V_{GS} =18V, V_{DS} =0V	T_j =25°C	-	6	-1200	nA
I_{GSS-}		V_{GS} =-4V, V_{DS} =0V	T_j =25°C	-1200	-6	0	
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=240A V_{GS}=18V	T_j=25°C	-	5.4	-	mΩ
			T_j=150°C	-	8.3	-	
			T_j=175°C	-	9.3	-	
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=240A V_{GS}=18V	T_j=25°C	-	1.20	-	V
			T_j=150°C	-	1.99	-	
			T_j=175°C	-	2.23	-	
C_{iss}	Input Capacitance	V_{DS} =1000V V_{GS} =0V f=100kHz		-	12.9	-	nF
C_{oss}	Output Capacitance			-	0.642	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.057	-	nF
Q_g	Total gate charge	V_{DS} =800V I_D =240A V_{GS} =+18/-4V		-	666	-	nC
Q_{gs}	Gate-source charge			-	165	-	
Q_{gd}	Gate-drain charge			-	264	-	
R_{gint}	Internal gate resistor	f=1MHz		-	0.467	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DS} =800V	T_j=25°C	-	17	-	ns
			T_j=150°C	-	15	-	
t_r	Rise time		T_j=25°C	-	27	-	ns
			T_j=150°C	-	25	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	40	-	ns

		I_D =240A V_{GS} =+18/-4V $R_{G(ON)}$ =2Ω $R_{G(OFF)}$ =2Ω Inductive load switching operation	T_j =150°C	-	42	-	
t_f	Fall time		T_j =25°C	-	9	-	ns
			T_j =150°C	-	11	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	3.42	-	mJ
E_{off}	Turn-off power dissipation		T_j =25°C	-	0.42	-	mJ
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.09	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note3		-	0.12	-	K/W

Note3: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} =120A	T_j =25°C	-	4.1	-	V
			T_j =175°C	-	3.6	-	
T_{rr}	Reverse recovery time	V_{DD} =800V，I_D =240A V_{GS} =+18/-4V $R_{G(ON)}$ =$R_{G(OFF)}$ =2Ω Inductive load switching operation	T_j =25°C	-	21	-	ns
Q_{rr}	Reverse recovery charge		T_j =25°C	-	1.41	-	μC
I_{rrm}	Peak Reverse Recovery Current				120		A

Test Conditions

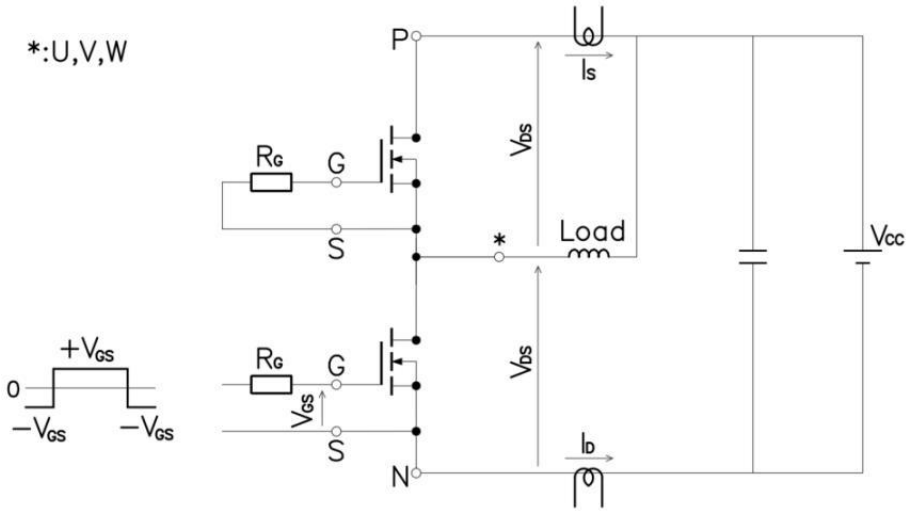


Figure 3. Switching time measure circuit

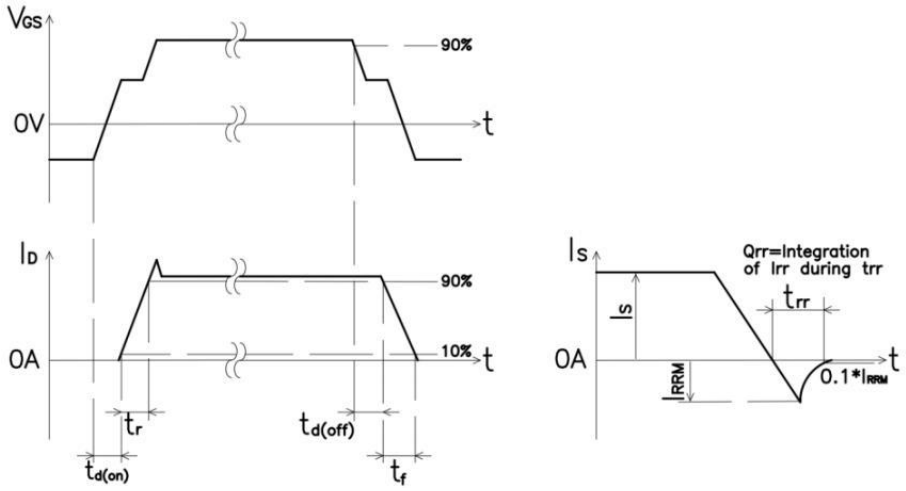


Figure 4. Switching time definition

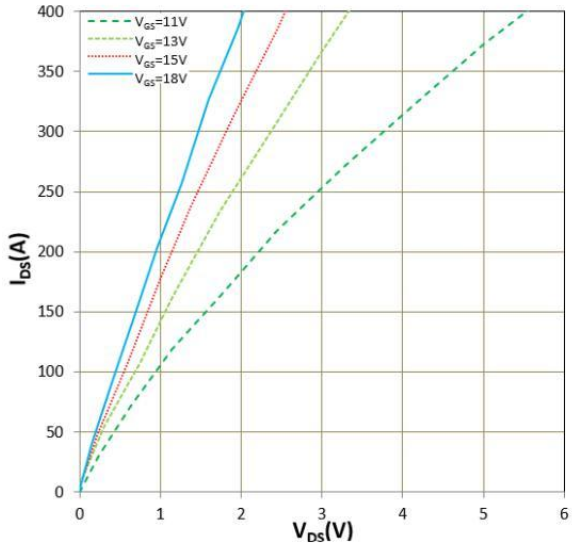


Figure 5. I_{DS} vs V_{DS}
T_j =25°C

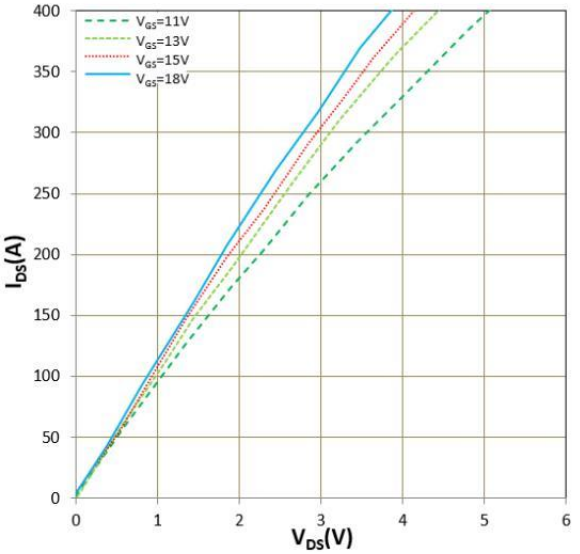


Figure 6. I_{DS} vs V_{DS}
T_j =175°C

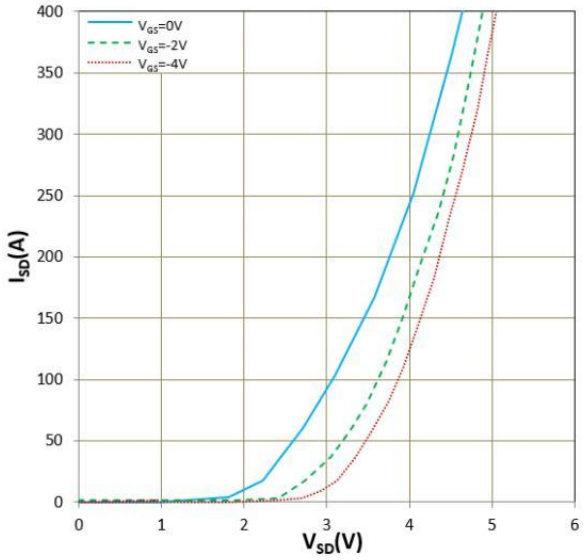


Figure 7. I_{SD} vs V_{SD} (V_F)
T_j =25°C

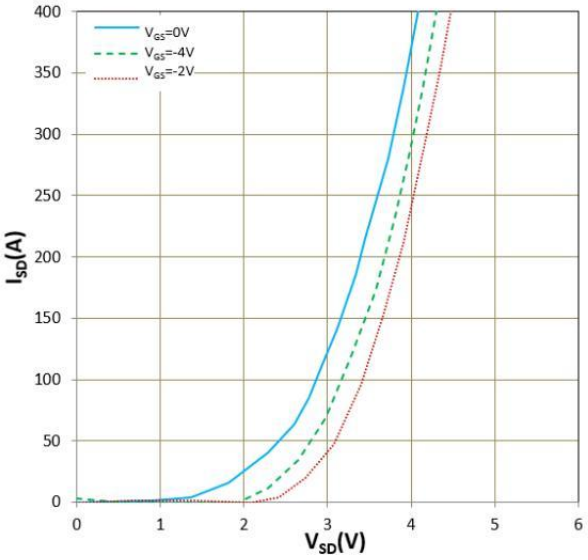


Figure 8. I_{SD} vs V_{SD} (V_F)
T_j =175°C

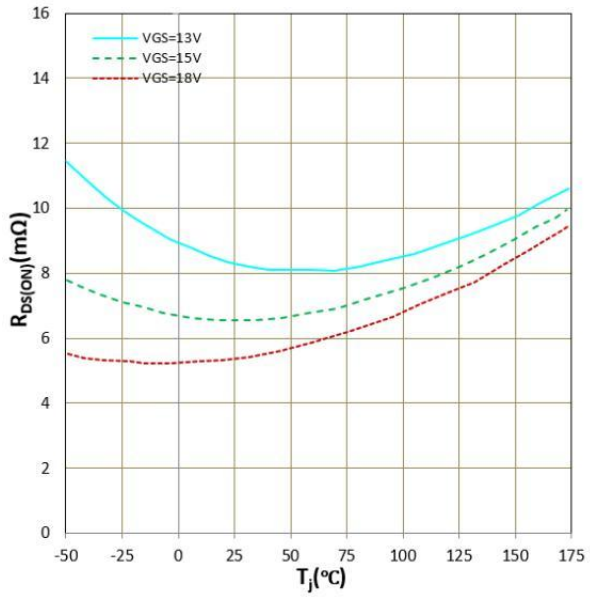


Figure 9. $R_{DS(ON)}$ vs T_j

I_D =240A

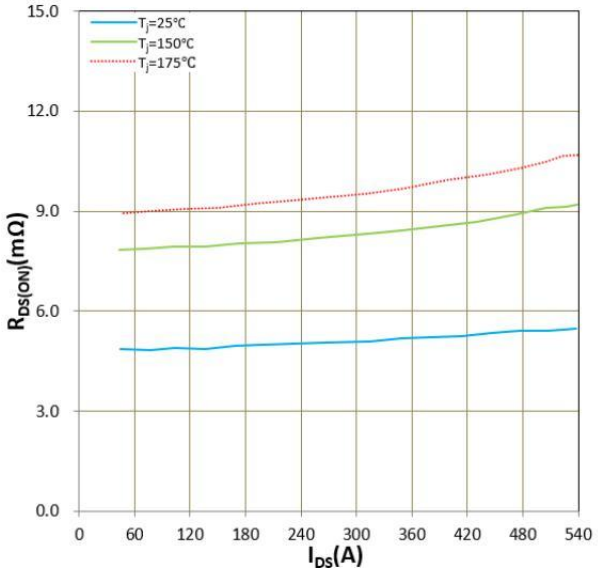


Figure 10. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+18V

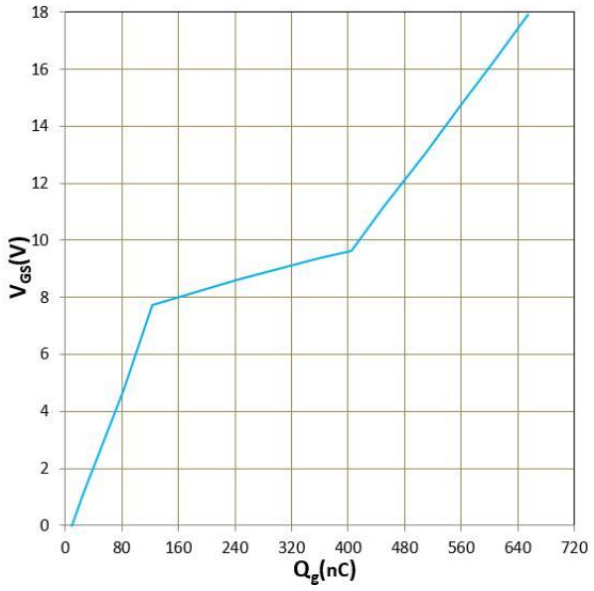


Figure 11. V_{GS} vs Q_g

T_j =25°C, V_{DS} =800V, I_D =240A

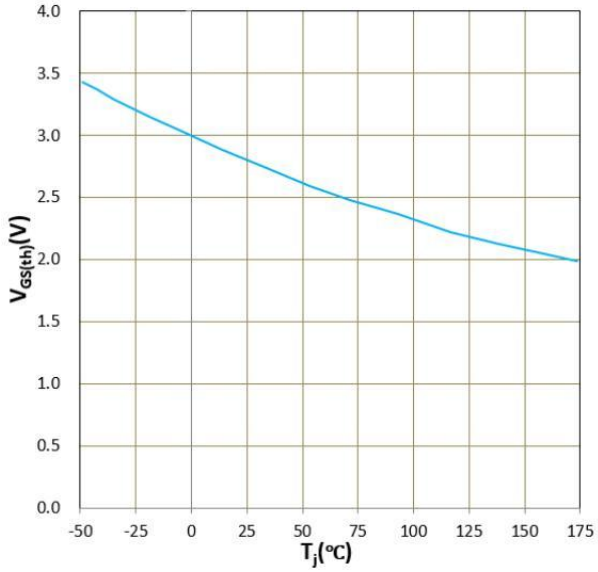


Figure 12. $V_{GS(th)}$ vs T_j

V_{GS} =V_{DS}, I_D =81mA

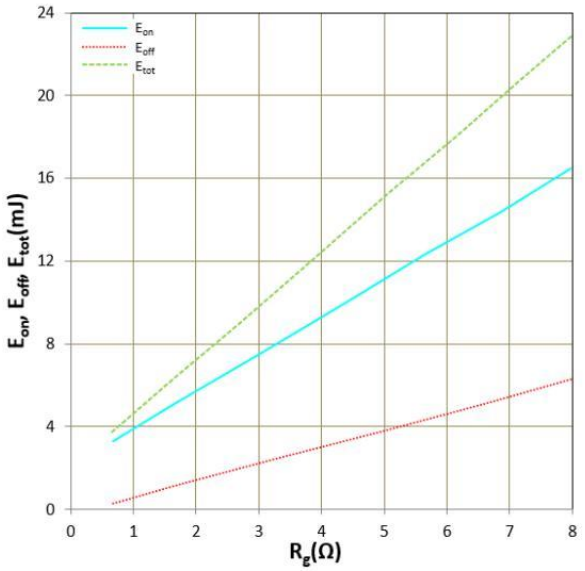


Figure 13. E_{on}, E_{off}, E_{tot} vs R_g

T_j =25°C, V_{CC} =800V, I_D =240A, V_{GS} =-4V/+18V

Inductive Load

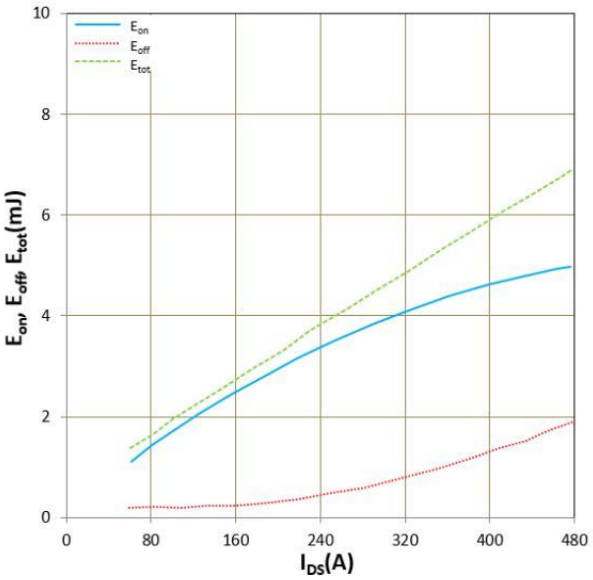


Figure 14. E_{on}, E_{off}, E_{tot} vs I_{DS}

T_j =25°C, V_{CC} =800V, R_g =2.0Ω, V_{GS} =-4V/+18V

Inductive Load

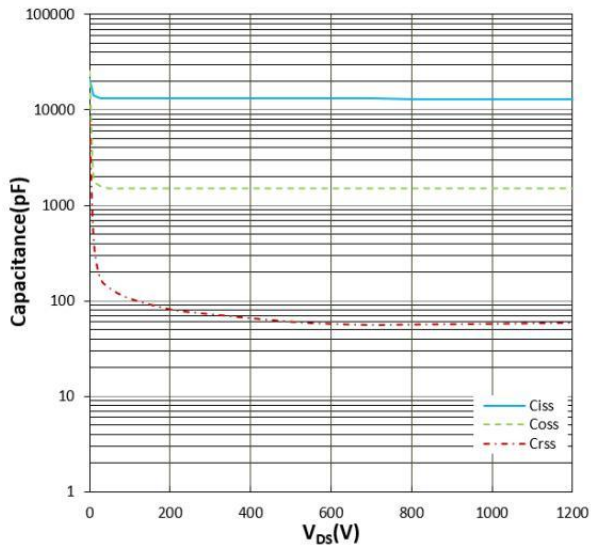
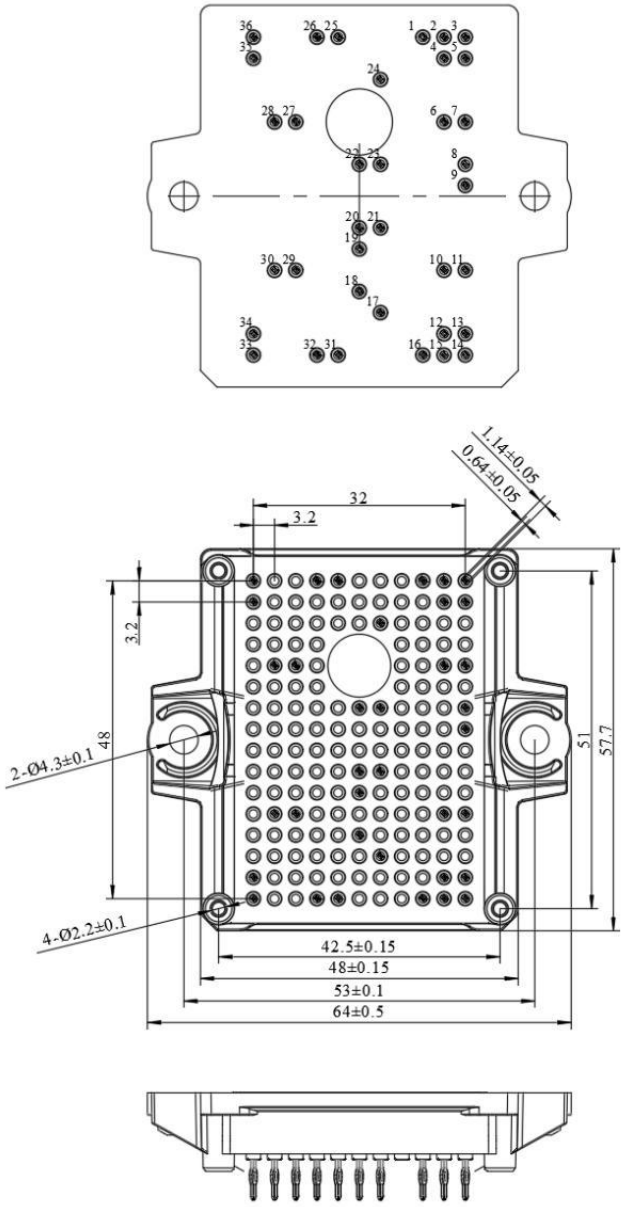


Figure 15. C_{iss}, C_{oss}, C_{rss} vs V_{DS}

V_{GS} =0V, f=1MHz, T_j =25°C

Package dimensions



Pin	X	Y
1	25,6	48
2	28,8	48
3	32	48
4	28,8	44,8
5	32	44,8
6	28,8	35,2
7	32	35,2
8	32	28,8
9	32	25,6
10	28,8	12,8
11	32	12,8
12	28,8	3,2
13	32	3,2
14	32	0
15	28,8	0
16	25,6	0
17	19,2	6,4
18	16	9,6
19	16	16
20	16	19,2
21	19,2	19,2
22	16	28,8
23	19,2	28,8
24	19,2	41,6
25	12,8	48
26	9,6	48
27	6,4	35,2
28	3,2	35,2
29	6,4	12,8
30	3,2	12,8
31	12,8	0
32	9,6	0
33	0	0
34	0	3,2
35	0	44,8
36	0	48

Unit: mm

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