DFS04HF12EZA2

1200V/3.23mΩ Half Bridge SiC MOSFET Module

Description

The DFS04HF12EZA2 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
- $R_{DS(on)}$: 3.23mΩ (V_{GS} =18V)
- I_D=240A
- Low Switching Losses
- 175°C maximum junction temperature
- IMS Substrate
- Epoxy Resin Potting
- Thermistor inside

Applications

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

Circuit diagram

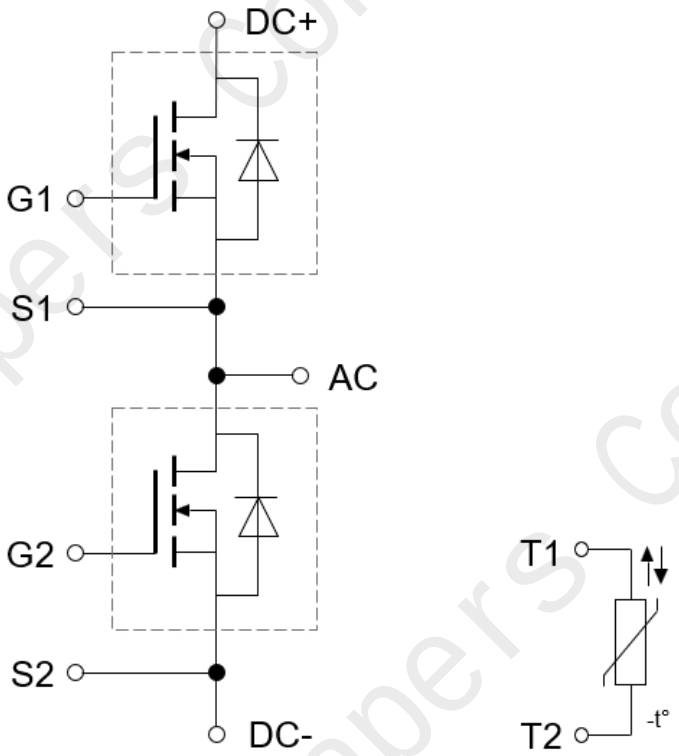


Figure 1. Out drawing & circuit diagram for DFS04HF12EZA2

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Pin Configuration and Function Description

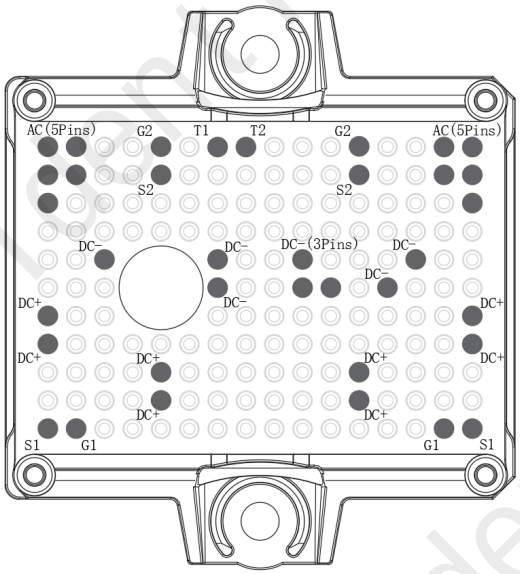


Figure 2. Pin configuration

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	T1	Thermistor connection 1
9	T2	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

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =50Hz, t =1min	3	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	-	400	-

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 22	V
I_{DS}	DC Continuous Drain Current	T_C =125°C	240	A
I_{SD}	Source (Body diode) Current	T_C =125°C, with ON signal	240	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	480	A
T_j	junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

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

Note2: Pulse width limited by maximum junction temperature

Note3：Under Pw≤10us, Duty cycle≤1%，$I_{DS(pulse)}$=480A

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)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=400uA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V		-	4	200	uA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=108mA, V_{DS}=V_{GS}, T_j=25°C		-	2.5	-	V
I_{GSS}^+	Gate-Source Leakage Current	V_{GS}=18V, V_{DS}=0V, T_j=25°C		-	4	800	nA
I_{GSS}^-	Gate-Source Leakage Current	V_{GS}=-4V, V_{DS}=0V, T_j=25°C		-800	-4	-	nA
$R_{DS(on)}$	Static drain-source On-state resistance	I_D=240A, V_{GS}=+18V	T_j=25°C	-	3.23	-	mΩ
			T_j=150°C	-	5.33	-	mΩ
			T_j=175°C	-	6.02	-	mΩ
C_{iss}	Input Capacitance	V_D=25V, V_{GS}=0V, f=100kHz, V_{AC}=25mV		-	20.15	-	nF
C_{oss}	Output Capacitance			-	4.37	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.24	-	nF
Q_G	Total gate charge	V_{DS}=800V, I_D=240A, V_{GS}=-5/+18V		-	1192	-	nC
Q_{GS}	Gate-source charge			-	250	-	nC
Q_{GD}	Gate-drain charge			-	460	-	nC
R_{Gint}	Internal Gate Resistance	f=1Mhz, V_{AC}=25mV		-	2.88	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DS}=800V, I_D=240A, V_{GS}=-5/+18V, R_G=2.2Ω, Inductive load switching operation	T_j=25°C	-	110	-	ns
			T_j=175°C	-	96	-	
t_r	Rise time		T_j=25°C	-	60	-	ns
			T_j=175°C	-	61	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	182	-	ns
			T_j=175°C	-	243	-	
t_f	Fall time		T_j=25°C	-	42	-	ns
			T_j=175°C	-	48	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	12.6	-	mJ
			T_j=175°C	-	13.5	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	2.7	-	mJ
			T_j=175°C	-	3.85	-	
$R_{th(j-c)}$	Thermal Resistance	Junction to Case		-	0.123	-	K/W

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-5V I_{SD} =240A	T_j =25°C	-	4.11	-	V
			T_j =150°C	-	3.65	-	
			T_j =175°C	-	3.57	-	
T_{rr}	Reverse recovery time	V_{DS} =800V I_{SD} =240A V_{GS} =-5/+18V R_G = 2.2Ω Inductive load switching operation	T_j =25°C	-	19	-	ns
			T_j =175°C	-	38	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	1.18	-	µC
			T_j =175°C	-	4.03	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.03	-	mJ
			T_j =175°C	-	0.34	-	

Test Conditions

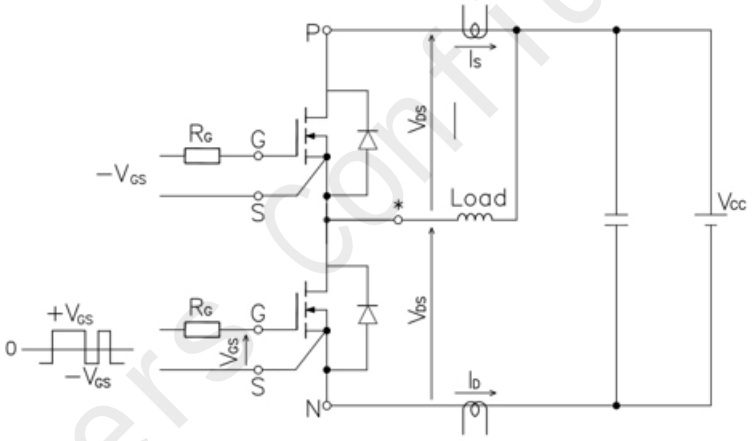


Figure 3. Switching time measure circuit

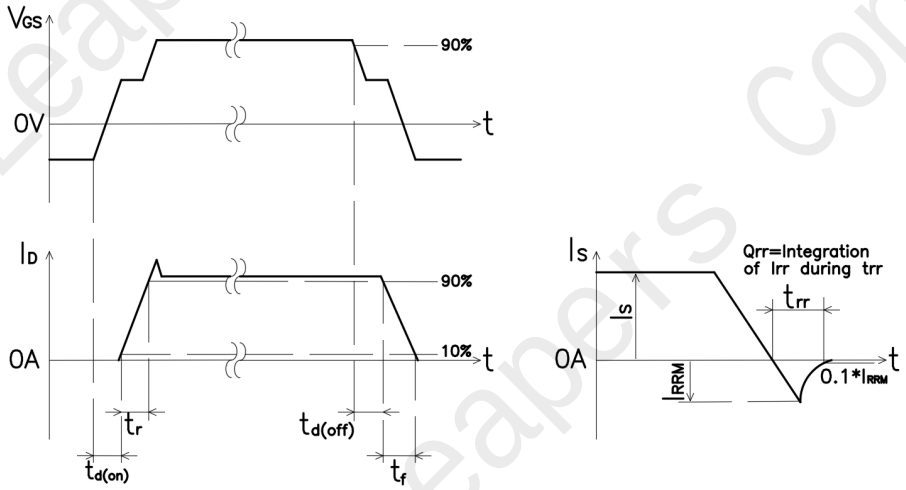


Figure 4. Switching time definition

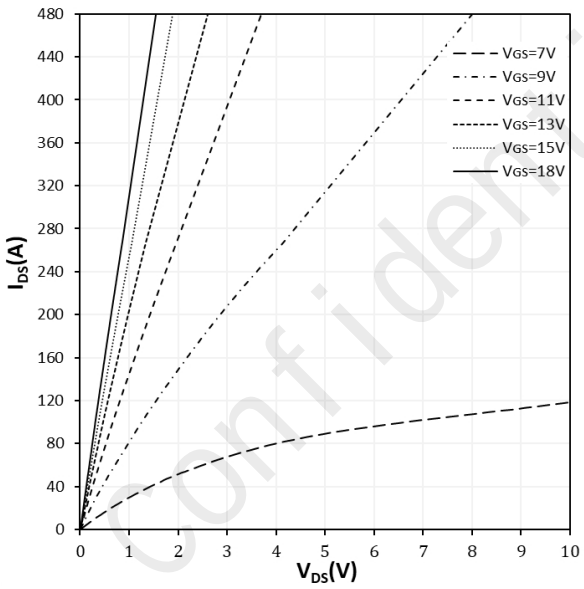


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, Typical Output characteristic

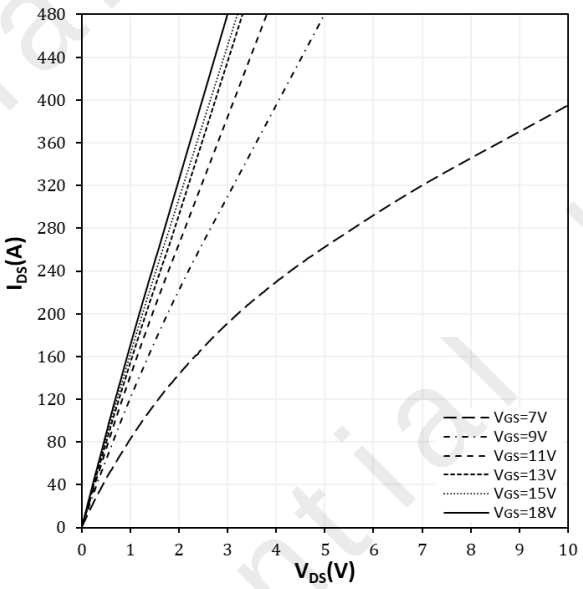


Figure 6. I_{DS} vs V_{DS}
T_j =175°C, Typical Output characteristic

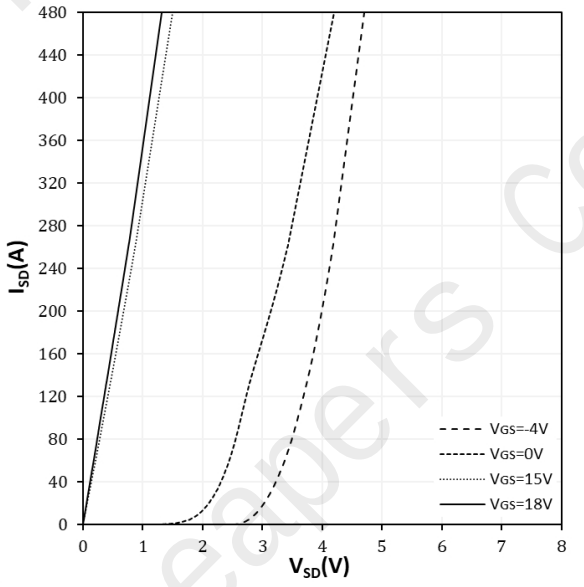


Figure 7. I_{SD} vs V_{SD}
T_j =25°C, Typical Output characteristic

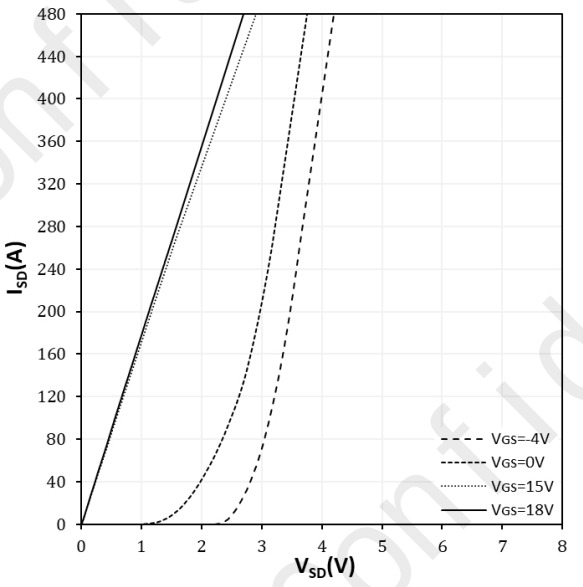


Figure8. I_{SD} vs V_{SD}
T_j =175°C, Typical Output characteristic

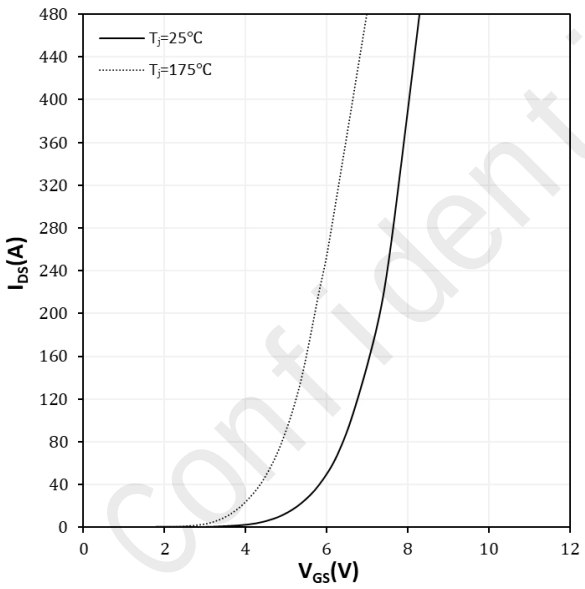


Figure 9. I_{DS} vs V_{GS}
V_{DS} =20V, T_j parameter

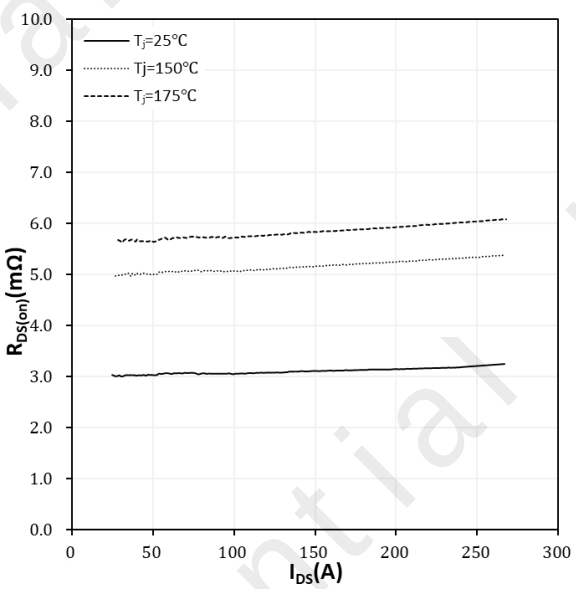


Figure 10. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V

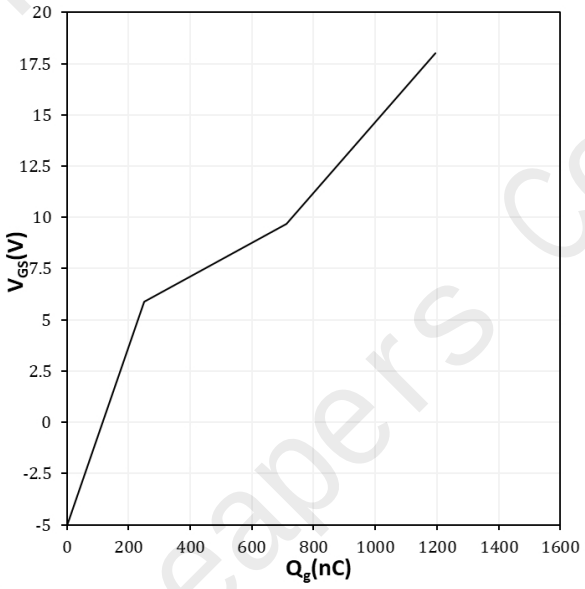


Figure 11. V_{GS} vs Q_g
V_{DS} =800V, I_D =240A , I_g=50mA , T_j =25°C

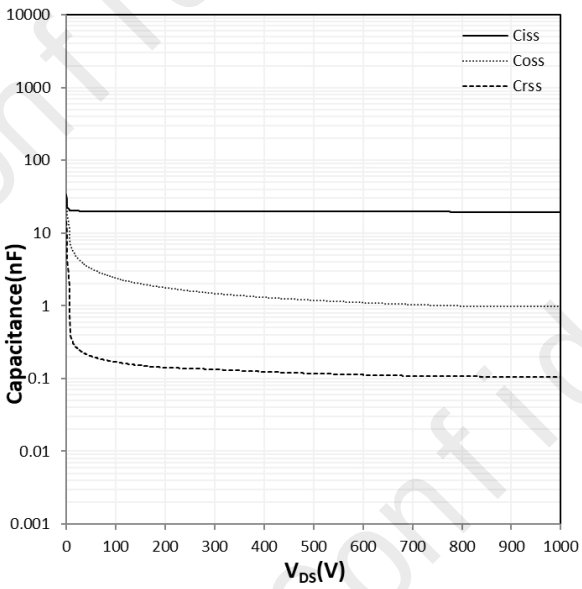


Figure 12. C_{iss},C_{oss},C_{rss} vs V_{DS}
T_j =25°C

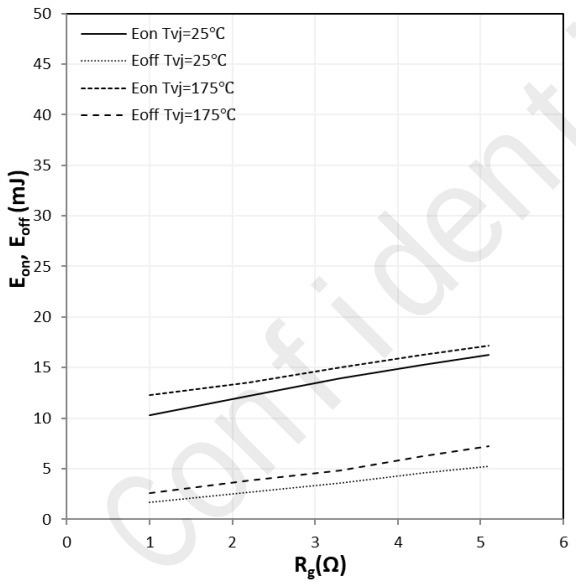


Figure 13. E_{on}, E_{off} vs R_g
V_{DS} =800V, I_D =240A, V_{GS} =-5V/+18V
Inductive Load

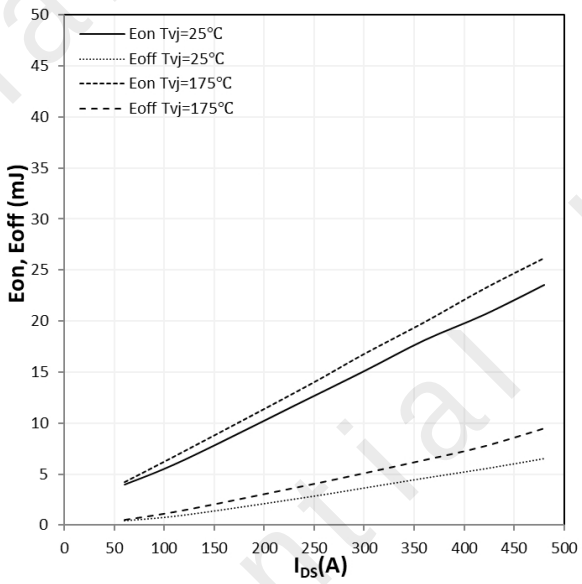


Figure 14. E_{on}, E_{off} vs I_{DS}
V_{DS} =800V, R_g=2.2Ω, V_{GS} =-5V/+18V
Inductive Load

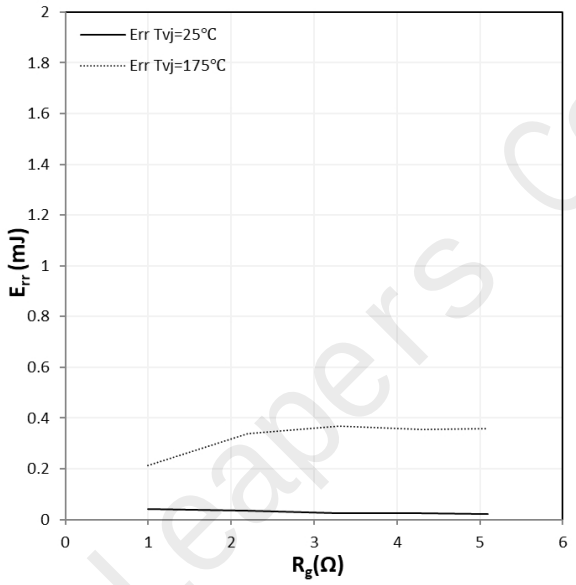


Figure 15. E_{rr} vs R_g
V_{DS} =800V, I_D =240A , V_{GS} =-5V/+18V
Inductive Load

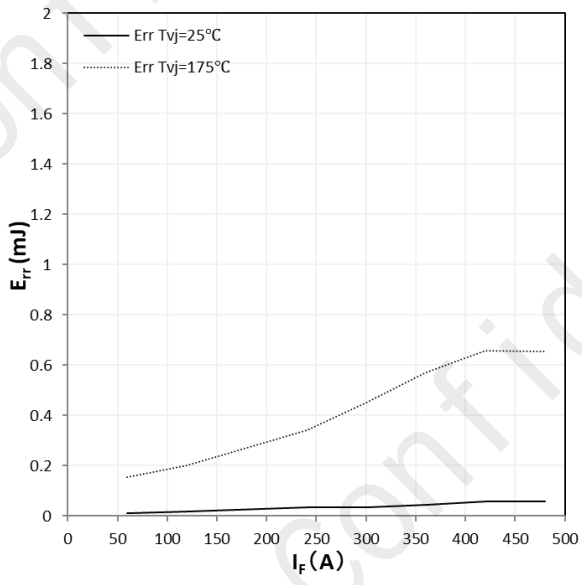


Figure 16. E_{rr} vs I_F
V_{DS} =800V, R_g = 2.2Ω, V_{GS} =-5V/+18V
Inductive Load

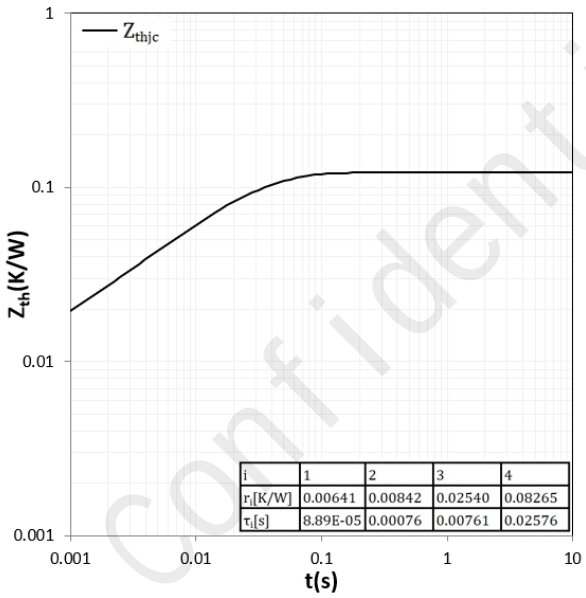
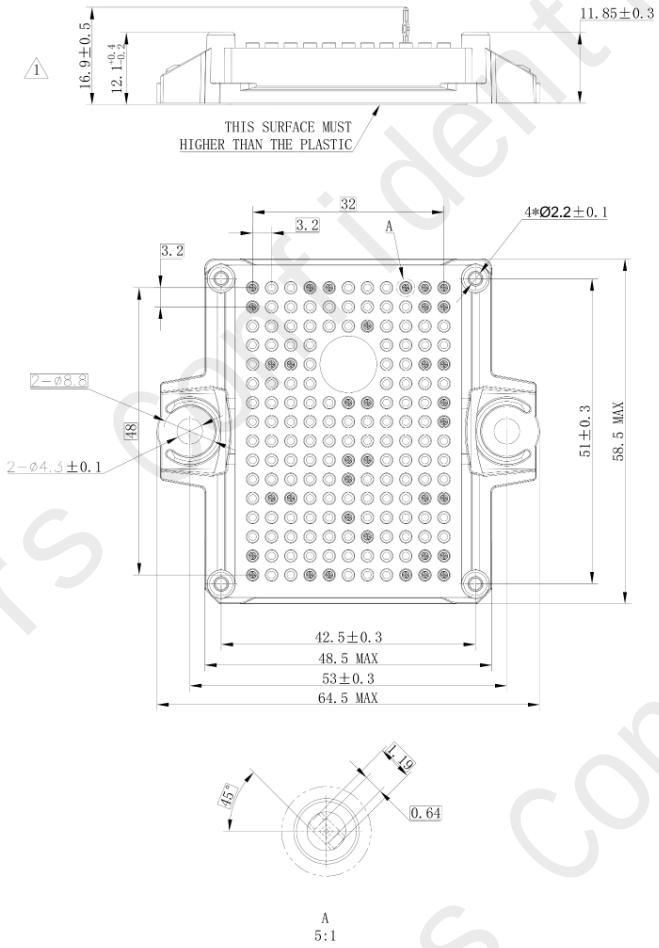
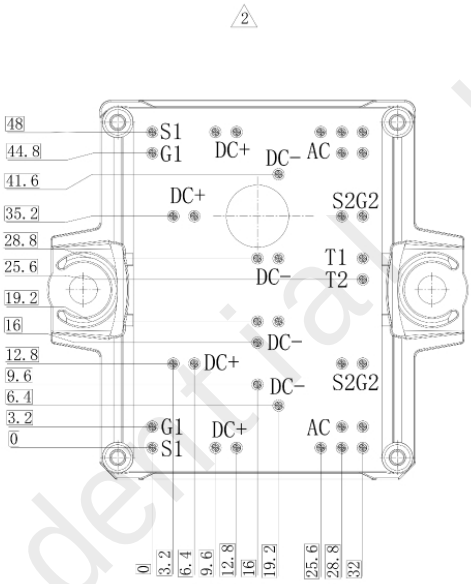


Figure 17. Transient themal impedance Zthjc for MOSFET

Outline drawing (Unit : mm)





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