DFS05HF12EYR1

1200V/5.5mΩ Half Bridge SiC MOSFET Module

Description

The DFS05HF12EYR1 is a half bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Solar Inverter Systems, Fuel cell-DC/DC converter, Uninterruptible Power Supplier, Energy Storage Systems.

Features

- Blocking voltage:1200V
- 5.5mΩ $R_{ds(on)}$
- Low Switching Losses
- 175°C maximum junction temperature
- Si_3N_4 AMB
- Thermistor inside

Applications

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

Circuit diagram

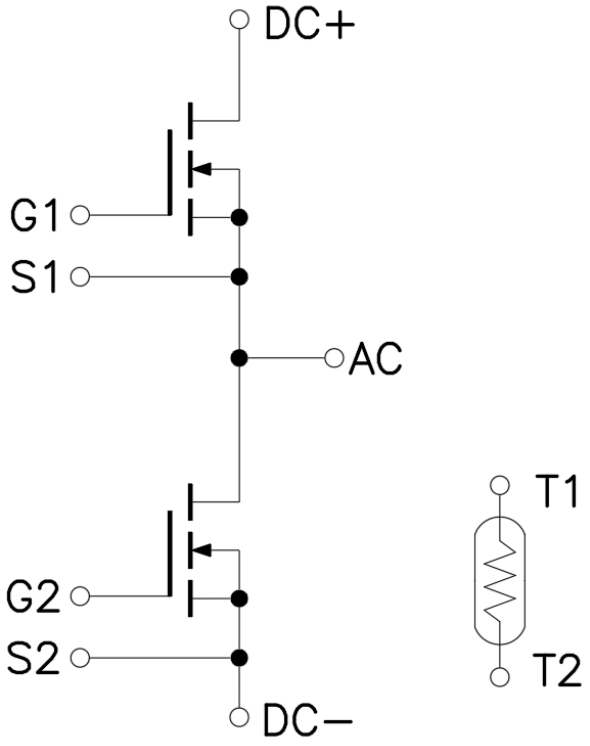


Figure 1. Out drawing & circuit diagram for DFS05HF12EYR1

Pin Configuration and Marking Information

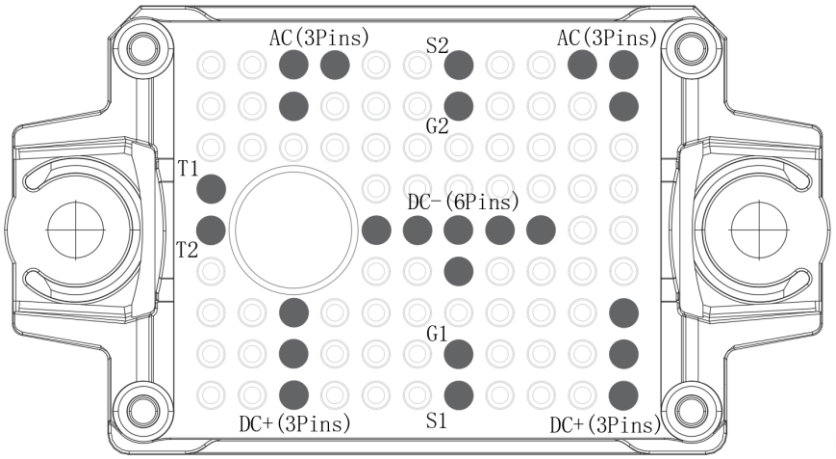


Figure 2. Pin configuration

Symbol	Description
AC	Output terminal of half bridge
S2	Low side source signal terminal
G2	Low side gate signal terminal
DC+	DC+ Bus connection
DC–	DC– Bus connection
S1	High side source signal terminal
G1	High side gate signal terminal
T1	Thermistor connection 1
T2	Thermistor connection 2

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
Comparative Tracking Index	-	600	-
Weight	-	26	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	21	V
V_{GSS}	Gate-Source Voltage(-)	D-S Short	-2	V
$V_{GSSSurge}$	G-S Voltage(t_{surge}<300nsec)	D-S Short, Note1	-6 to 23	V
I_{DS}	DC Continuous Drain Current	T_f =95°C, Note2	150	A
I_{SD}	Source (Body diode) Current	T_f =95°C, with ON signal	150	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note3	400	A
T_j	junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +18V/0V.

Note2: Case temperature(Tc) is defined on the surface of base plate just under the chips.

Note3: 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 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, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=1mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS}=1200V, V_{GS}=0V		-	-	160	μA
$V_{GS(th)}$	Gate-source threshold voltage	I_D=73mA, V_{DS}=V_{GS}		2.8	-	4.8	V
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=21V, V_{DS}=0V, T_j=25°C		-	-	200	nA
I_{GSS-}		V_{GS}=-2V, V_{DS}=0V, T_j=25°C		-200	-	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=150A, V_{GS}=+18V	T_j=25°C	-	5.5	6.9	mΩ
			T_j=175°C	-	13	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state voltage	I_D=150A, V_{GS}=+18V	T_j=25°C	-	0.83	1.04	V
			T_j=175°C	-	1.95	-	V
C_{iss}	Input capacitance	V_D=10V, V_{GS}=0V, f=200kHz		-	14.5	-	nF
C_{oss}	Output capacitance			-	0.4	-	nF
C_{rss}	Reverse transfer capacitance			-	0.03	-	nF
Q_G	Total gate charge	V_{DD}=600V, I_D=150A, V_{GS}=+15/0V		-	520	-	nC
R_{Gint}	Internal Gate Resistance	T_j=25°C		-	1.9	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD}=600V, I_D=150A, V_{GS}=+18/0V, R_G=3.3Ω, Inductive load switching operation	T_j=25°C	-	58	-	ns
			T_j=150°C	-	55	-	
t_r	Rise time		T_j=25°C	-	27	-	ns
			T_j=150°C	-	18	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	245	-	ns
			T_j=150°C	-	290	-	
t_f	Fall time		T_j=25°C	-	40	-	ns
			T_j=150°C	-	43	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	3.54	-	mJ
			T_j=150°C	-	3.35	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	1.59	-	mJ
			T_j=150°C	-	1.76	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	0.12	-	K/W
$R_{th(c-f)}$	Contact thermal resistance	With thermal conductive grease/MOSFET		-	0.15	-	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} =0V I_{SD} =150A	T_j=25°C	-	3.3	-	V
			T_j=150°C	-	4.0	-	
T_{rr}	Reverse recovery time	V_{DD}=600V I_D=150A V_{GS}=+18/0V R_G=3.3Ω Inductive load switching operation	T_j=25°C	-	41.5	-	ns
			T_j=150°C	-	45	-	
Q_{rr}	Reverse recovery charge		T_j=25°C	-	2.19	-	μC
			T_j=150°C	-	3.94	-	
E_{rr}	Diode switching power dissipation		T_j=25°C	-	0.64	-	mJ
			T_j=150°C	-	1.42	-	

Test Conditions

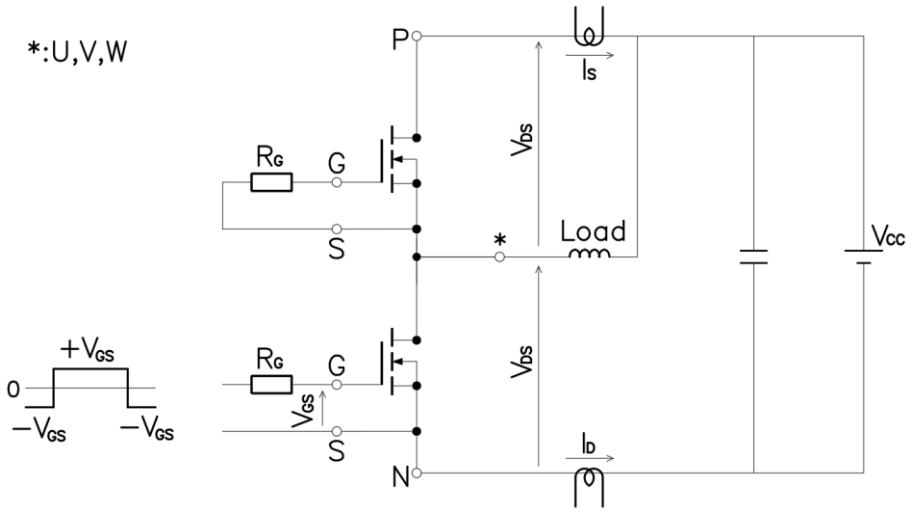


Figure 3. Switching time measure circuit

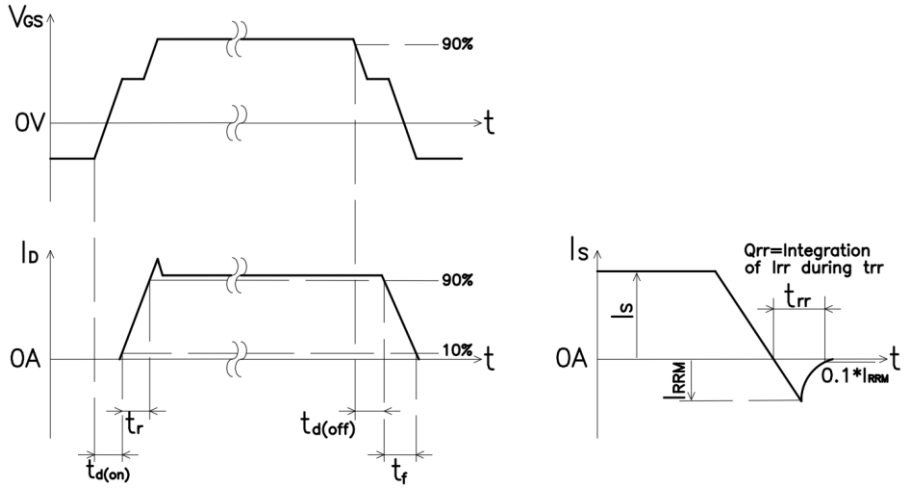


Figure 4. Switching time definition

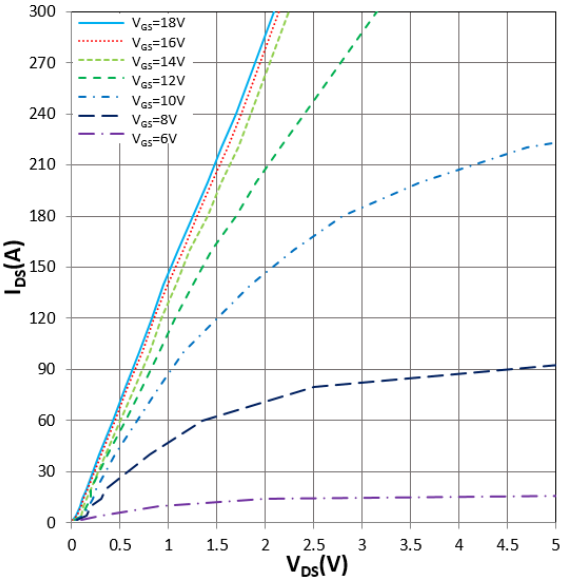


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

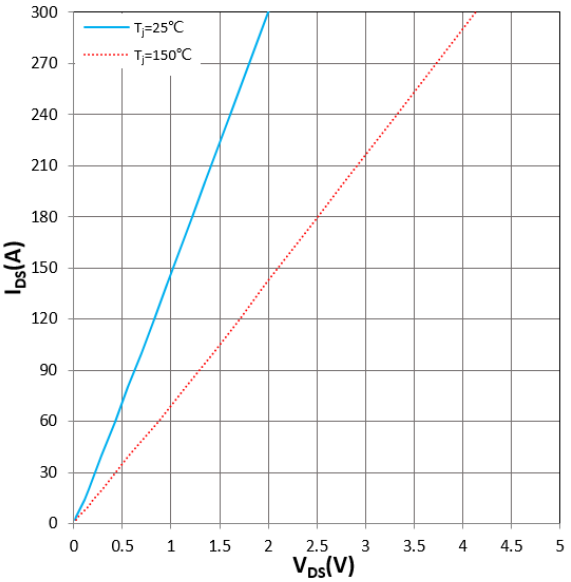


Figure 6. I_{DS} vs V_{DS}
V_{GS} =+18V

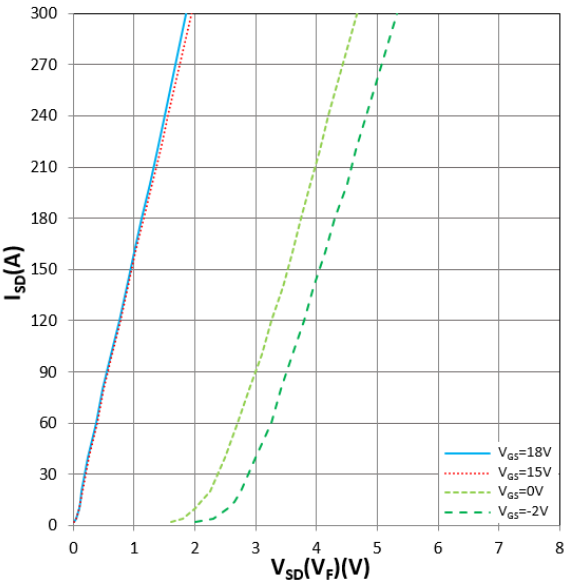


Figure 7. I_{SD} vs V_{SD} (V_F)
T_j =25°C, V_{GS} parameter

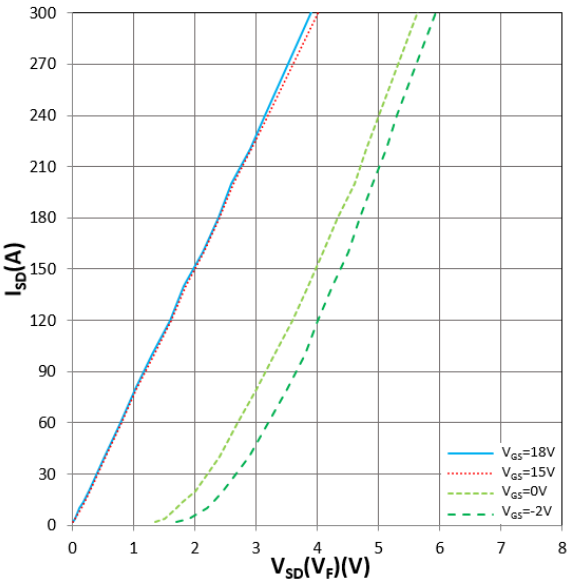


Figure8. I_{SD} vs V_{SD} (V_F)
T_j =150°C, V_{GS} parameter

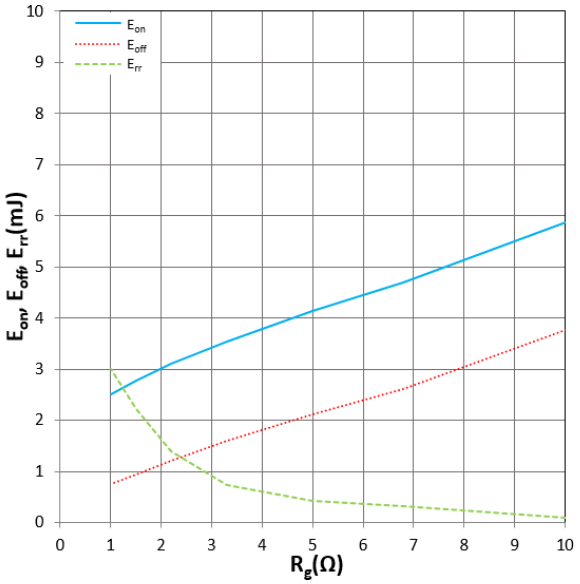


Figure 9. E_{on}, E_{off}, E_{rr} vs R_G
T_j =25°C, I_D =150A, V_{GS} =+18V/0V

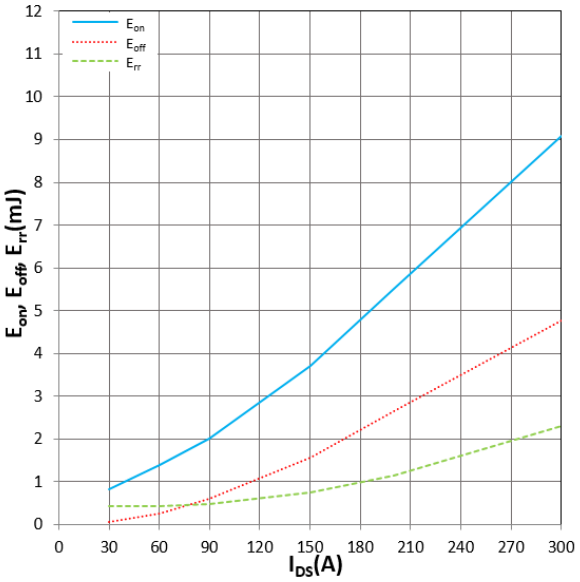


Figure 10. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j =25°C, R_G =3.3Ω, V_{GS} =+18V/0V

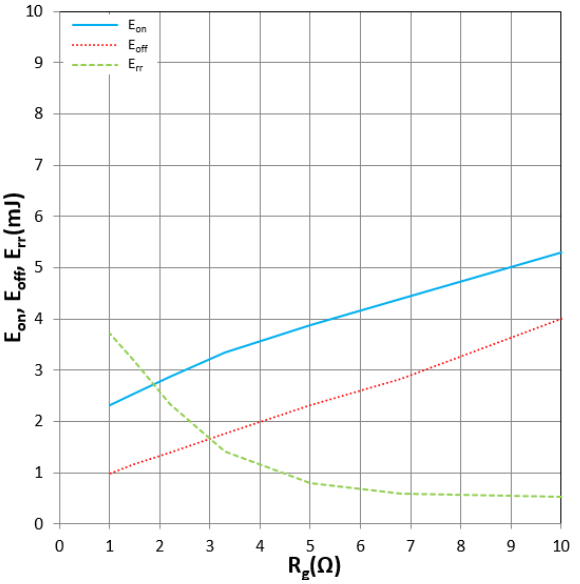


Figure 11. E_{on}, E_{off}, E_{rr} vs R_G
T_j =150°C, I_D =150A, V_{GS} =+18V/0V

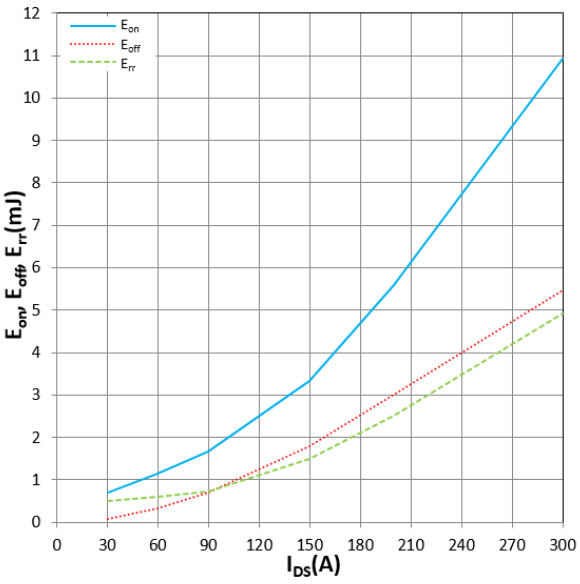
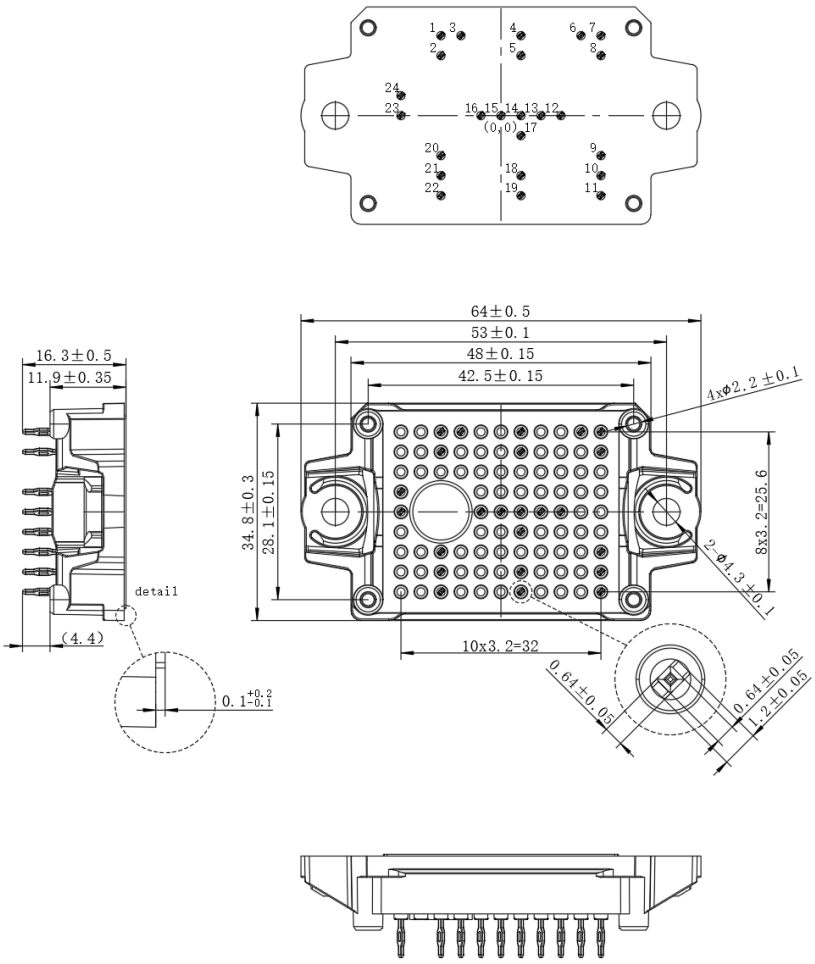


Figure 12. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j =150°C, R_G =3.3Ω, V_{GS} =+18V/0V

Package dimensions



Pin table		
Pin	X	Y
1	-9.6	12.8
2	-9.6	9.6
3	-6.4	12.8
4	3.2	12.8
5	3.2	9.6
6	12.8	12.8
7	16	12.8
8	16	9.6
9	16	-6.4
10	16	-9.6
11	16	-12.8
12	9.6	0
13	6.4	0
14	3.2	0
15	0	0
16	-3.2	0
17	3.2	-3.2
18	3.2	-9.6
19	3.2	-12.8
20	-9.6	-6.4
21	-9.6	-9.6
22	-9.6	-12.8
23	-16	0
24	-16	3.2

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