

HCS10FH120E1A2

1200V/10mΩ Half Bridge SiC MOSFET Module

Description

The HCS10FH120E1A2 is a Half 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
- $R_{ds(on)}=10.1\text{m}\Omega$
- Low Switching Losses
- 175maximum junction temperature
- Thermistor inside

Applications

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

Circuit diagram

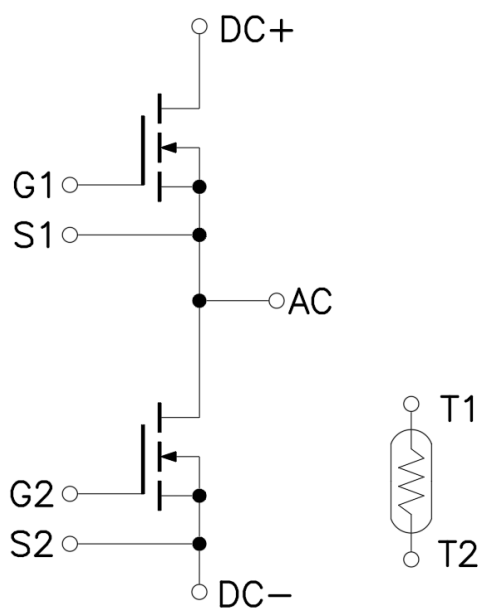


Figure 1. Out drawing & circuit diagramfor HCS10FH120E1A2

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Pin Configuration and Marking Information

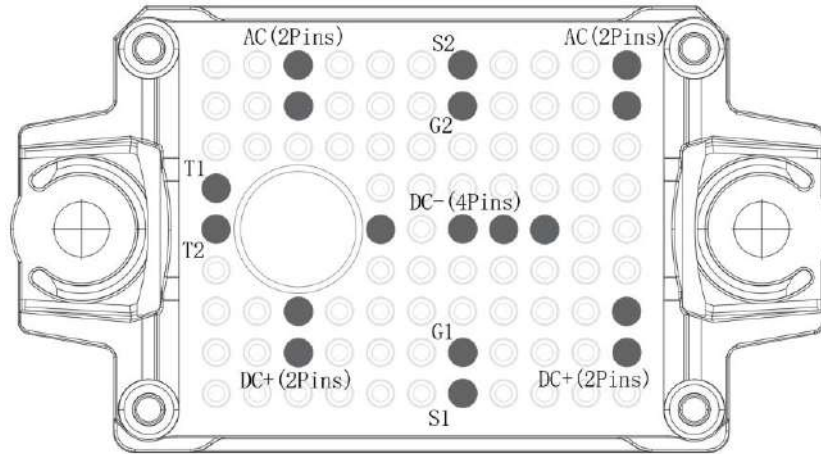


Figure 2. Pin configuration

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	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	-	400	-
Weight	-	24	g

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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 _{GS,max}	Gate-Source Voltage	D-S Short, Note1	-8/+19	V
I _{DS}	DC Continuous Drain Current	T _f =75°C, V _{GS} =18V	100	A
I _{SD}	Source (Body Diode) Current	T _f =75°C, with ON signal	100	A
I _{DSM}	Pulse Drain Current	T _C =100°C, Pulse width =1ms, V _{GS} =15V, Note2	200	A
P _{tot}	Total Power Dissipation	T _C =25°C	440	W
T _j	junction temperature	-	-40 to 175	°C
T _{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +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	R ₂ =R ₂₅ exp [B _{25/50} (1/T ₂ - 1/(298,15 K))]	-	3375	-	K
B _{25/80}	B-value	R ₂ =R ₂₅ exp [B _{25/80} (1/T ₂ - 1/(298,15 K))]	-	3411	-	K
B _{25/100}	B-value	R ₂ =R ₂₅ exp [B _{25/100} (1/T ₂ - 1/(298,15 K))]	-	3433	-	K

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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 =400μA		1200	-	-	V
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V		-	-2	200	μA
V _{GS(th)}	Gate-source threshold Voltage	I _D =40mA, V _{DS} =V _{GS}	T _j =25°C	1.8	.61	-	V
			T _j =175°C	-	.9	-	V
I _{GSS+}	Gate-Source Leakage Current	V _{GS} =15V, V _{DS} =0V, T _j =25°C		-	10	800	nA
I _{GSS-}		V _{GS} = -4V, V _{DS} =0V, T _j =25°C		-800	-10	-	nA
R _{DS(on)}	Static drain-source	I _D =100A , V _{GS} =15V	T _j =25°C	-	10.1	-	m Ω
(Chip)	On-state resistance		T _j =175°C	-	18.8	-	m Ω
V _{DS(on)}	Static drain-source	I _D =100A , V _{GS} =15V	T _j =25°C	-	1.01	-	V
(Chip)	On-state Voltage		T _j =175°C	-	1.88	-	V
C _{iss}	Input Capacitance	V _{DS} =1000V, V _{GS} =0V, f =100kHz, T _j =25°C		-	9200	-	pF
C _{oss}	Output Capacitance			-	475	-	pF
C _{rss}	Reverse transfer Capacitance			-	29	-	pF
Q _G	Total gate charge	V _{DD} =800V, I _D =100A, V _{GS} =-4/+15V		-	398	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	1.5	-	Ω
t _{d(on)}	Turn-on delay time	V _{DD} =600V I _D =100A V _{GS} =+15/-4V R _{gon} = R _{goff} =5.1μs Inductive load switching operation	T _j =25°C	-	23	-	ns
			T _j =150°C	-	21	-	
t _r	Rise time		T _j =25°C	-	18	-	ns
			T _j =150°C	-	15	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	33	-	ns
			T _j =150°C	-	21	-	
t _f	Fall time		T _j =25°C	-	15	-	ns
			T _j =150°C	-	14	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	1050	-	μJ
			T _j =150°C	-	1455	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	245	-	μJ
			T _j =150°C	-	350	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case/MOSFET		-	0.34	-	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.

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Body Diode Electrical characteristics ($T_j=25^\circ\text{C}$ unless otherwise specified, chip: Target)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V _{SD}	Body Diode Forward Voltage	V _{GS} =-4V I _{SD} =100A	T _j =25°C	-	4.6	-	V
			T _j =175°C	-	4.1	-	
T _{rr}	Reverse recovery time	V _{RR} =600V, I _D =100A V _{GS} =+15/-4V	T _j =25°C	-	23	-	ns
			T _j =150°C	-	24	-	
Q _{rr}	Reverse recovery charge	R _{gon} = R _{goff} =5.1 Ω Inductive load	T _j =25°C	-	0.44	-	μC
			T _j =150°C	-	0.76	-	
E _{rr}	Diode switching power dissipation	switching operation	T _j =25°C	-	450	-	μJ
			T _j =150°C	-	890	-	

Test Conditions

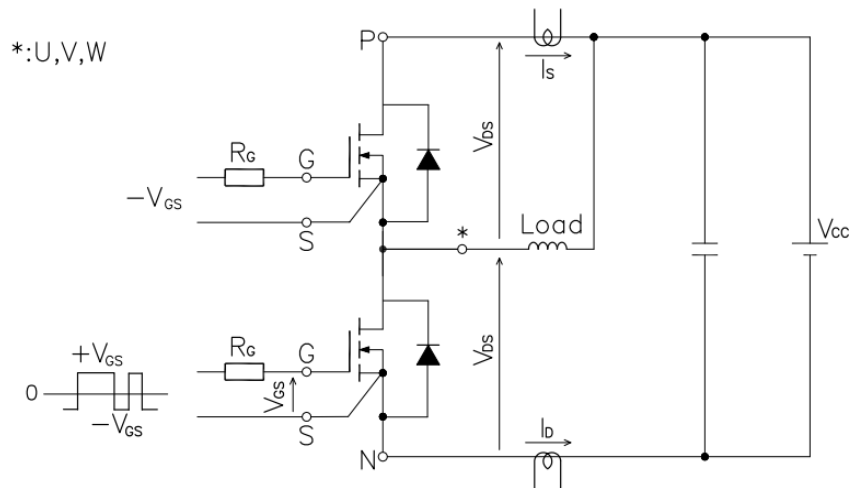


Figure 3. Switching time measure circuit

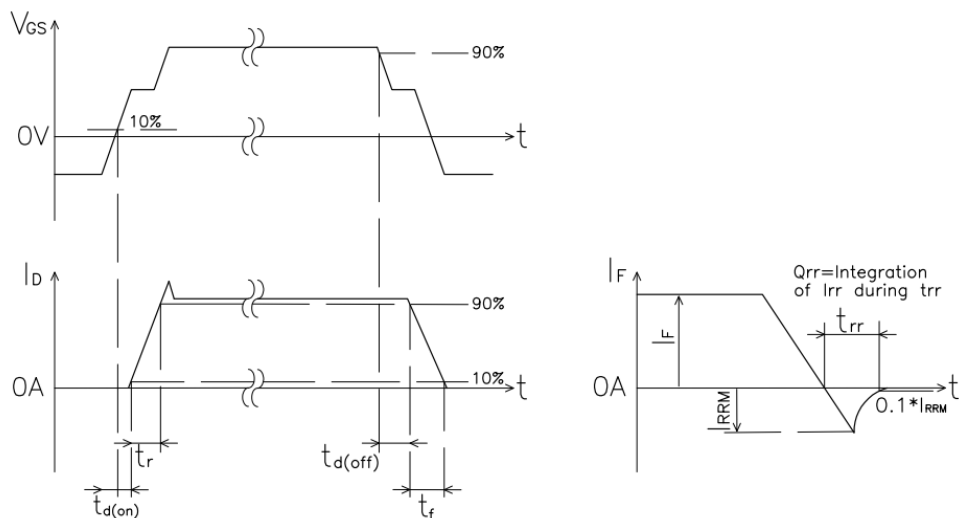


Figure 4. Switching time definition

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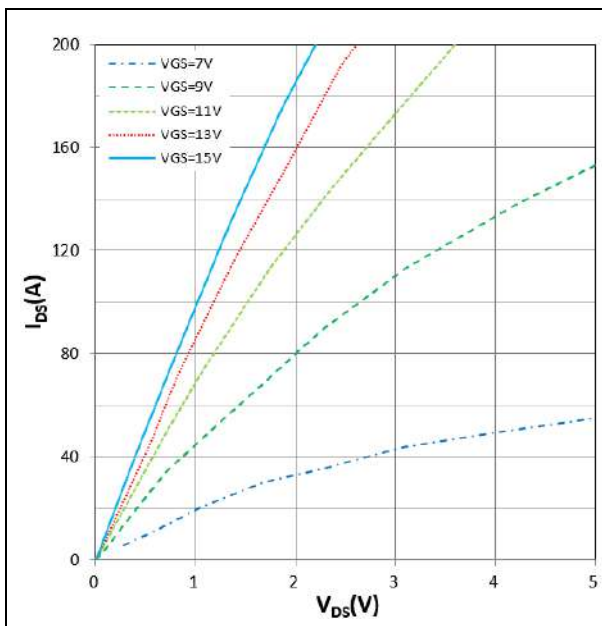


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

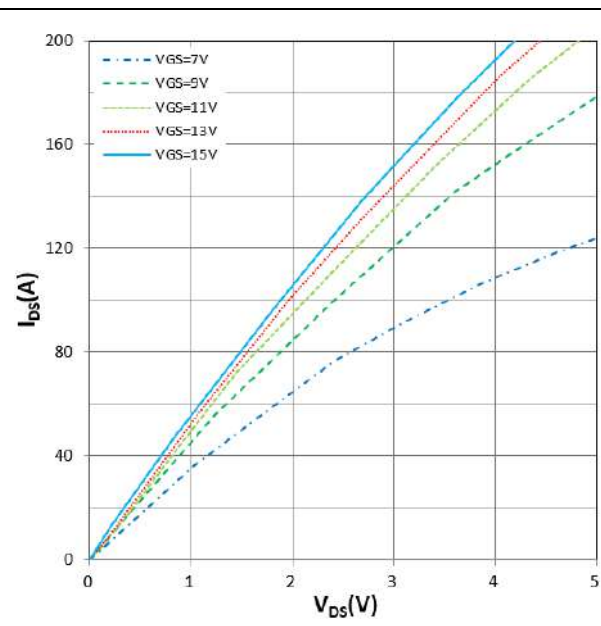


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

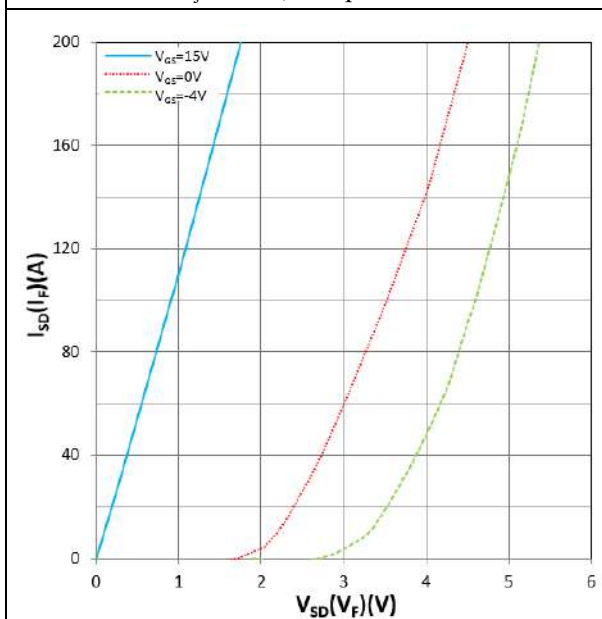


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

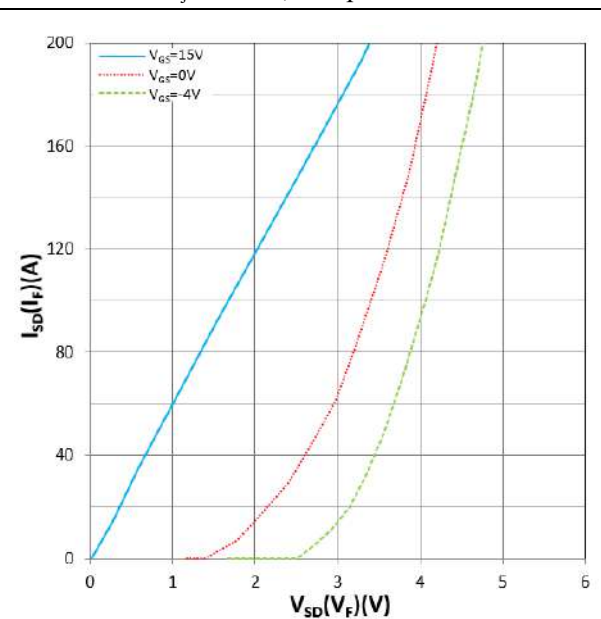


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

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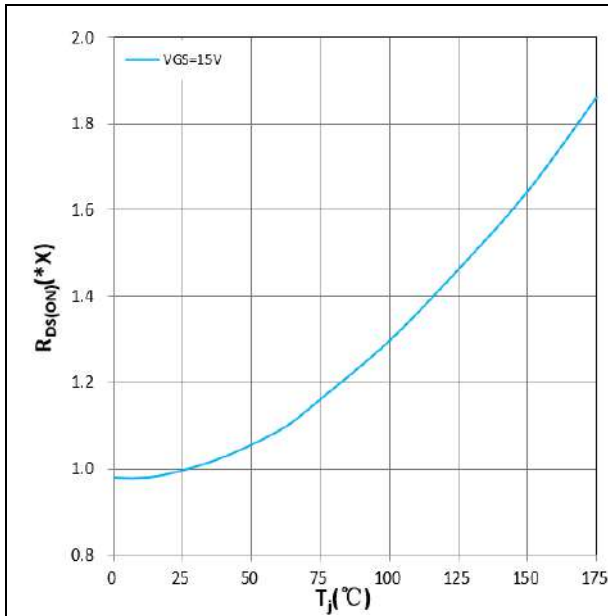


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +15V$, $I_D = 100A$, $1.0X = 10.1m\Omega$

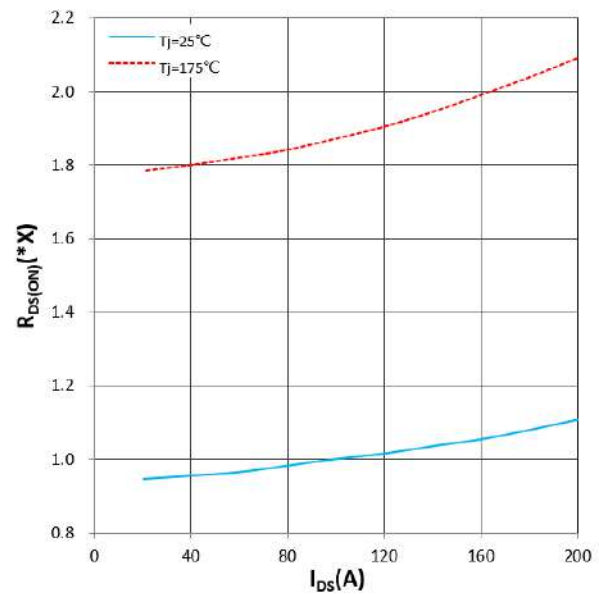


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +15V$, $1.0X = 10.1m\Omega$

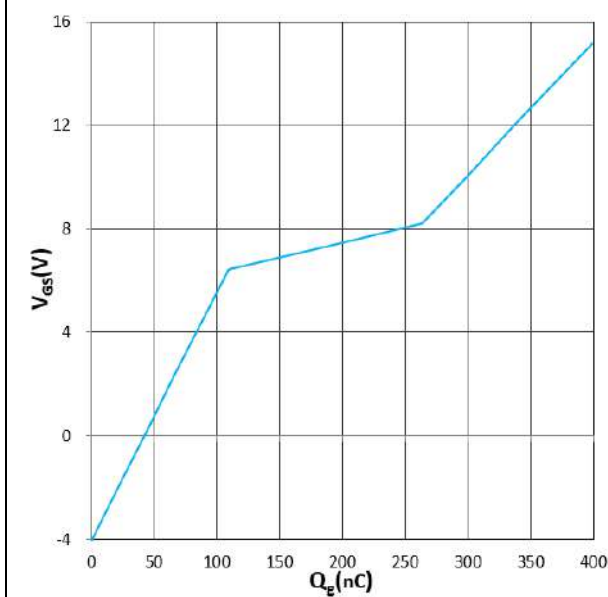


Figure 11. V_{GS} vs Q_g
 $V_{DS} = 800V$, $I_D = 100A$, $T_j = 25^\circ C$

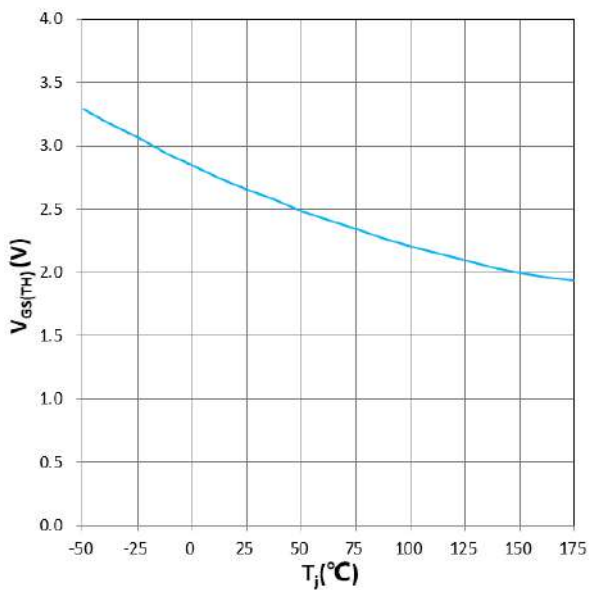


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 40mA$

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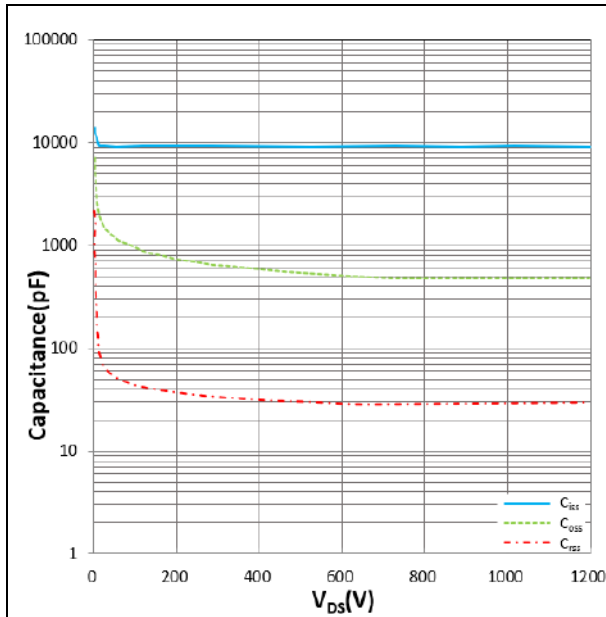


Figure 13. C_{iss} , C_{oss} , C_{rss} vs V_{DS}
 $T_j = 25^\circ\text{C}$

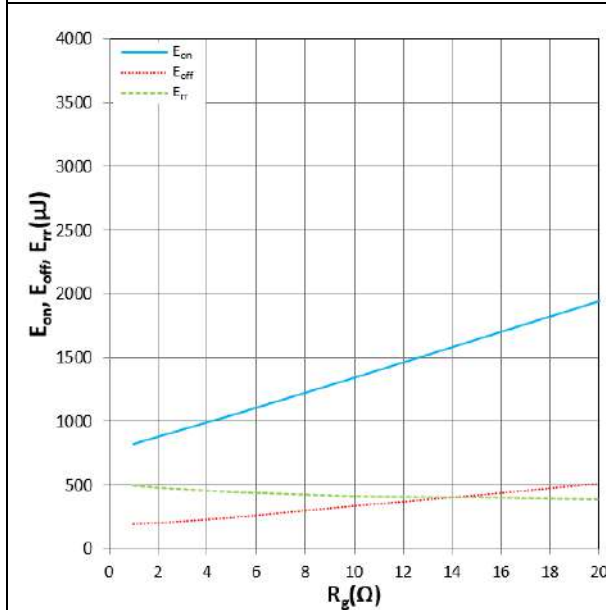


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 25^\circ\text{C}$, $I_D = 100\text{A}$, $V_{GS} = +15/-4\text{V}$

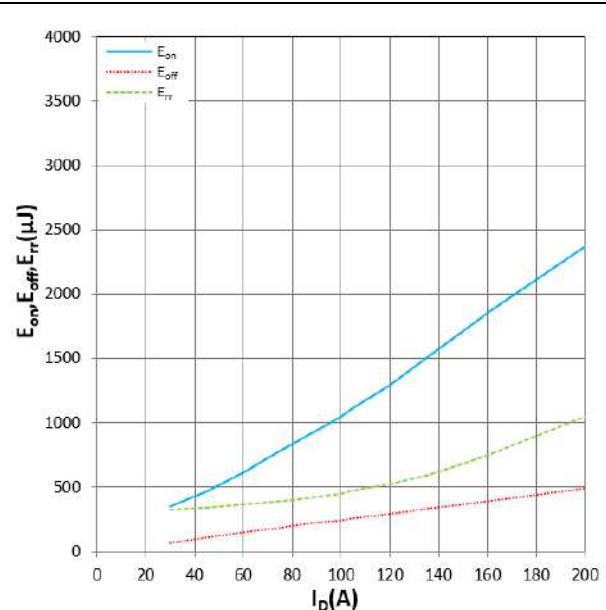


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j = 25^\circ\text{C}$, $R_{gon} = R_{goff} = 5.1\text{m}\Omega$, $V_{GS} = +15/-4\text{V}$

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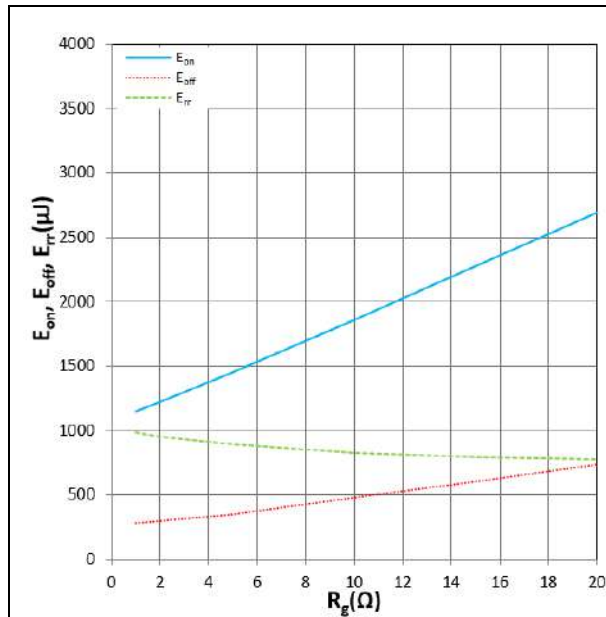


Figure 16. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 150^\circ C$, $I_D = 100 A$, $V_{GS} = +15/-4 V$

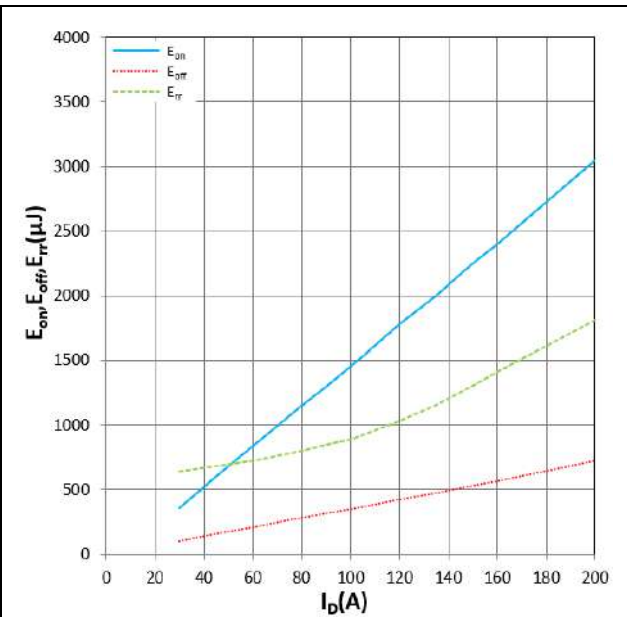
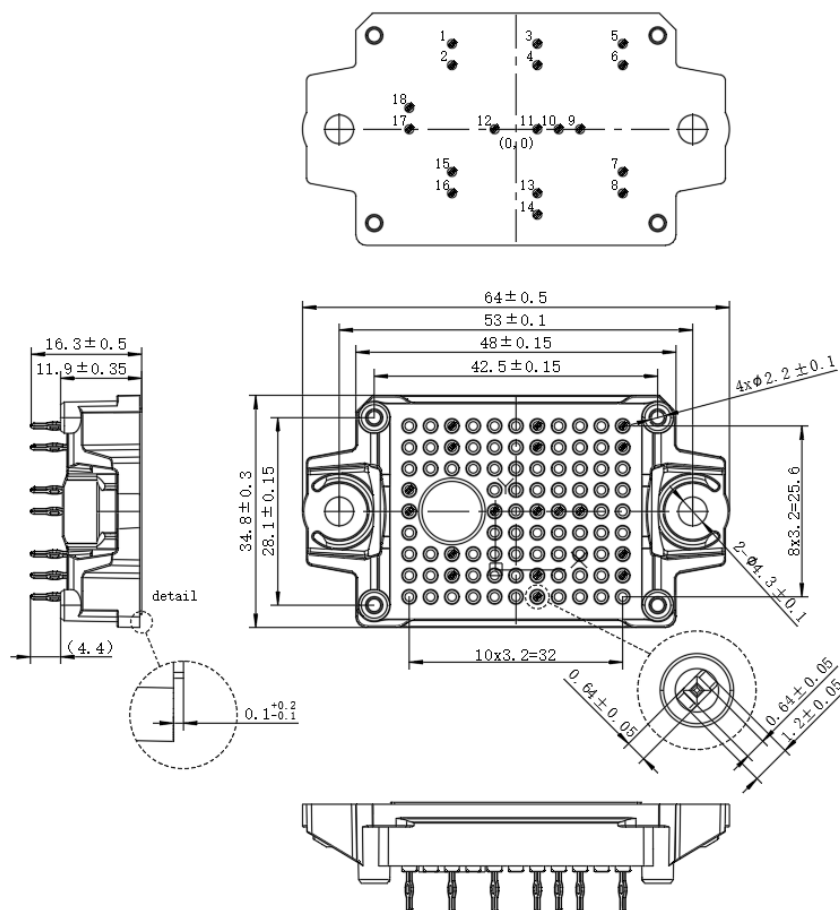


Figure 17. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j = 150^\circ C$, $R_{gon} = R_{goff} = 5.1 \Omega$, $V_{GS} = +15/-4 V$

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Package dimensions



Pin Table		
Pin	X	Y
1	-9.6	12.8
2	-9.6	9.6
3	3.2	12.8
4	3.2	9.6
5	16	12.8
6	16	9.6
7	16	-6.4
8	16	-9.6
9	9.6	0
10	6.4	0
11	3.2	0
12	-3.2	0
13	3.2	-9.6
14	3.2	-12.8
15	-9.6	-6.4
16	-9.6	-9.6
17	-16	0
18	-16	3.2

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The data contained in this document is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the product's suitability for the intended application and the completeness of the product data concerning such application.

Due to technical requirements, our product may contain dangerous substances. For information on the types in question, please contact the sales staff responsible for you.

Changes to this product data sheet are reserved.

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Revision History

Document Version	Description of Changes
RevX.0.1	Released

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