

HCS30FF120E1A1

1200V/30mΩ H Bridge SiC MOSFET Module

Description

The HCS30FF120E1A1 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
- $R_{ds(on)}@T_j=25^{\circ}\text{C}$
- $46\text{m}\Omega R_{ds(on)}@T_j=175^{\circ}\text{C}$
- Low Switching Losses
- 175 maximum junction temperature
- Thermistor inside

Applications

- SolarInverter
- UPS
- Fuel cell-DC/DC converter
- Energy Storage Systems

Circuit diagram

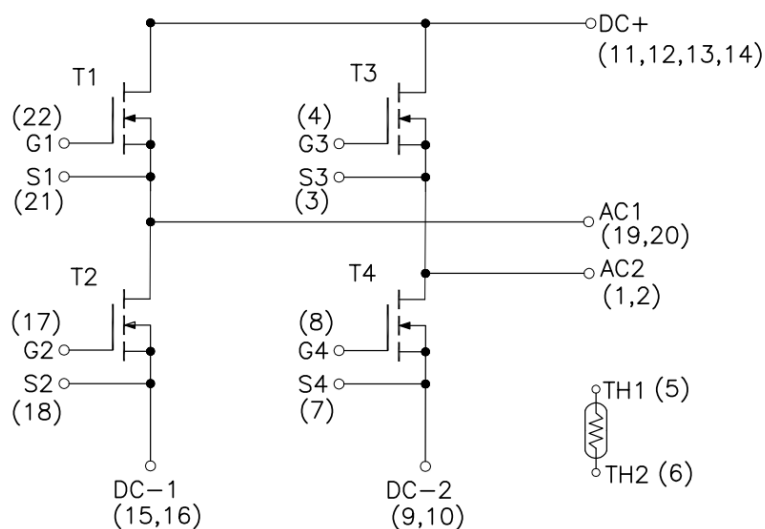


Figure 1. Out drawing & circuit diagram for HCS30FF120E1A1

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Pin Configuration and Marking Information

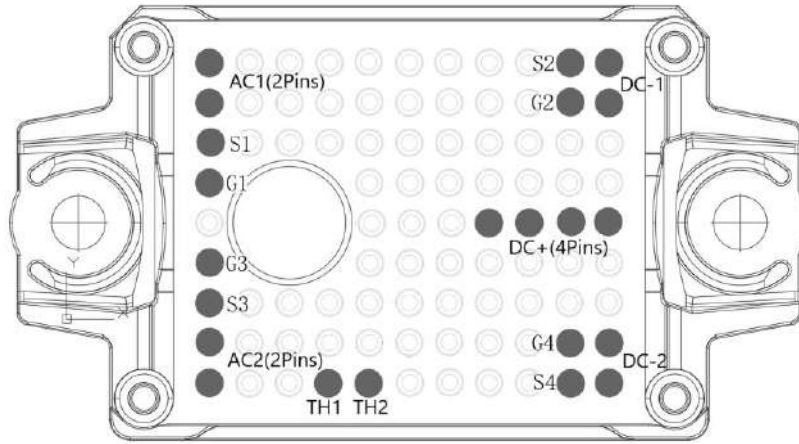


Figure 2. Pin configuration

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	-

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Maximum Ratings ($T_j=25^{\circ}\text{C}$ unless otherwise specified)

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

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	$T_C=25^{\circ}\text{C}$	-	5	-	$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}$, $R_{100}=493\Omega$	-5	-	5	%
P_{25}	Power dissipation	$T_C=25^{\circ}\text{C}$	-	-	20	mW
$B_{25/50}$	B-value	$R_2=R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	K
$B_{25/80}$	B-value	$R_2=R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3411	-	K
$B_{25/100}$	B-value	$R_2=R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	-	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 =100μA		1200	-1	-	V
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V		-	2.	50	μA
V _{GS(th)}	Gate-Source threshold Voltage	I _D =13.5mA, V _{DS} =V _{GS}	T _J =25°C	1.8	82.	3.7	V
			T _J =175°C	-	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)}	Static drain-source	I _D =40A V _{GS} =+15V	T _J =25°C	-	29.5	40.0	mΩ
(Chip)	On-state resistance		T _J =175°C	-	46.1	-	mΩ
V _{DS(on)}	Static drain-source	I _D =40A V _{GS} =+15V	T _J =25°C	-	1.18	1.60	V
(Chip)	On-state Voltage		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.

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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} =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	T _j =25°C	-	21	-	ns
			T _j =150°C	-	24	-	
Q _{rr}	Reverse recovery charge	V _{GS} =+15/-4V R _G =2.2 Ω	T _j =25°C	-	105	-	nC
			T _j =150°C	-	265	-	
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j =25°C	-	252	-	μJ
			T _j =150°C	-	328	-	

Test Conditions

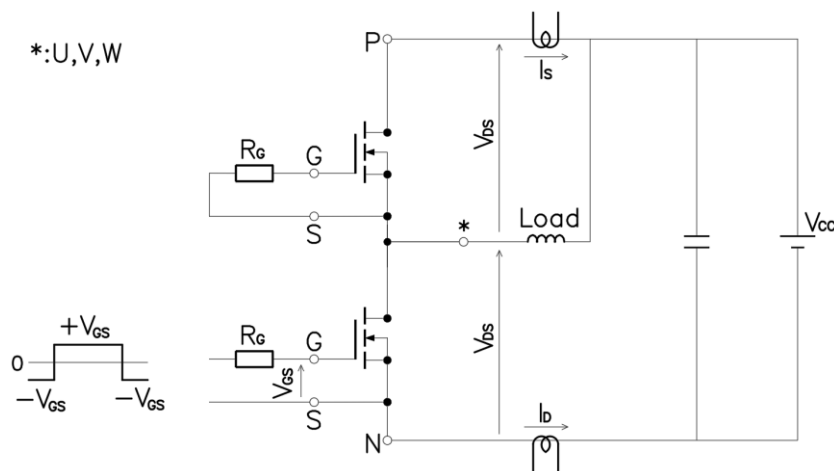


Figure 3. Switching time measure circuit

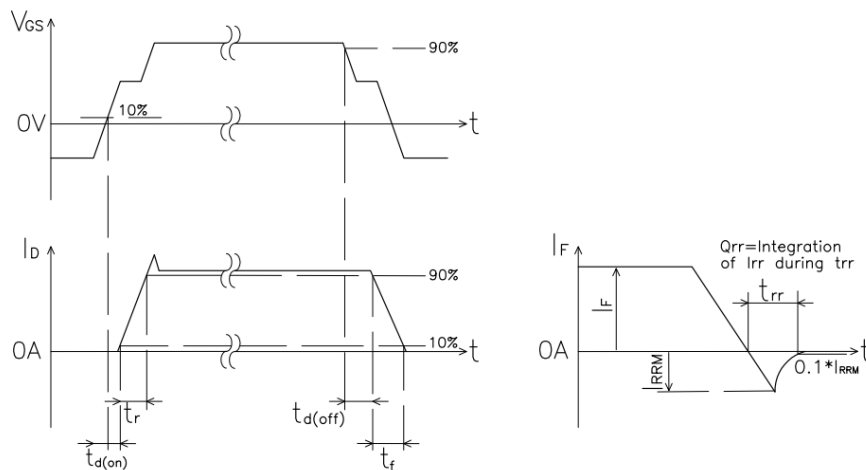


Figure 4. Switching time definition

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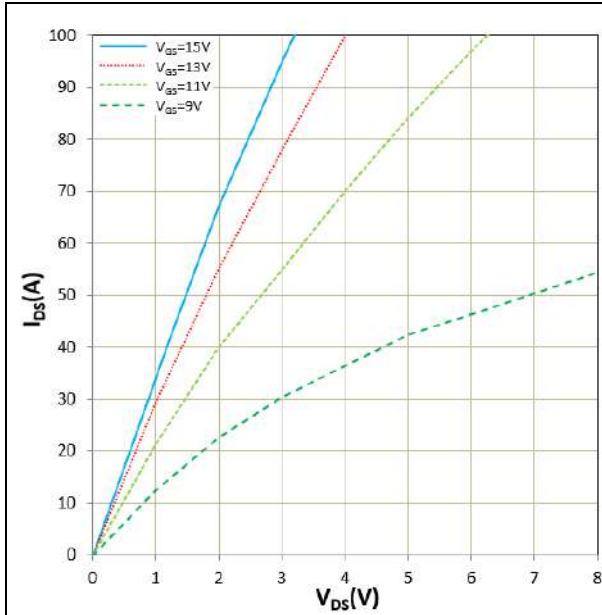


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

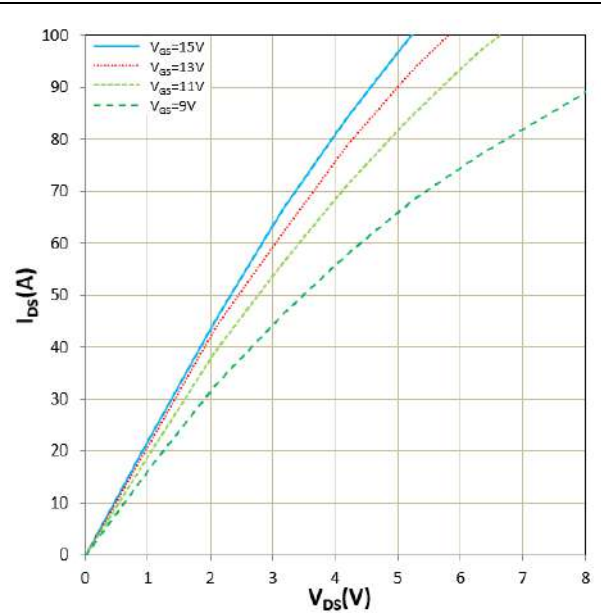


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

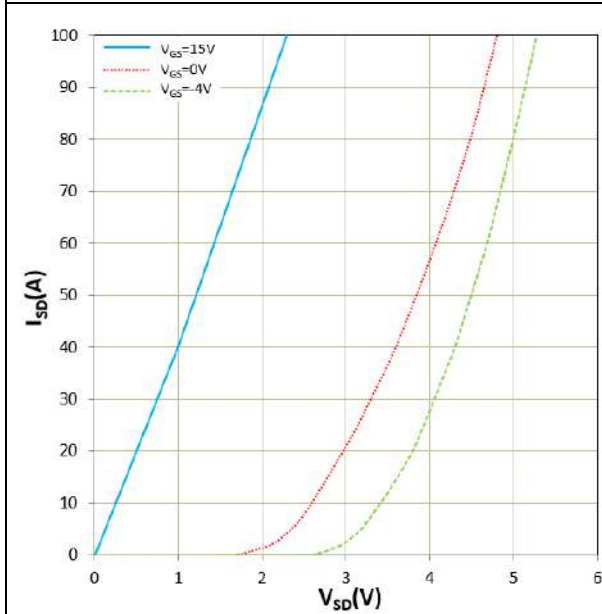


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

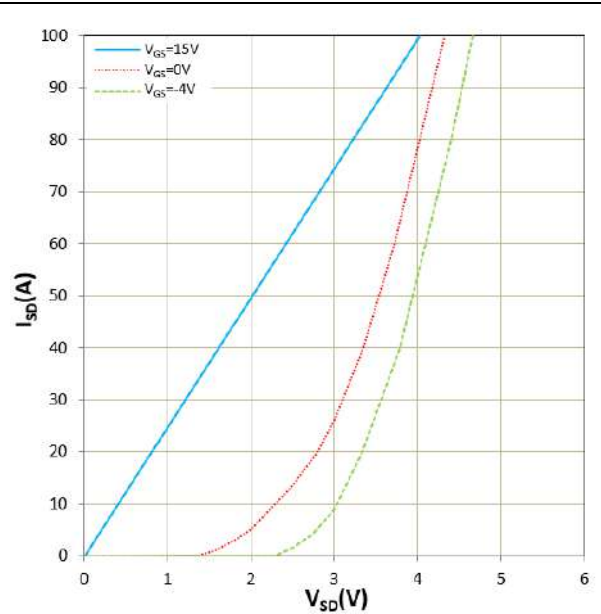


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

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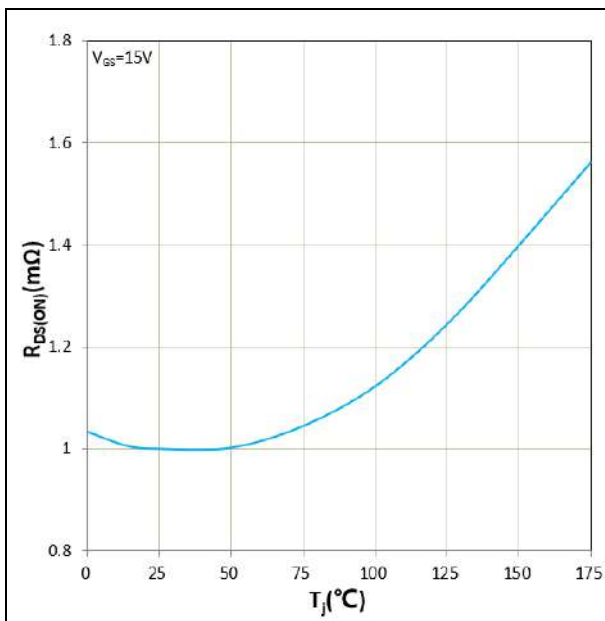


Figure 9. $R_{DS(ON)}$ vs T_J
 $V_{GS}=+15V$, $I_D=40A$, $1.0X=29.5m\Omega$

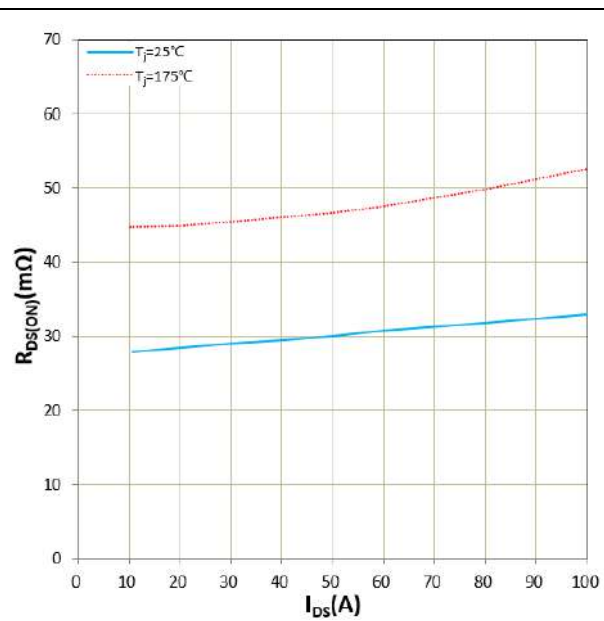


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $T_J=25^\circ C/175^\circ C$, $V_{GS}=+15V$

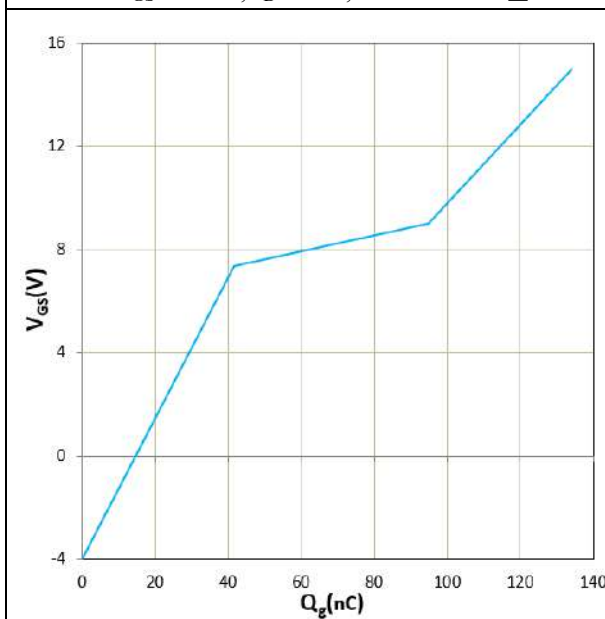


Figure 11. V_{GS} vs Q_g
 $T_J=25^\circ C$, $V_{DS}=800V$, $I_D=40A$

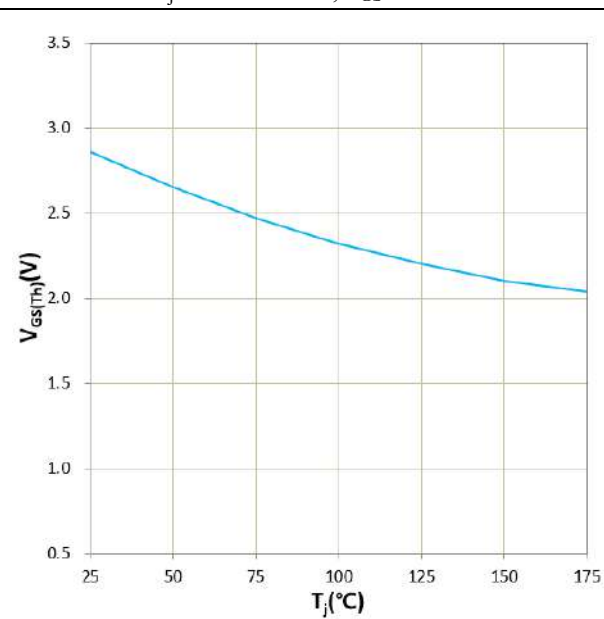


Figure 12. $V_{GS(TH)}$ vs T_J
 $V_{GS}=V_{DS}$, $I_D=13.5mA$

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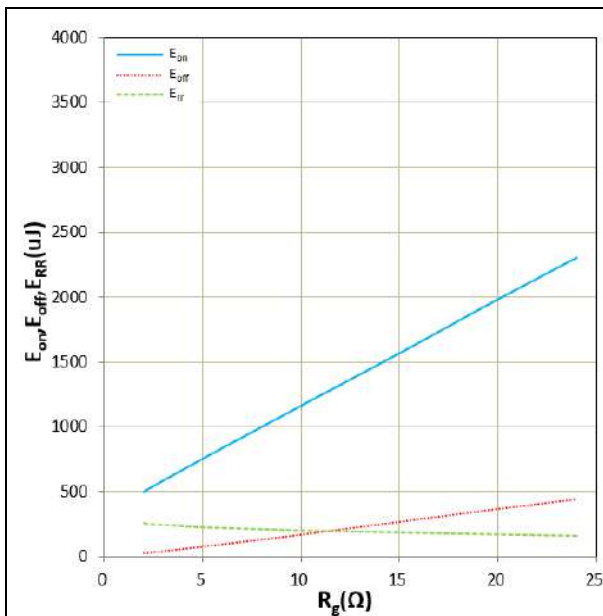


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{DD} = 800\text{V}$, $I_D = 40\text{A}$, $V_{GS} = -4\text{V}/+15\text{V}$
Inductive Load

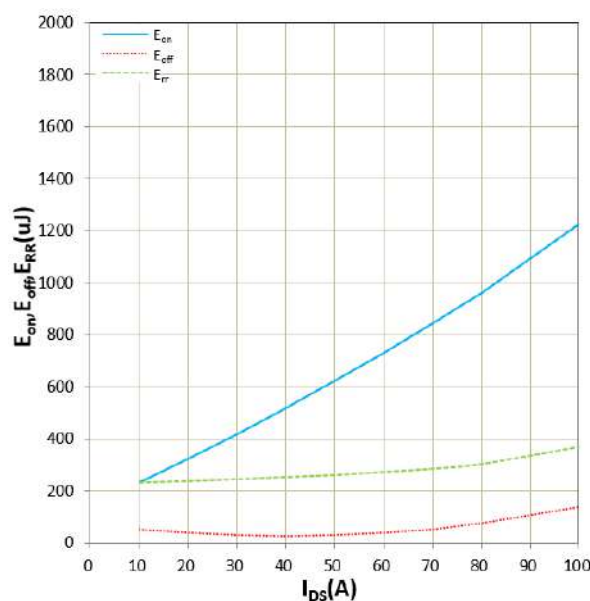


Figure 14. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j = 25^\circ\text{C}$, $V_{DD} = 800\text{V}$, $R_g = 2.2\Omega$, $V_{GS} = -4\text{V}/+15\text{V}$
Inductive Load

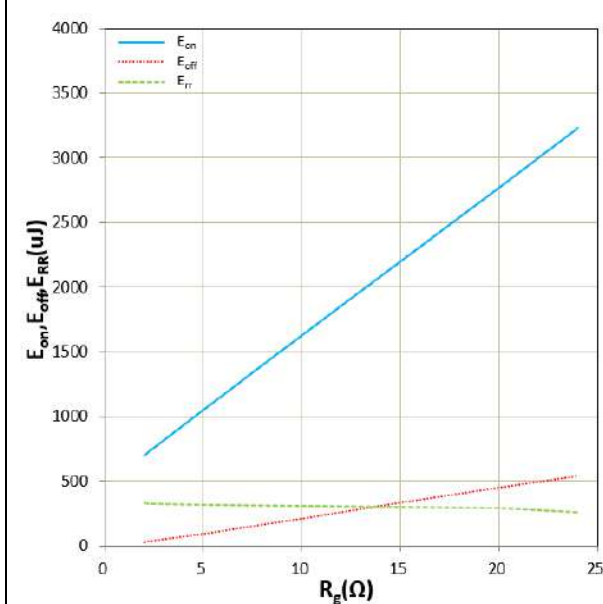


Figure 15. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{DD} = 800\text{V}$, $I_D = 40\text{A}$, $V_{GS} = -4\text{V}/+15\text{V}$
Inductive Load

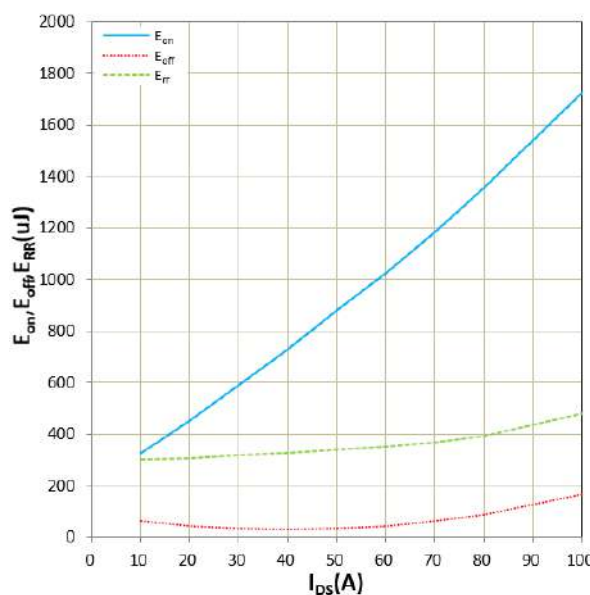
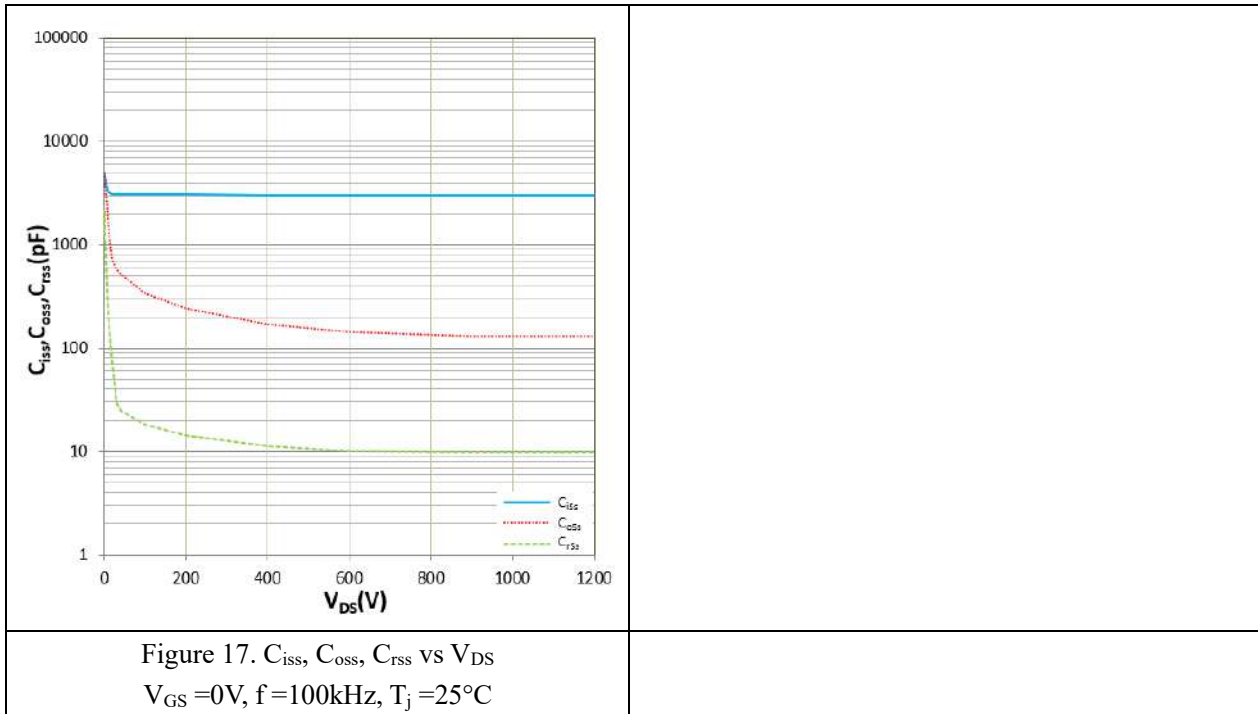


Figure 16. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j = 150^\circ\text{C}$, $V_{DD} = 800\text{V}$, $R_g = 2.2\Omega$, $V_{GS} = -4\text{V}/+15\text{V}$
Inductive Load

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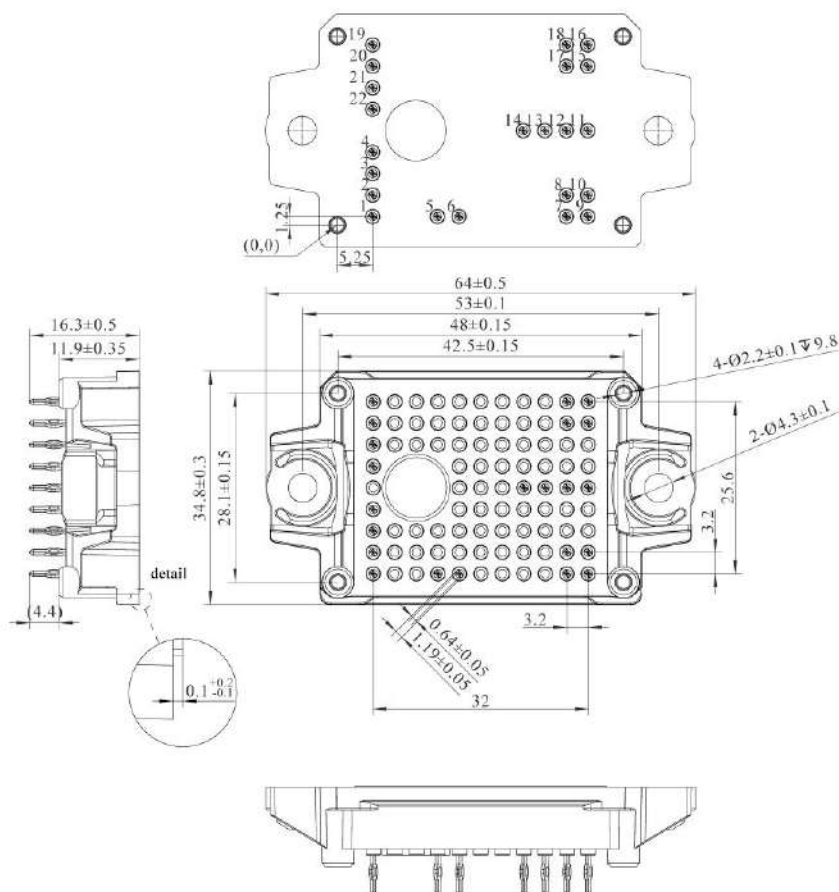
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Package dimensions



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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This product data sheet describes the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively under the terms and conditions of the supply agreement. There will be no guarantee or of any kind for the product and its characteristics.

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.

Please contact the sales staff (sales@hiitio.com) for further information on the product, technology, delivery terms, conditions and prices.

Revision History

Document Version	Description of Changes
RevX.0.1	Released

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