

HCS06FH120E2A2

1200V/6.0mΩ Half Bridge SiC MOSFET Module

Description

The HCS06FH120E2A2 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
- $R_{ds(on)}=6.0m\Omega$
- 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

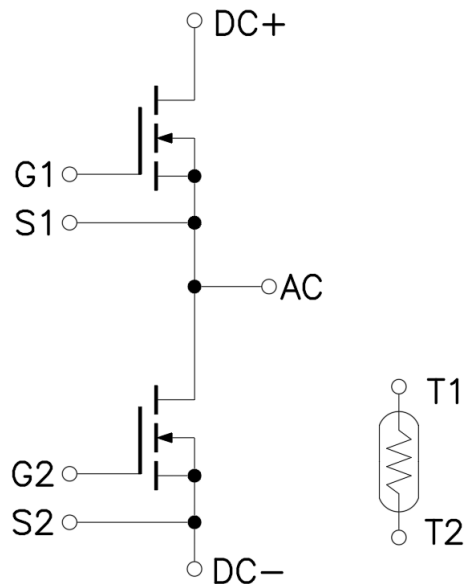


Figure 1. Out drawing & circuit diagram for HCS06FH120E2A2

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Pin Configuration and Function Description

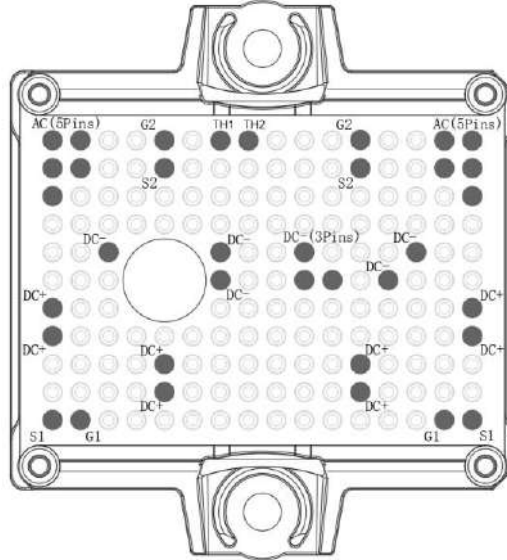


Figure 2. Pin configuration

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	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

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_{GSS}	Gate - Source Voltage (dynamic), $T_{surge} < 100\text{ns}$	D-S Short, Note1	-8 to 19	V
V_{GSOP}	Gate - Source Voltage (static)	D-S Short, Note1	-4 to 15	
I_{DS}	DC Continuous Drain Current	$T_f = 90^\circ\text{C}$	200	A
I_{SD}	Source (Body diode) Current	$T_f = 90^\circ\text{C}$, with ON signal	200	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	400	A
P_{tot}	Total Power Dissipation	$T_C = 25^\circ\text{C}$	1500	W
T_{jmax}	Max Junction Temperature	-	175	$^\circ\text{C}$
T_{stg}	Storage temperature	-	-40 to 125	$^\circ\text{C}$

Note1: Recommended Operating Value, -4V/+15V

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	-	kΩ
$\frac{\Delta R}{R}$	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 ($T_j=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=0.5mA$	1200	-	-	V	
I_{DSS}	Zero gate voltage drain Current	$V_{DS}=1200V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	5	250	μA	
$V_{GS(th)}$	Gate-source threshold Voltage	$I_D=67.5mA, V_{DS}=V_{GS}$	$T_j=25^\circ\text{C}$	1.8	2.8	3.7	V
			$T_j=150^\circ\text{C}$	-	2.1	-	
			$T_j=175^\circ\text{C}$	-	2.0	-	
I_{GSS+}	Gate-Source Leakage Current	$V_{GS}=15V, V_{DS}=0V$	$T_j=25^\circ\text{C}$	-	5	1000	nA
I_{GSS-}		$V_{GS}=-4V, V_{DS}=0V$	$T_j=25^\circ\text{C}$	-1000	-5	-	
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	$I_D=200A$ $V_{GS}=15V$	$T_j=25^\circ\text{C}$	-	6.0	-	mΩ
			$T_j=150^\circ\text{C}$	-	8.6	-	
			$T_j=175^\circ\text{C}$	-	9.4	-	
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	$I_D=200A$ $V_{GS}=15V$	$T_j=25^\circ\text{C}$	-	1.20	-	V
			$T_j=150^\circ\text{C}$	-	1.72	-	
			$T_j=175^\circ\text{C}$	-	1.88	-	
C_{iss}	Input Capacitance	$V_D=1000V, V_{GS}=0V, f=100KHz$	-	15.35	-	nF	
C_{oss}	Output Capacitance		-	0.65	-	nF	
C_{rss}	Reverse transfer Capacitance		-	0.05	-	nF	
Q_g	Total gate charge	$V_{DD}=800V, I_D=200A, V_{GS}=-4/+15V$	-	670	-	nC	
Q_{GS}	Gate-source charge		-	210	-		
Q_{GD}	Gate-drain charge		-	265	-		
R_{Gint}	Internal Gate Resistance	$f=1MHz$	-	1.2	-	☒	
$t_{d(on)}$	Turn-on delay time	$V_{DD}=600V$ $I_D=200A$ $V_{GS}=-4/+15V$ $R_{G(on)}=2.2\Omega$ $R_{G(off)}=2.2\Omega$ Inductive load switching operation	$T_j=25^\circ\text{C}$	-	23	-	ns
			$T_j=150^\circ\text{C}$	-	19	-	
t_r	Rise time		$T_j=25^\circ\text{C}$	-	28	-	ns
			$T_j=150^\circ\text{C}$	-	24	-	
$t_{d(off)}$	Turn-off delay time		$T_j=25^\circ\text{C}$	-	42	-	ns
			$T_j=150^\circ\text{C}$	-	46	-	
t_f	Fall time		$T_j=25^\circ\text{C}$	-	14	-	ns
			$T_j=150^\circ\text{C}$	-	11	-	
E_{on}	Turn-on power dissipation		$T_j=25^\circ\text{C}$	-	6.15	-	mJ
			$T_j=150^\circ\text{C}$	-	7.26	-	
E_{off}	Turn-off power dissipation		$T_j=25^\circ\text{C}$	-	1.03	-	mJ
			$T_j=150^\circ\text{C}$	-	0.78	-	
$R_{th(j-c)}$	FET Thermal Resistance		Junction to Case	-	0.10	-	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.

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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	$V_{GS} = -4\text{V}$ $I_{SD} = 200\text{A}$	$T_j = 25^\circ\text{C}$	-	4.3	-	V
			$T_j = 150^\circ\text{C}$	-	3.9	-	
			$T_j = 175^\circ\text{C}$	-	3.8	-	
T_{rr}	Reverse recovery time	$V_{DD} = 600\text{V}$ $I_D = 200\text{A}$	$T_j = 25^\circ\text{C}$	-	30	-	ns
			$T_j = 150^\circ\text{C}$	-	33	-	
Q_{rr}	Reverse recovery charge	$V_{GS} = -4/+15\text{V}$ $R_{GON} = R_{GOFF} = 2.2\ \Omega$	$T_j = 25^\circ\text{C}$	-	2.67	-	μC
			$T_j = 150^\circ\text{C}$	-	5.24	-	
E_{rr}	Diode switching power dissipation	Inductive load switching operation	$T_j = 25^\circ\text{C}$	-	1.24	-	mJ
			$T_j = 150^\circ\text{C}$	-	2.31	-	

Test Conditions

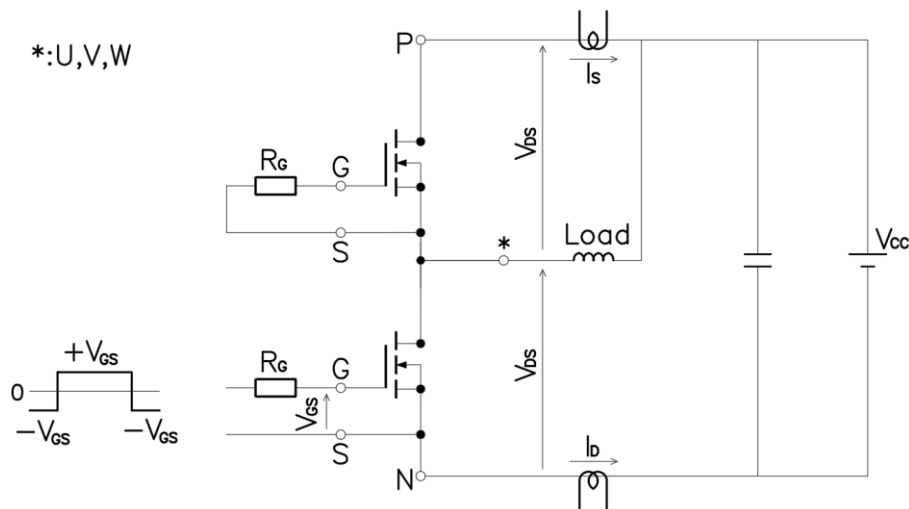


Figure 3. Switching time measure circuit

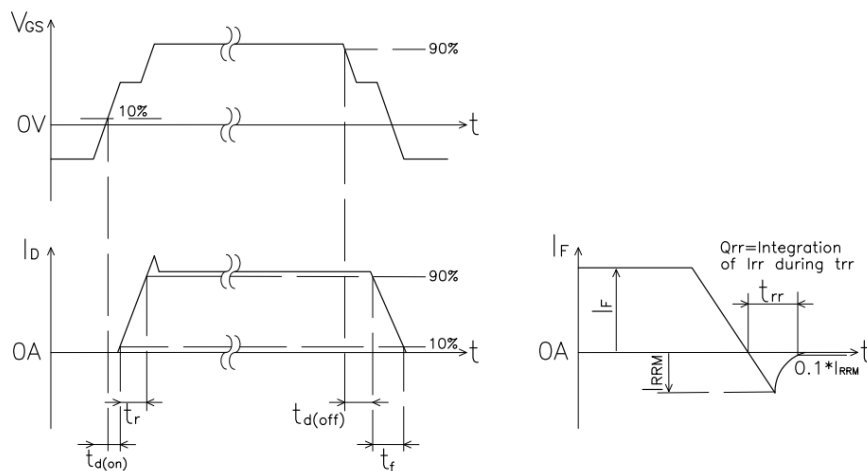


Figure 4. Switching time definition

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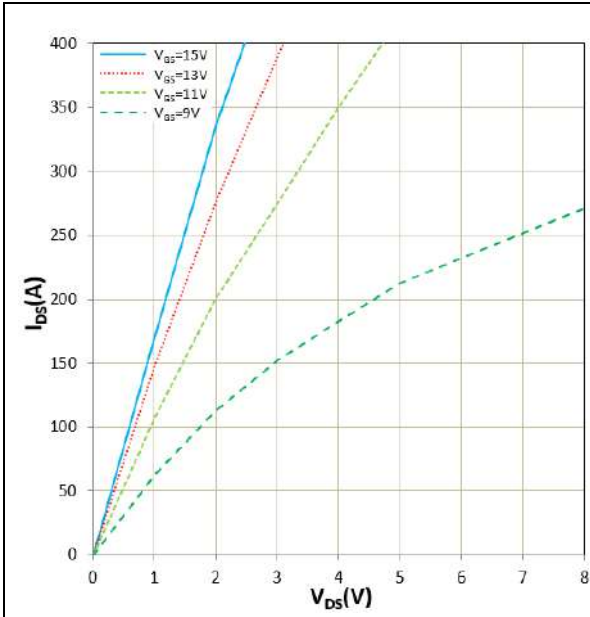


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

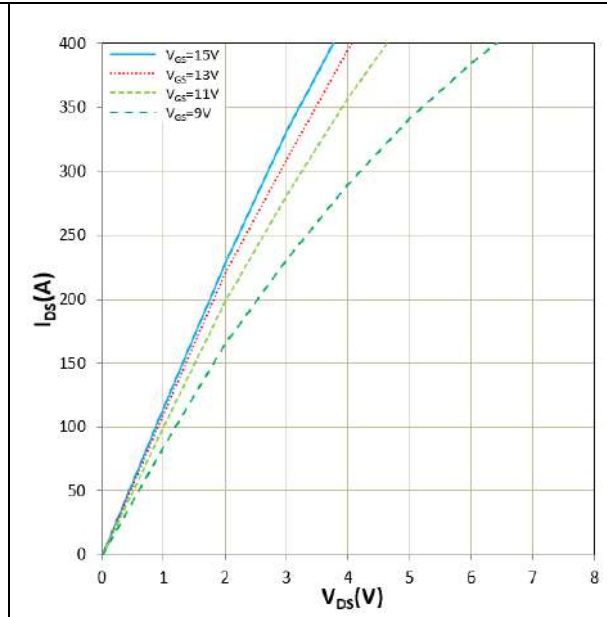


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$

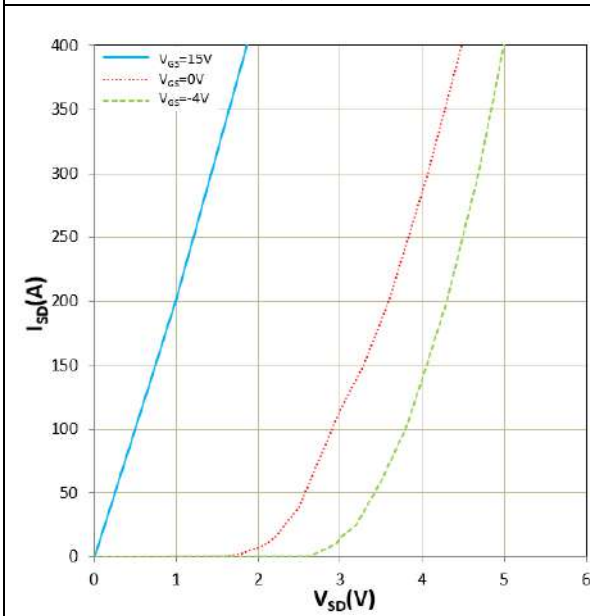


Figure 7. I_{SD} vs V_{SD}
 $T_j = 25^\circ\text{C}$

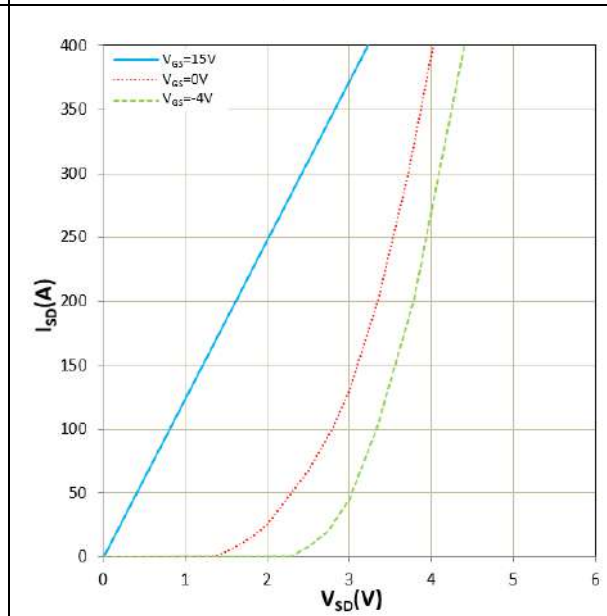


Figure 8. I_{SD} vs V_{SD}
 $T_j = 175^\circ\text{C}$

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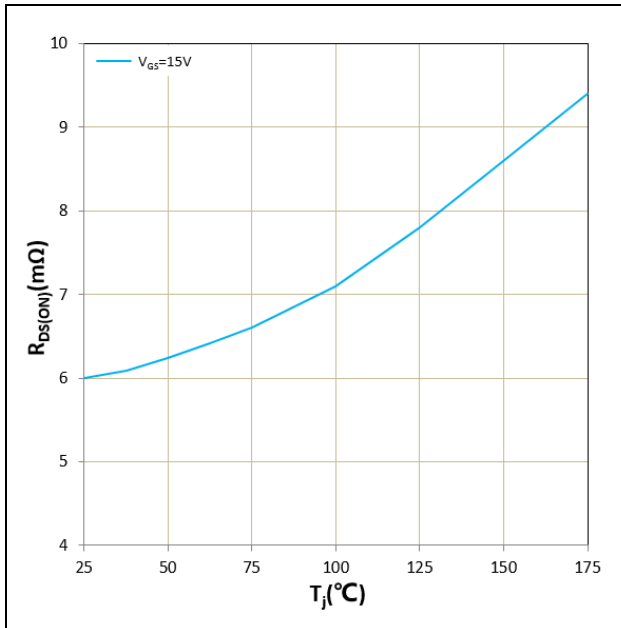


Figure 9. $R_{DS(ON)}$ vs T_j
 $I_D = 200A$

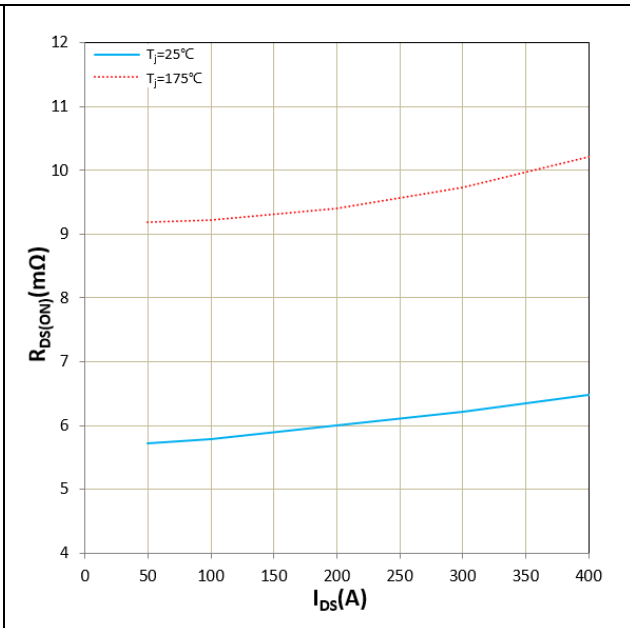


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +15V$

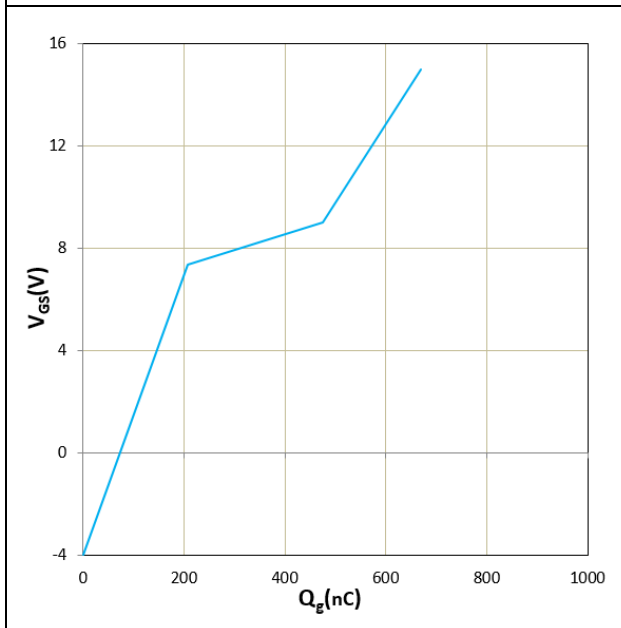


Figure 11. V_{GS} vs Q_g
 $T_j = 25^\circ C, V_{DS} = 800V, I_D = 200A$

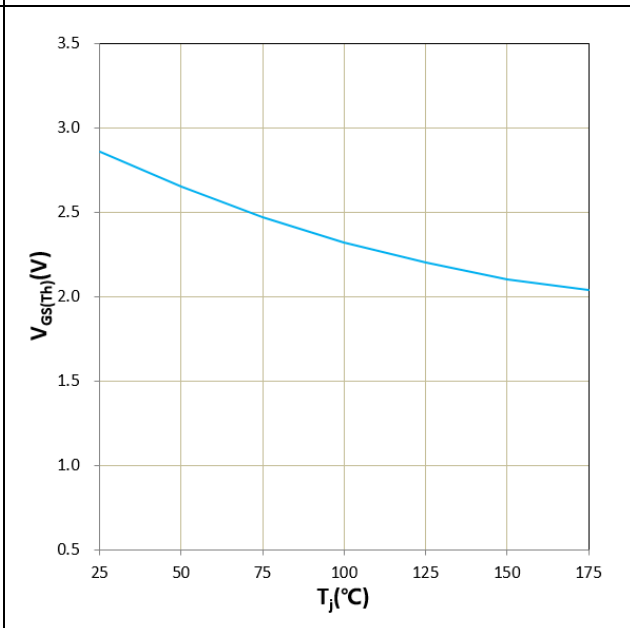


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}, I_D = 67.5mA$

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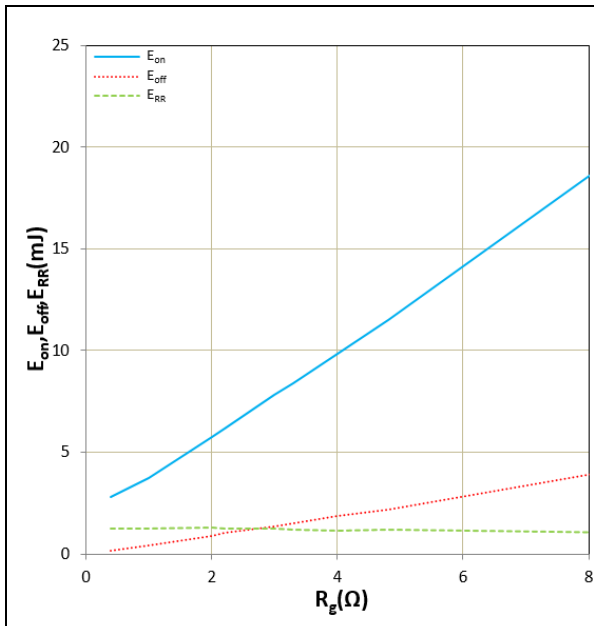


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{DD} = 600\text{V}$, $I_D = 200\text{A}$, $V_{GS} = -4\text{V}/+15\text{V}$
 Inductive Load

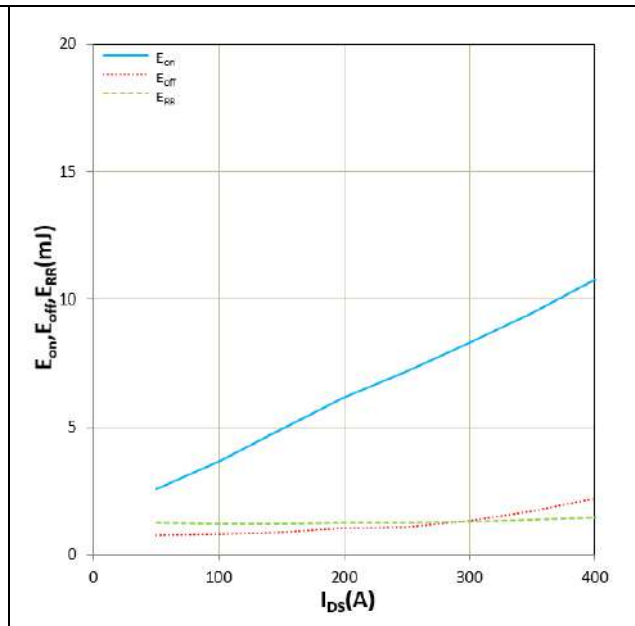


Figure 14. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j = 25^\circ\text{C}$, $V_{DD} = 600\text{V}$, $R_g = 2.2\Omega$, $V_{GS} = -4\text{V}/+15\text{V}$
 Inductive Load

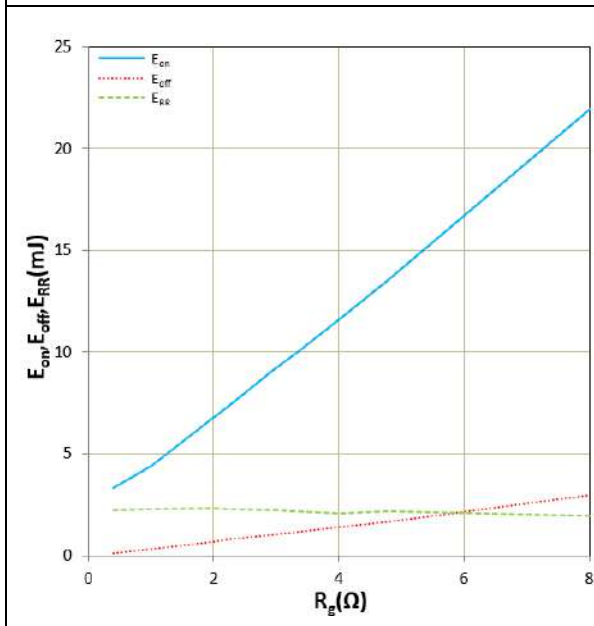


Figure 15. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{DD} = 600\text{V}$, $I_D = 200\text{A}$, $V_{GS} = -4\text{V}/+15\text{V}$
 Inductive Load

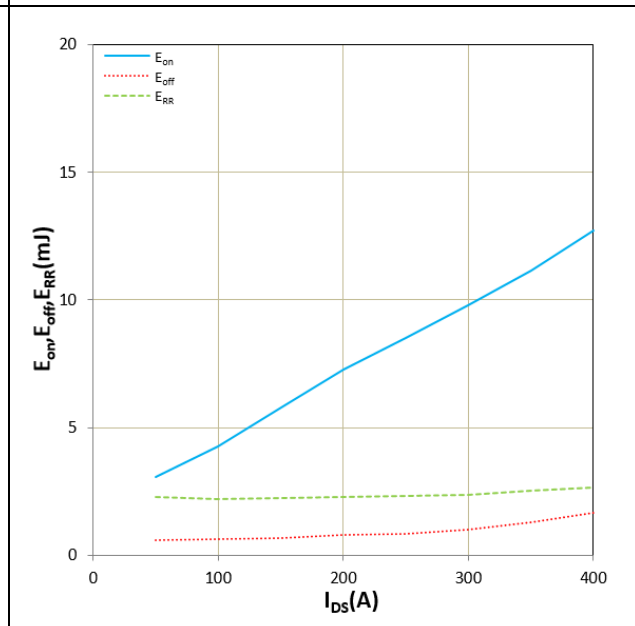


Figure 16. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_j = 150^\circ\text{C}$, $V_{DD} = 600\text{V}$, $R_g = 2.2\Omega$, $V_{GS} = -4\text{V}/+15\text{V}$
 Inductive Load

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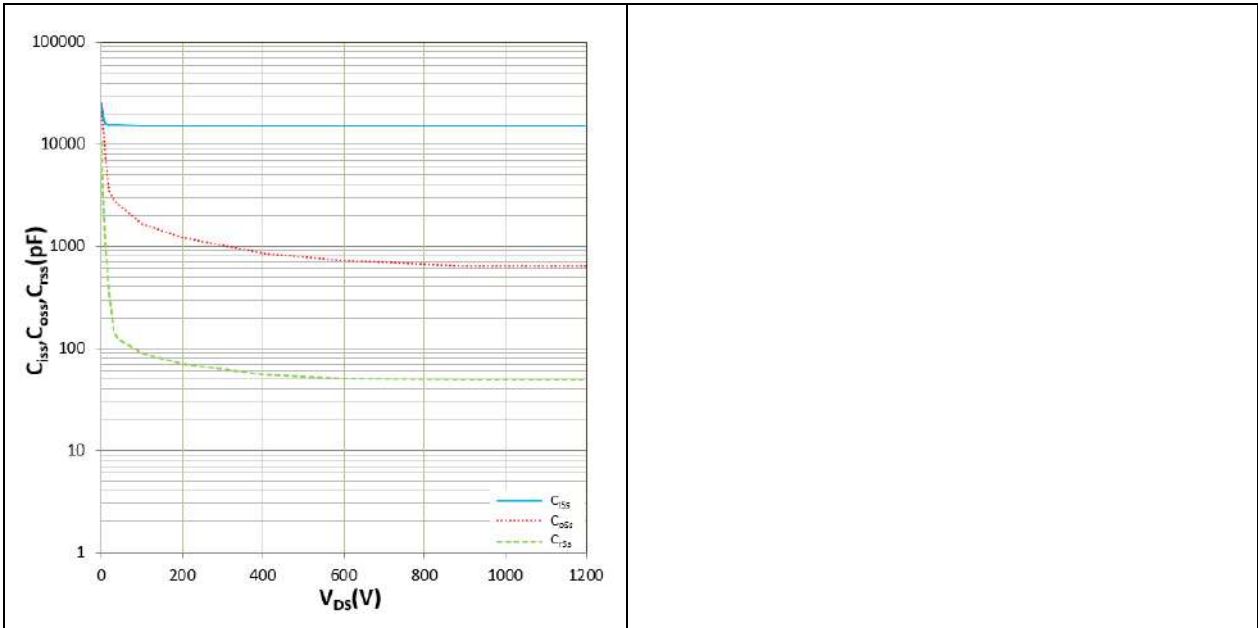
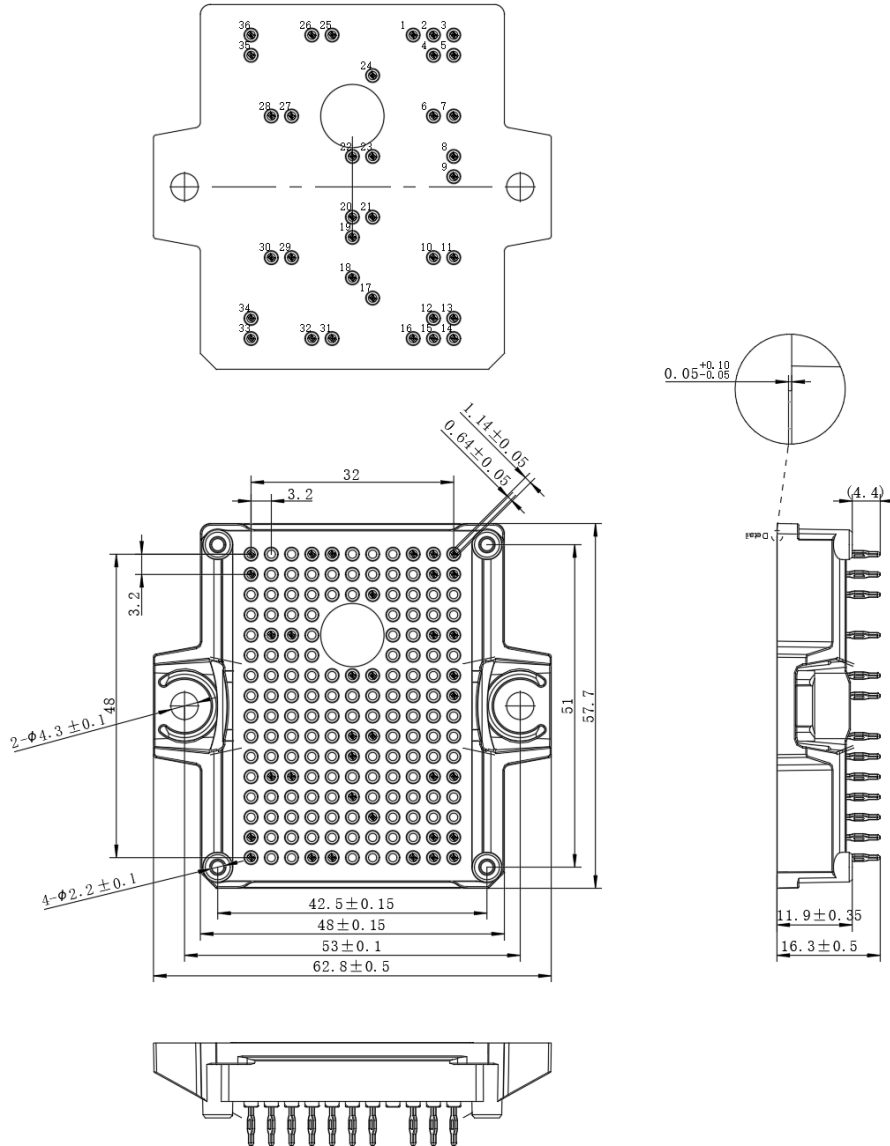


Figure 17. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
 V_{GS} = 0V, f = 100KHz, T_j = 25°C

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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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IMPORTANT NOTICE

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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