

HCS800FH140D4A1S

1400V/800A Half Bridge SiC MOSFET Module

Description

The HCS800FH140D4A1S is a half bridge IGBT Power Module. It integrates high performance IGBT chips designed for the applications such as High Power supply and Motor control.



Circuit diagram

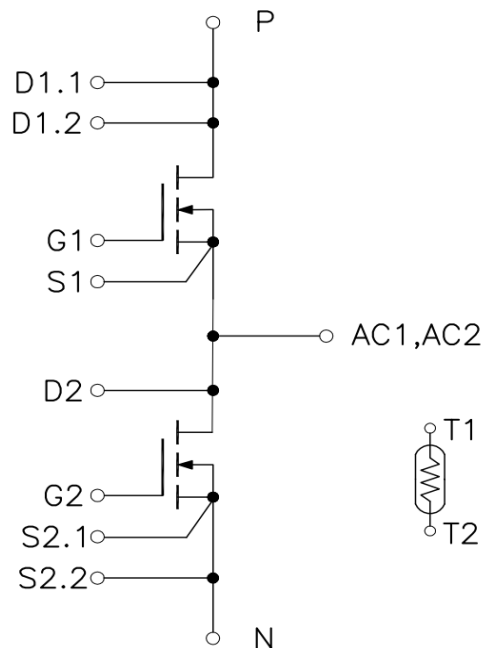


Figure 1 Out drawing & circuit diagram for HCS800FH140D4A1S

Note: Please use **S2.1** for the low side drive signal and do not connect it to **S2.2** which is power terminal

Features

- 1400V/2.45mΩ @T_j =25℃ ,V_{GS} =20V
- Low thermal resistance with Si3N4 AMB
- 175℃ maximum junction temperature
- Low Inductive Design
- Thermistor inside

Applications

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Smart-Grid / Grid-Tied Distributed Generation

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Pin Configuration and Marking Information

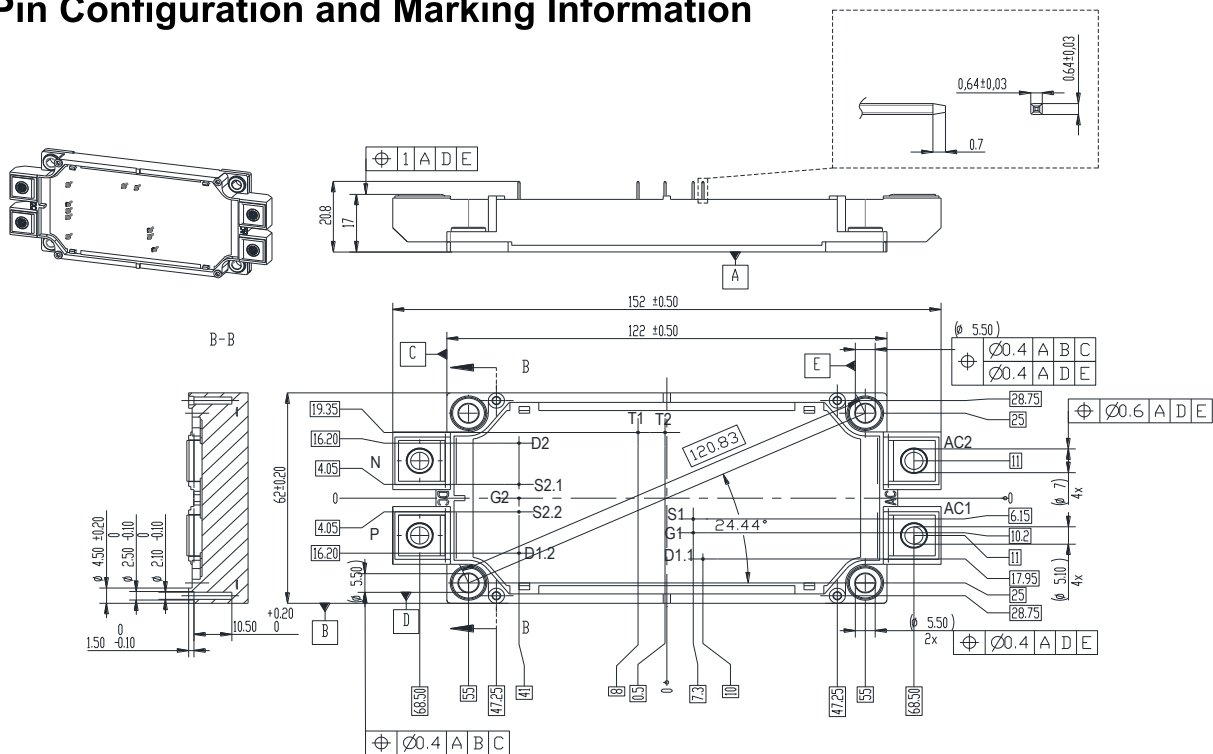


Figure2. Pin configuration

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Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =50Hz, t =1min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
Module lead resistance, terminals – chip	T _C = 25°C	0.2	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	380	g

Maximum Ratings (T_J =25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V _{DSS}	Drain-Source Voltage	G-S Short	1400	V
V _{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1	-10V/+25V	V
I _{DS}	DC Continuous Drain Current	T _f =25°C, V _{GS} =20V	705	A
		T _f =65°C, V _{GS} =20V	600	A
I _{DS}	DC Continuous Drain Current	T _f =25°C, V _{GS} =18V	695	A
		T _f =65°C, V _{GS} =18V	595	A
I _{SD}	Source (Body Diode) Current	T _f =25°C, with ON signal	695	A
I _{SD}	Source (Body Diode) Current	T _f =65°C, with ON signal	595	A
I _{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	1600	A
P _{tot}	Maximum Power Dissipation	T _C =25°C	3333	W
T _{jmax}	Max junction temperature	-	175	°C
T _{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value: +20V/-5V, +20V/-4V, +18V/-5V, +18V/-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 R100	T _C =100°C, R ₁₀₀ =493 Ω	-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 =800μA		1400	-	-	V	
I _{DSS}	Zero gate voltage drain current	V _{DS} =1200V, V _{GS} =0V		-	8	400	μA	
V _{GS(Th)}	Gate-source threshold voltage	I _D =160mA V _{DS} =V _{GS}	T _j =25°C	1.9	2.45	3.8	V	
			T _j =150°C	-	1.70	-	V	
			T _j =175°C	-	1.60	-	V	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V		-	8	1600	nA	
		V _{GS} =-5V, V _{DS} =0V		-1600	-8	0	nA	
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =800A V _{GS} =20V	T _j =25°C	-	2.45	-	mΩ	
			T _j =175°C	-	4.64	-	mΩ	
		I _D =800A V _{GS} =18V	T _j =25°C	-	2.65	-	mΩ	
			T _j =175°C	-	4.76	-	mΩ	
V _{DS(on)} (Chip)	Static drain-source On-state voltage	I _D =800A V _{GS} =20V	T _j =25°C	-	1.96	-	V	
			T _j =175°C	-	3.71	-	V	
		I _D =800A V _{GS} =18V	T _j =25°C	-	2.12	-	V	
			T _j =175°C	-	3.81	-	V	
C _{iss}	Input capacitance	V _{DS} =1000V		-	38.2	-	nF	
C _{oss}	Output capacitance	V _{GS} =0V		-	1.73	-	nF	
C _{rss}	Reverse transfer capacitance	f =100kHz		-	0.13	-	nF	
Q _g	Total gate charge	V _{DS} =800V		-	1912	-	nC	
Q _{gs}	Gate to source charge	I _D =400A		-	496	-	nC	
Q _{gd}	Gate to drain charge	V _{GS} =+20/-5V		-	624	-	nC	
R _{gint}	Internal gate resistor	f =1MHz		-	1.1	-	Ω	
t _{d(on)}	Turn-on delay time	V _{DD} =900V I _D =800A V _{GS} =+18/-5V R _{G(ON)} =5.6Ω R _{G(OFF)} =5.6Ω Inductive load switching operation	T _j =25°C	-	162	-	ns	
			T _j =150°C	-	144	-		
t _r	Rise time		T _j =25°C	-	113	-	ns	
			T _j =150°C	-	105	-		
t _{d(off)}	Turn-off delay time		T _j =25°C	-	392	-	ns	
			T _j =150°C	-	470	-		
t _f	Fall time		T _j =25°C	-	69	-	ns	
			T _j =150°C	-	79	-		
E _{on}	Turn-on power dissipation		T _j =25°C	-	87.9	-	mJ	
			T _j =150°C	-	87.5	-		
E _{off}	Turn-off power dissipation		T _j =25°C	-	82.1	-	mJ	
			T _j =150°C	-	89.8	-		
R _{th(j-c)}	Thermal Resistance, Junction to Case (MOSFET)			-	0.045	-	K/W	
R _{th(c-f)}	Contact Thermal Resistance, With thermal conductive grease, Note1			-	0.020	-	K/W	

Note1: 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 °C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit
			Min.	Typ.	Max.	
V _{SD}	Body Diode Forward Voltage	V _{GS} = -5V				V
		T _j = 25°C	-	5.8	-	
		I _{SD} = 800A				
		T _j = 175°C	-	5.2	-	
T _{rr}	Reverse recovery time	V _{DD} = 900V				ns
		T _j = 25°C	-	41	-	
		I _D = 800A				
		T _j = 150°C	-	76	-	
Q _{rr}	Reverse recovery charge	V _{GS} = +18/-5V				μC
		T _j = 25°C	-	3.42	-	
		R _{G(ON)} = R _{G(OFF)} = 5.6 Ω				
		T _j = 150°C	-	13.2	-	
E _{rr}	Diode switching power dissipation	Inductive load				mJ
		switching operation				
		T _j = 25°C	-	0.69	-	
		T _j = 150°C	-	3.52	-	

Test Conditions

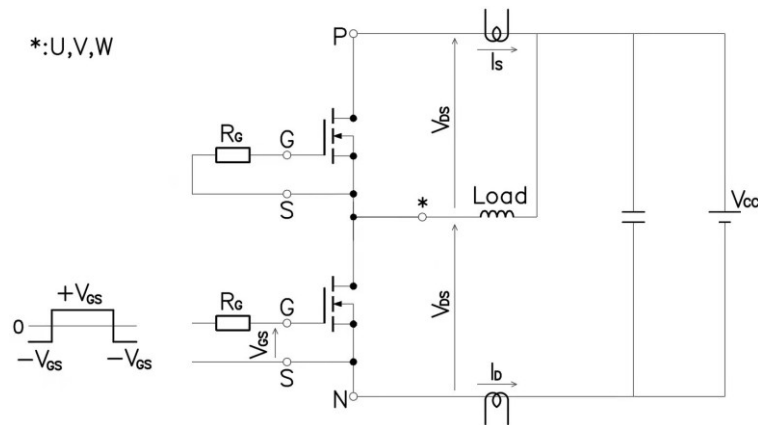


Figure 3. Switching time measure circuit

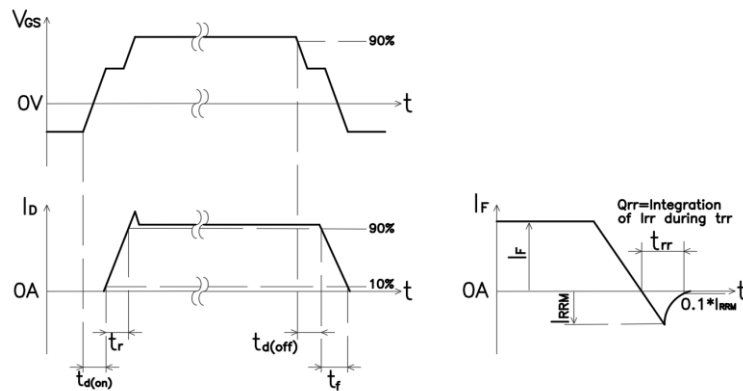


Figure 4. Switching time definition

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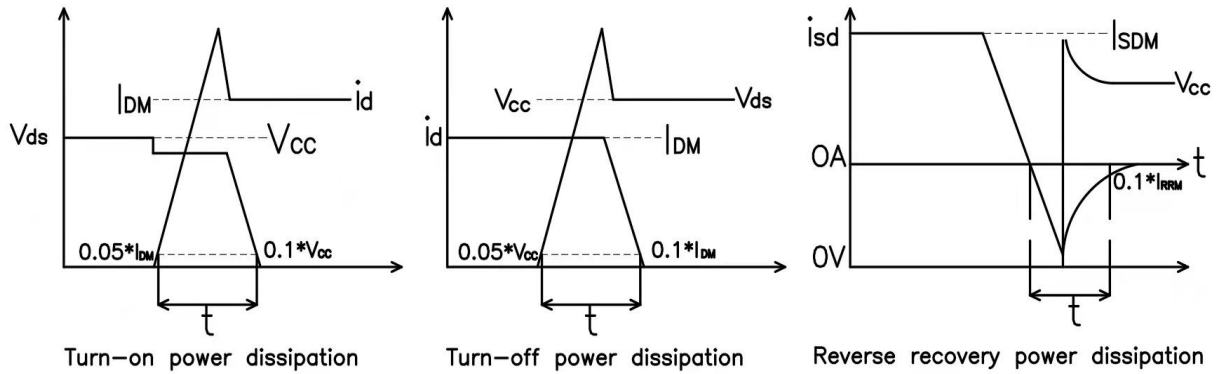


Figure 5. Switching power dissipation definition

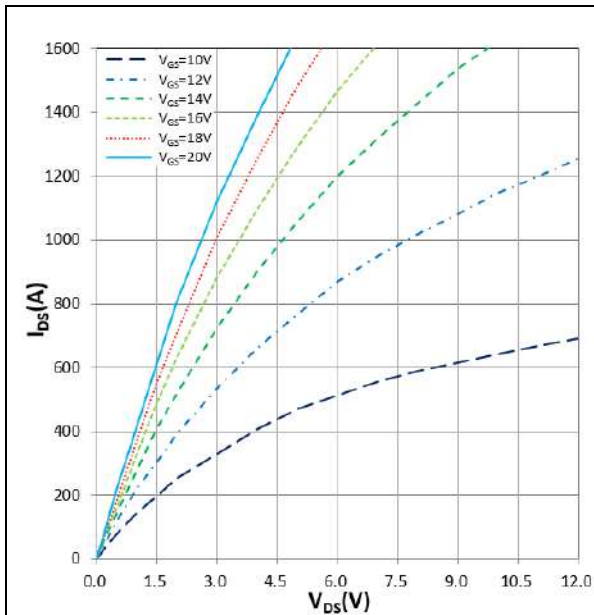


Figure 6. I_{DS} vs V_{DS}
 $T_j=25^\circ\text{C}$, V_{GS} parameter

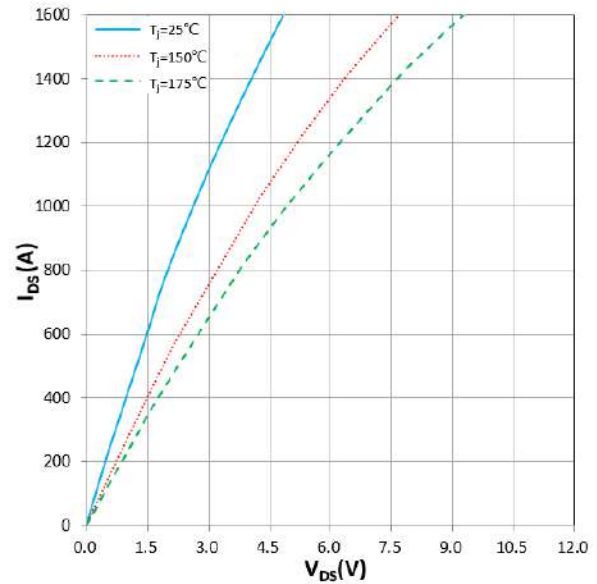


Figure 7. I_{DS} vs V_{DS}
 $V_{GS}=20\text{V}$, T_j parameter

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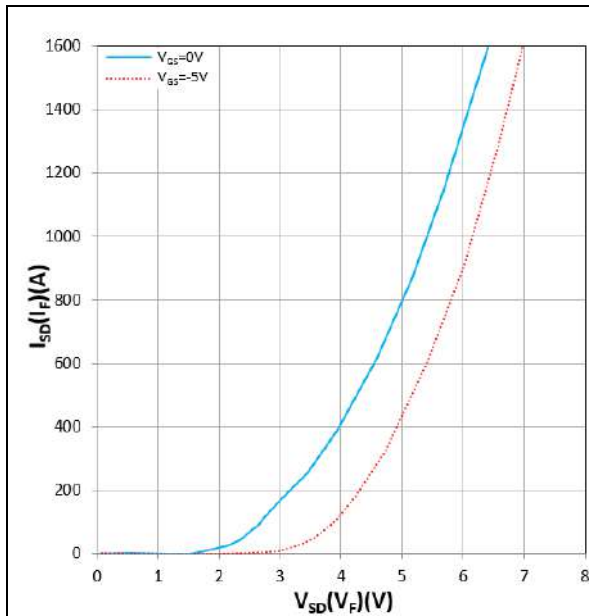


Figure 8. I_{SD} vs V_{SD}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

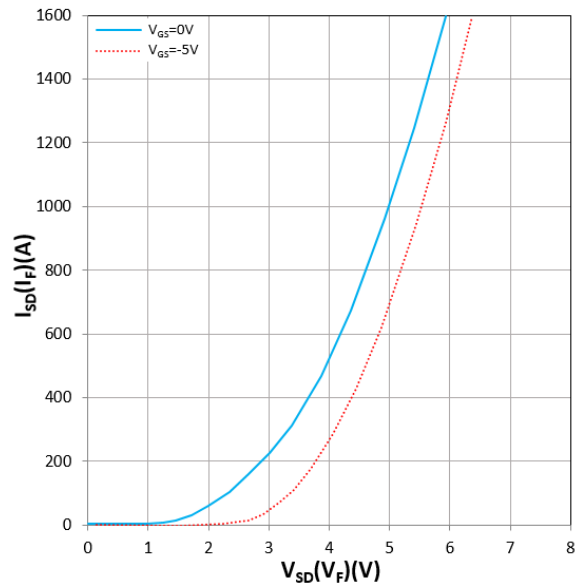


Figure 9. I_{SD} vs V_{SD}
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

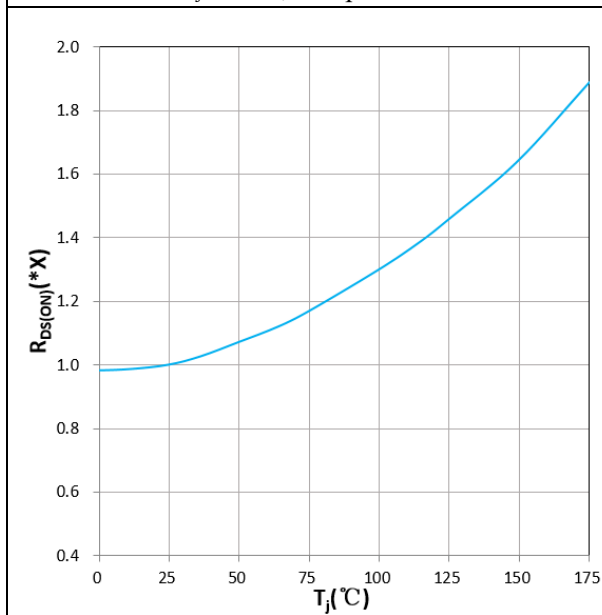


Figure 10. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +20\text{V}$, $I_D = 800\text{A}$, $1.0X = 2.45\text{m}\Omega$

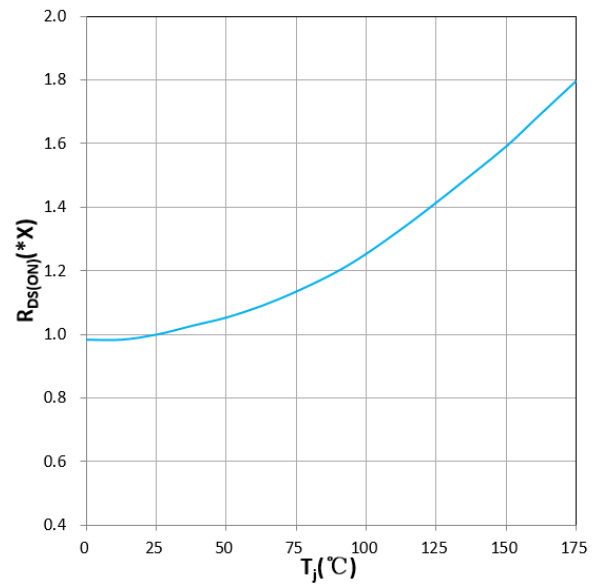


Figure 11. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +18\text{V}$, $I_D = 800\text{A}$, $1.0X = 2.65\text{m}\Omega$

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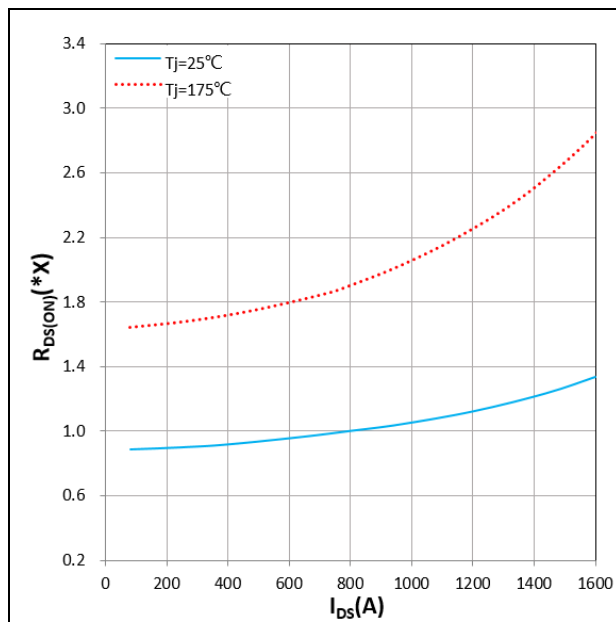


Figure 12. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +20V$, $1.0X = 2.45m\Omega$

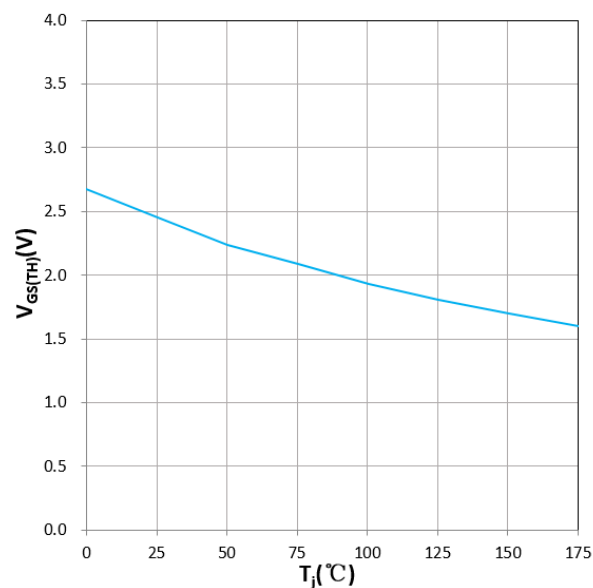


Figure 13. $V_{GS(Th)}$ vs T_J
 $V_{GS} = V_{DS}$, $I_D = 160mA$

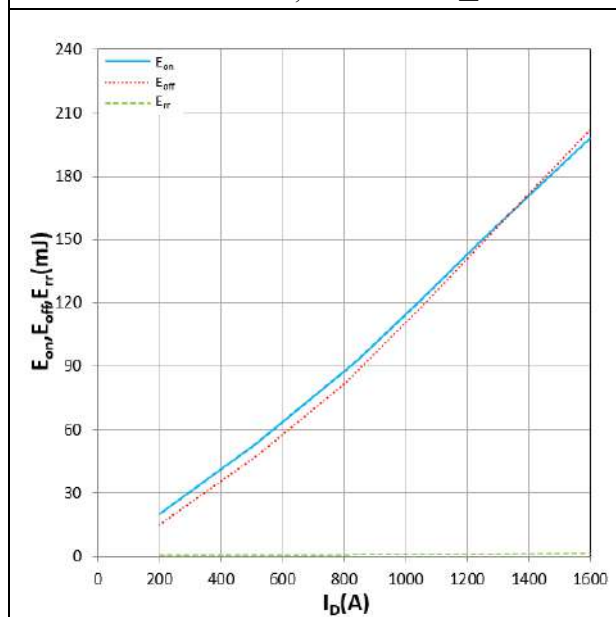


Figure 14. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_J = 25^\circ C$, $V_{DD} = 900V$, $R_G = 5.6\Omega$, $V_{GS} = +18V/-5V$
 Inductive Load

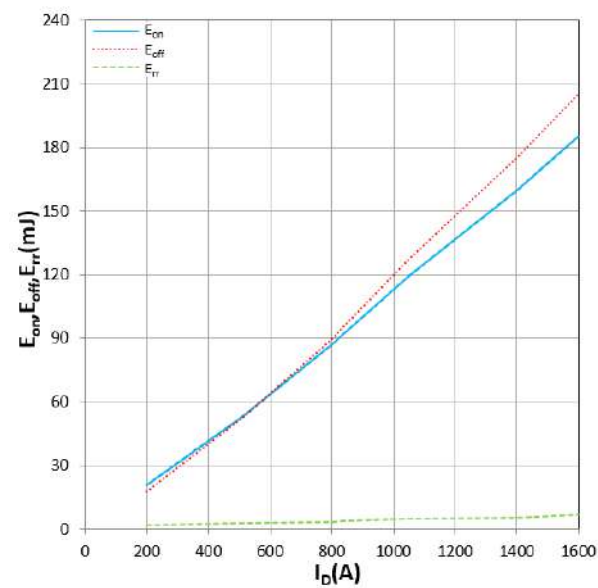


Figure 15. E_{on} , E_{off} , E_{rr} vs I_{DS}
 $T_J = 150^\circ C$, $V_{DD} = 900V$, $R_G = 5.6\Omega$, $V_{GS} = +18V/-5V$
 Inductive Load

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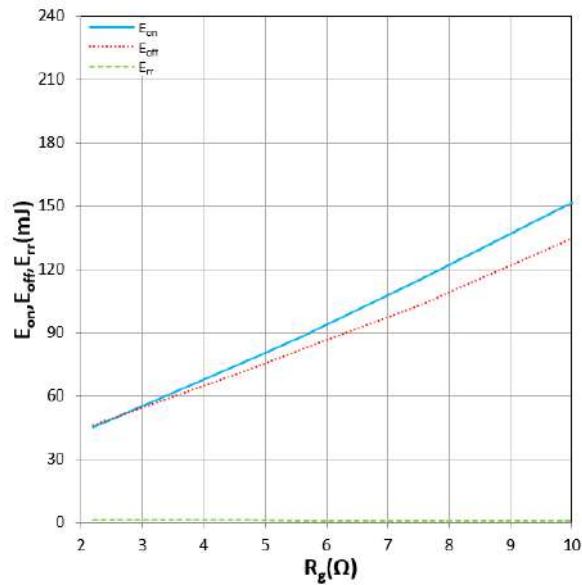


Figure 16. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{DD} = 900\text{V}$, $I_D = 800\text{A}$, $V_{GS} = +18\text{V}/-5\text{V}$
 Inductive Load

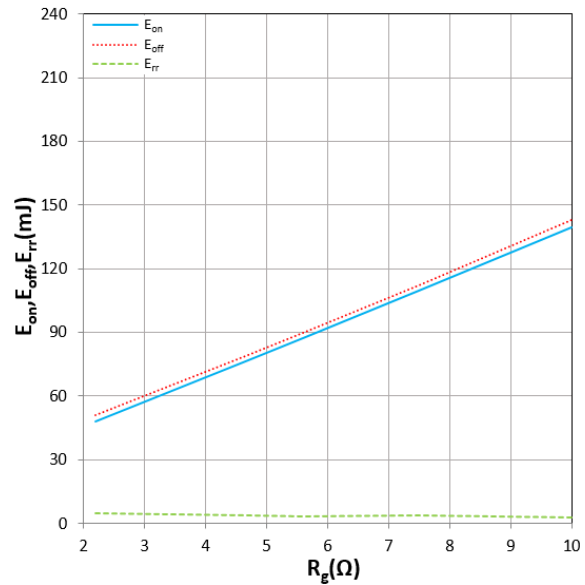


Figure 17. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{DD} = 900\text{V}$, $I_D = 800\text{A}$, $V_{GS} = +18\text{V}/-5\text{V}$
 Inductive Load

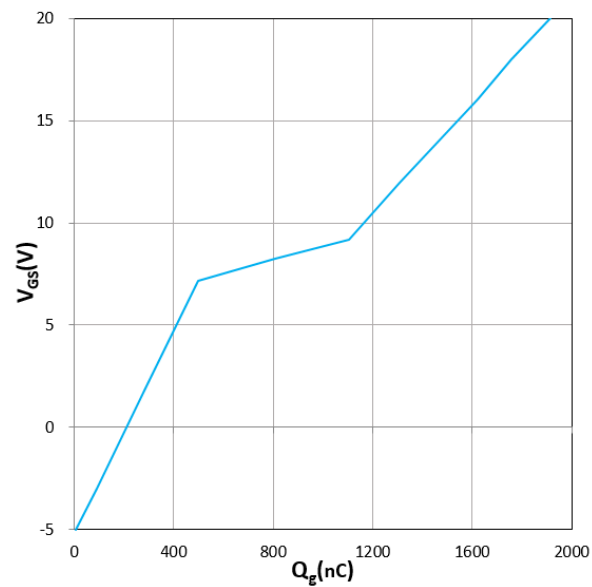


Figure 18. V_{GS} vs Q_g
 $T_j = 25^\circ\text{C}$, $I_D = 400\text{A}$, $V_{DS} = 800\text{V}$

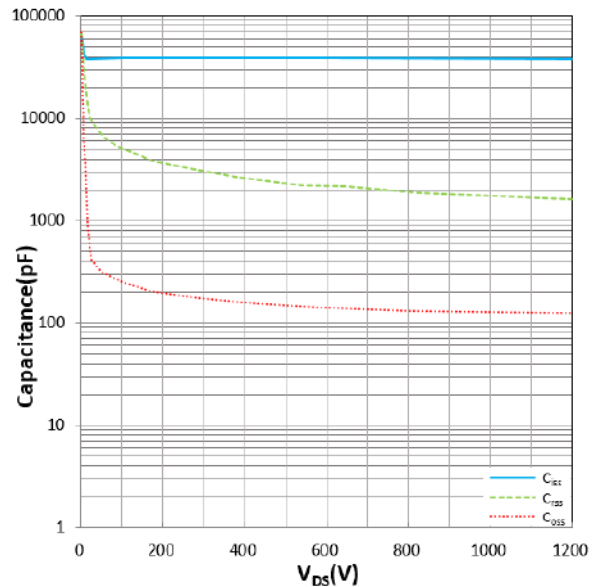


Figure 19. C_{iss} , C_{oss} , C_{rss} vs V_{DS}
 $T_j = 25^\circ\text{C}$, $f = 100\text{kHz}$

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This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee 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 suitability of the product for the intended application and the completeness of the product data with respect to such application.

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

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

Changes of this product data sheet are reserved.

Revision History

Document Version	Description of Changes
RevX.0.1	Released

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