

HCS600FF120E3C1

1200V/600A Half Bridge SiC MOSFET Module

Description

The HCS600FF120E3C1 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Motor drives and Renewable energy.



Features

- Blocking voltage 1200V
- $R_{DS(on)} = 3.2m@V_{GS} = 18V$
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses

Applications

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

Circuit diagram

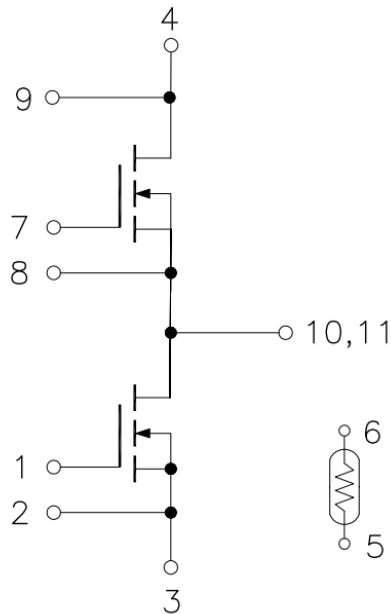


Figure 1. Out drawing & circuit diagram for HCS600FF120E3C1

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Pin Configuration and Marking Information

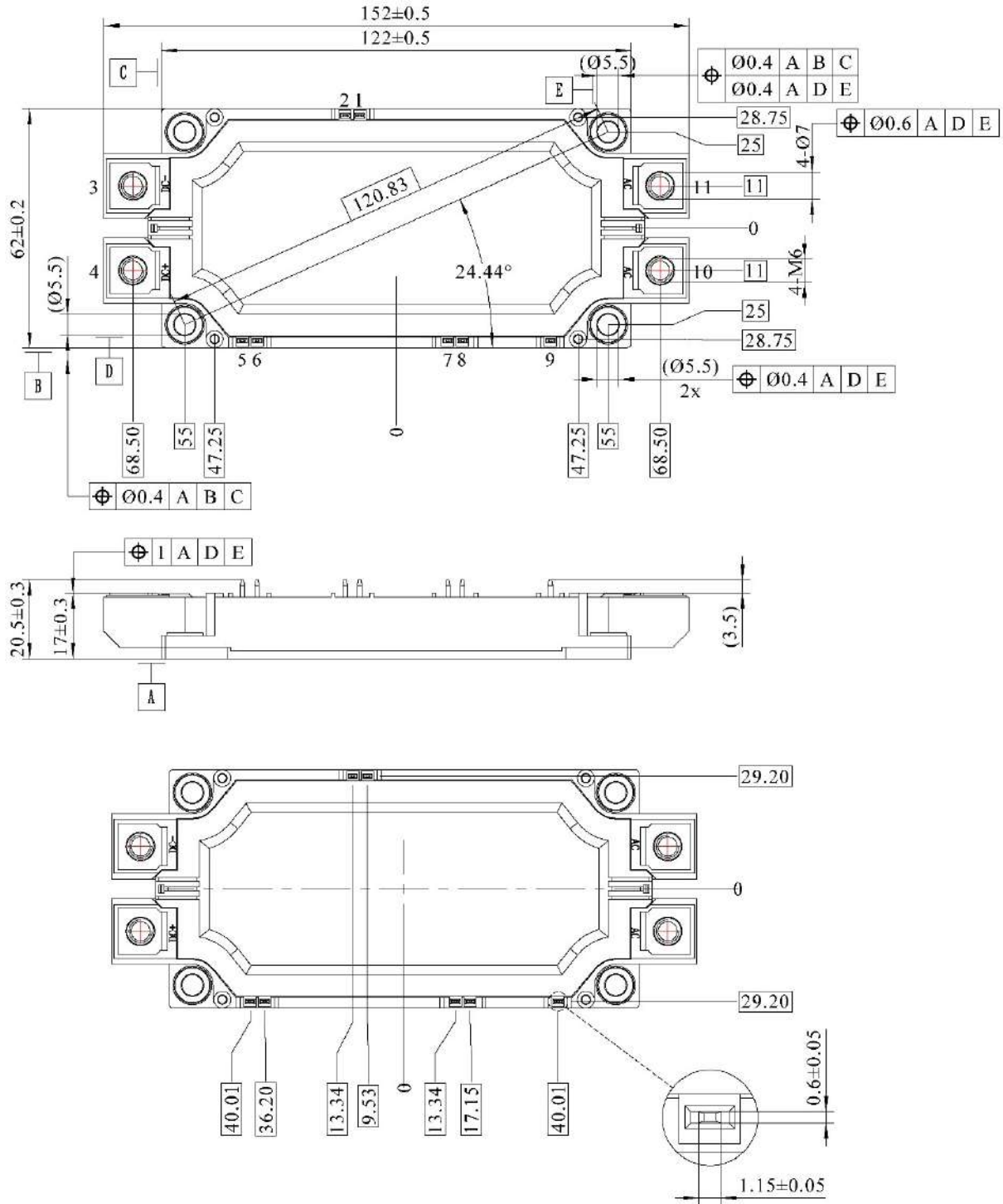


Figure 2. Pin configuration

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Module

Parameter	Condition	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	0.5	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	340	g

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 _{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥ 1Hz, Note1	-10 to 22	V
I _{DS}	DC Continuous Drain Current	T _C =25°C, V _{GS} =18V	710	A
I _{DS}	DC Continuous Drain Current	T _C =60°C, V _{GS} =18V	620	A
I _{SD}	Source (Body diode) Current	T _C =25°C, with ON signal	710	A
I _{SD}	Source (Body diode) Current	T _C =60°C, with ON signal	620	A
I _{DSM}	Pulse Forward Current	T _C =25°C, Pulse width =1ms, V _{GS} =20V, Note2	1200	A
P _{tot}	Total Power Dissipation	T _C =25°C	2250	W
T _{jmax}	Max Junction Temperature	-	175	°C
T _{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +18V/-5V, +18V/-4V, +15V/-5V

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 =600μA	1200	-	-	V	
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V	-	20	-	μA	
V _{GS(th)}	Gate-source threshold Voltage	I _D =210mA T _j =25°C	1.8	2.7	-	V	
		V _{DS} =V _{GS} T _j =175°C	-	2.1	-	V	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V, T _j =25°C	-	-	600	nA	
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =600A V _{GS} =+15V T _j =25°C	-	3.6	5.0	mΩ	
		T _j =175°C	-	5.2	-	mΩ	
		I _D =600A V _{GS} =+18V T _j =25°C	-	3.2	-	mΩ	
		T _j =175°C	-	4.4	-	mΩ	
V _{DS(on)} (Chip)	Static drain-source On-state Voltage	I _D =600A V _{GS} =+15V T _j =25°C	-	2.16	3.0	V	
		T _j =175°C	-	3.12	-	V	
		I _D =600A V _{GS} =+18V T _j =25°C	-	1.92	-	V	
		T _j =175°C	-	2.64	-	V	
C _{iss}	Input Capacitance	V _D =1000V, V _{GS} =0V f =200kHz, V _{AC} =25mV	-	34.8	-	nF	
C _{oss}	Output Capacitance		-	1.06	-	nF	
C _{rss}	Reverse transfer Capacitance		-	0.086	-	nF	
R _{Gint}	Internal gate resistor	-	-	1.1	-	Ω	
Q _G	Total gate charge	V _{DD} =800V, I _D =360A, V _{GS} =+18/-5V	-	1240	-	nC	
t _{d(on)}	Turn-on delay time	V _{DD} =600V I _D =600A V _{GS} =+18/-5V R _{gon} /R _{goff} =3.3/3.3Ω Inductive load switching operation	T _j =25°C	-	93	-	ns
			T _j =150°C	-	81	-	
t _r	Rise time		T _j =25°C	-	58	-	ns
			T _j =150°C	-	50	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	182	-	ns
			T _j =150°C	-	221	-	
t _f	Fall time		T _j =25°C	-	13	-	ns
			T _j =150°C	-	22	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	18.68	-	mJ
			T _j =150°C	-	17.85	-	
E _{off}	Turn-off power dissipation	T _j =25°C	-	21.30	-	mJ	
		T _j =150°C	-	23.12	-		
R _{th(j-c)}	FET Thermal Resistance	Junction to Case	-	0.066	-	K/W	
R _{th(c-f)}	Contact thermal Resistance	With thermal conductive grease, Note3	-	0.015	-	K/W	

Note3: Assumes Thermal Conductivity of grease is 0.9W/m·K and thickness is 50um.

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

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V_{SD}	Body Diode Forward Voltage	$V_{GS} = -5\text{V}$ $I_{SD} = 600\text{A}$	$T_j = 25^\circ\text{C}$	-	6.3	-	V
			$T_j = 175^\circ\text{C}$	-	5.6	-	
T_{rr}	Reverse recovery time	$V_{DD} = 600\text{V}$ $I_D = 600\text{A}$	$T_j = 25^\circ\text{C}$	-	33	-	ns
			$T_j = 150^\circ\text{C}$	-	47	-	
Q_{rr}	Reverse recovery charge	$V_{GS} = +18/-5\text{V}$ $R_{gon}/R_{goff} = 3.3/3.3\Omega$	$T_j = 25^\circ\text{C}$	-	1.99	-	uC
			$T_j = 150^\circ\text{C}$	-	5.87	-	
E_{rr}	Diode switching power dissipation	Inductive load switching operation	$T_j = 25^\circ\text{C}$	-	0.56	-	mJ
			$T_j = 150^\circ\text{C}$	-	1.99	-	

Test Conditions

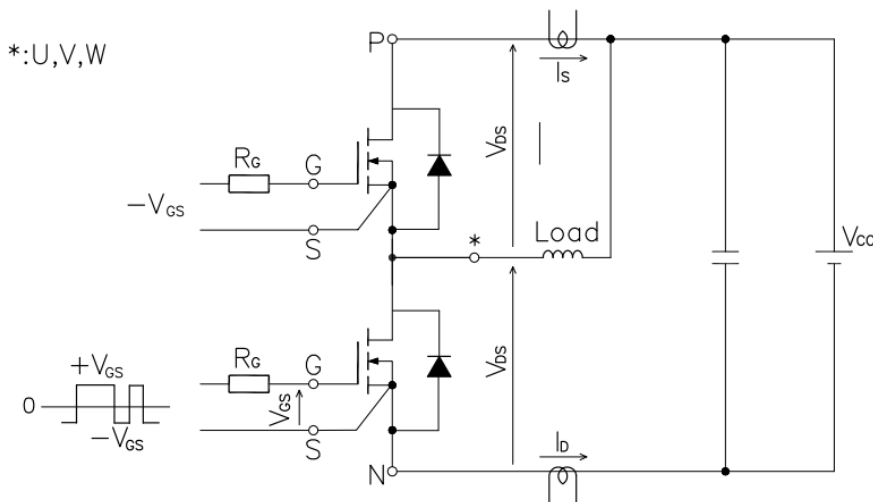


Figure 3. Switching time measure circuit

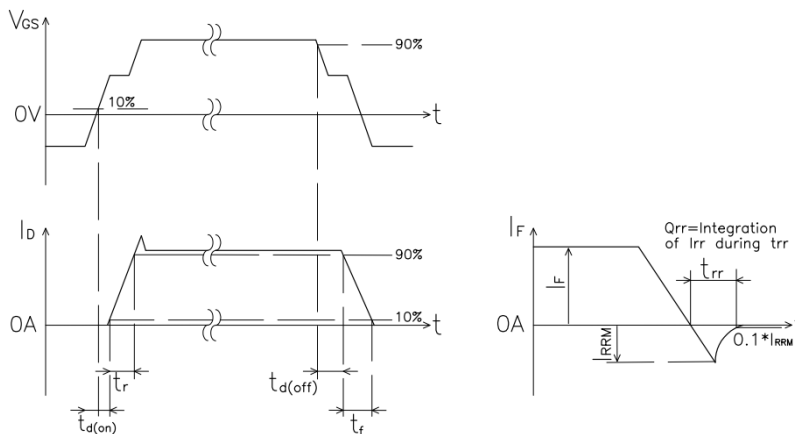


Figure 4. Switching time definition

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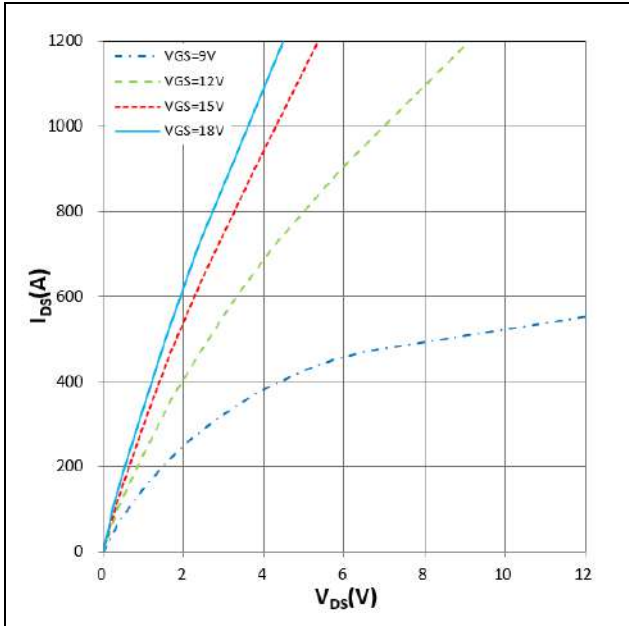


Figure 5. I_{DS} vs V_{DS}
 $T_j=25^\circ\text{C}$, V_{GS} parameter

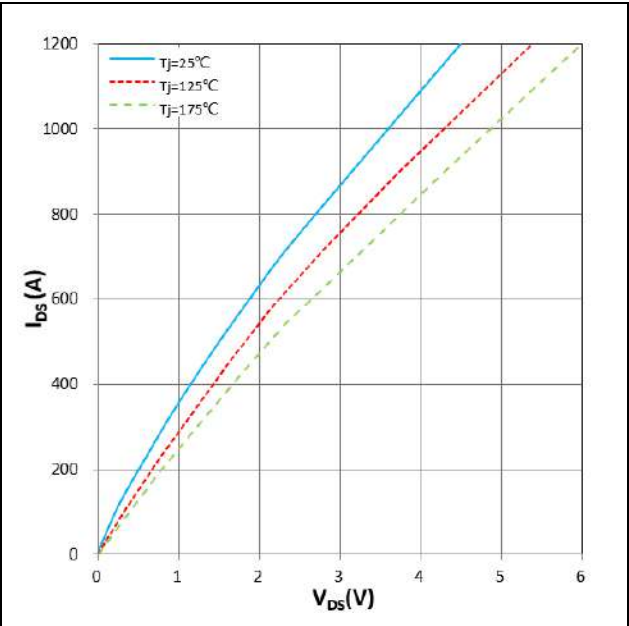


Figure 6. I_{DS} vs V_{DS}
 $V_{GS}=18V$, T_j parameter

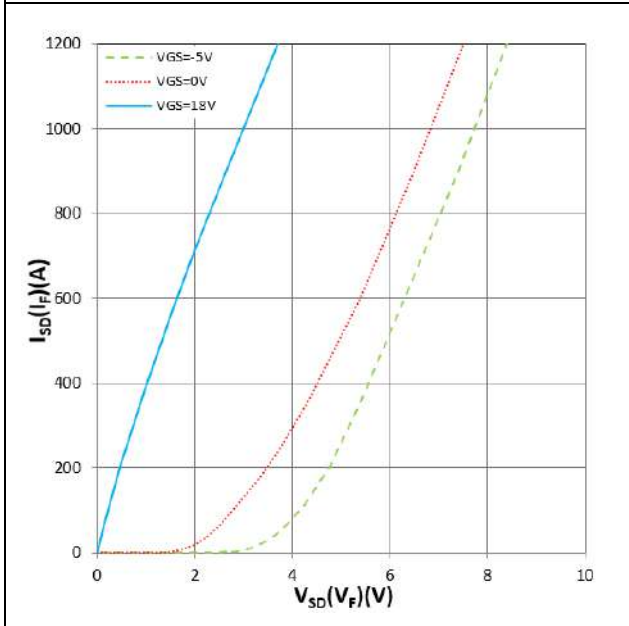


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j=25^\circ\text{C}$, V_{GS} parameter

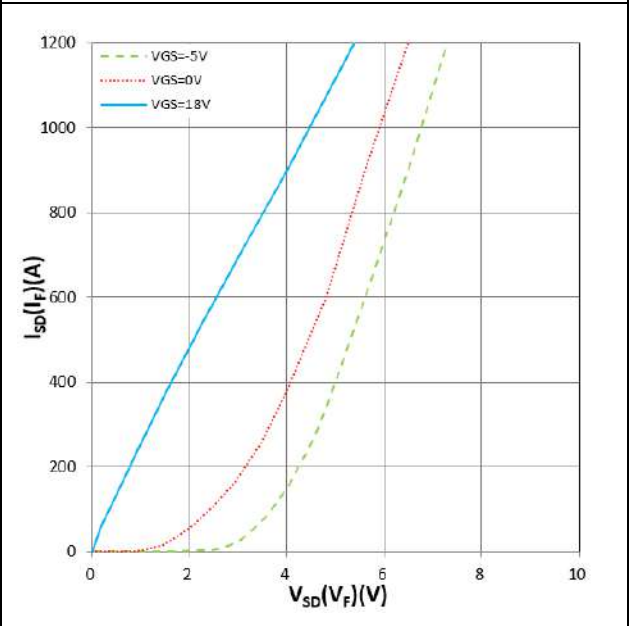


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j=175^\circ\text{C}$, V_{GS} parameter

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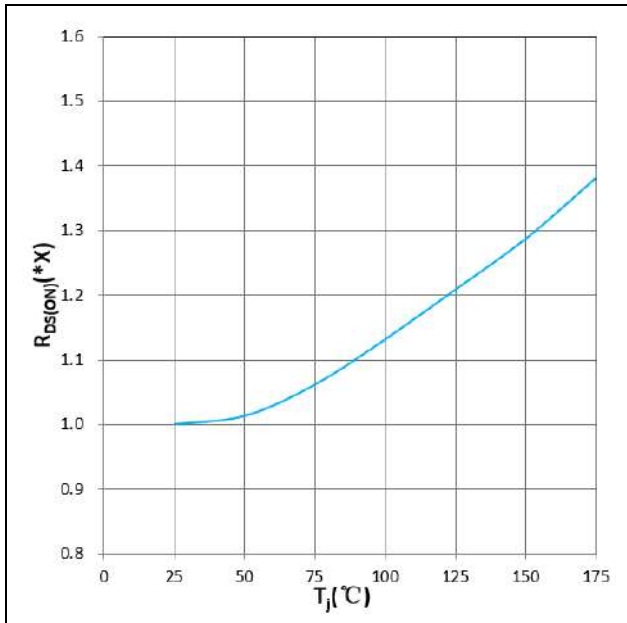


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS}=+18V$, $I_D=600A$, $1.0X=3.2m\mu$

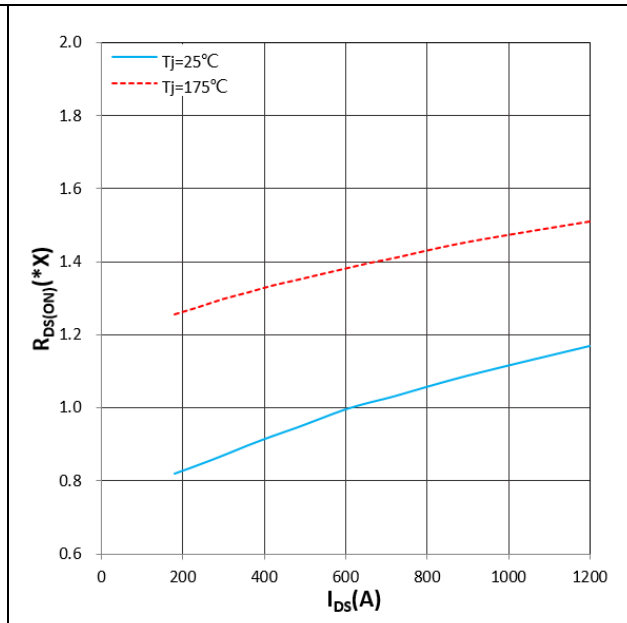


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $T_j=25/175^\circ C$, $V_{GS}=+18V$, $1.0X=3.2m\mu$

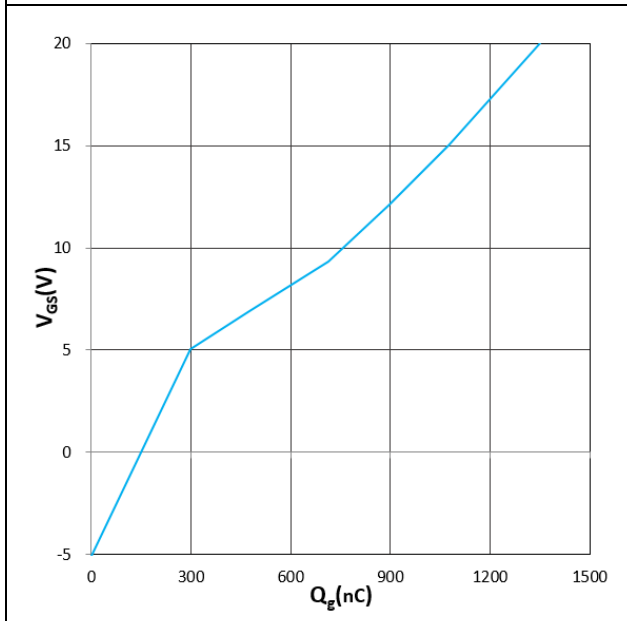


Figure 11. V_{GS} vs Q_g
 $T_j=25^\circ C$, $V_{DS}=800V$, $I_D=360A$

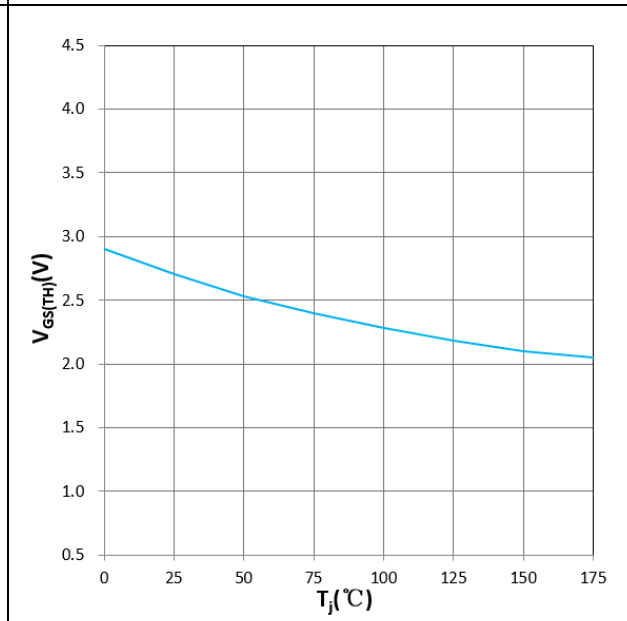
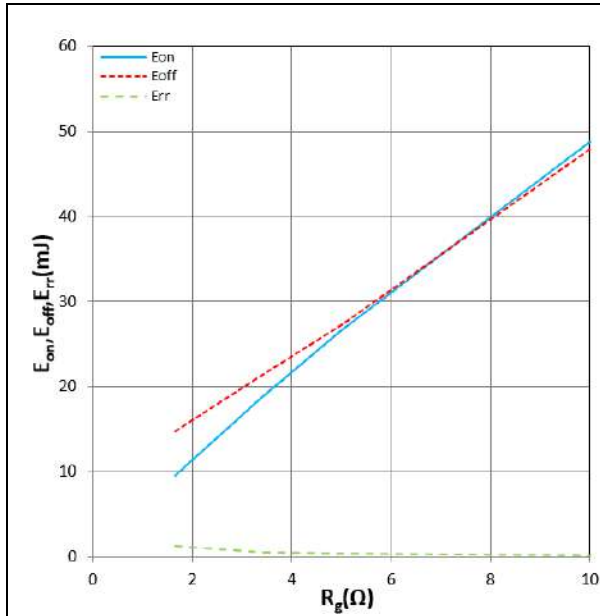


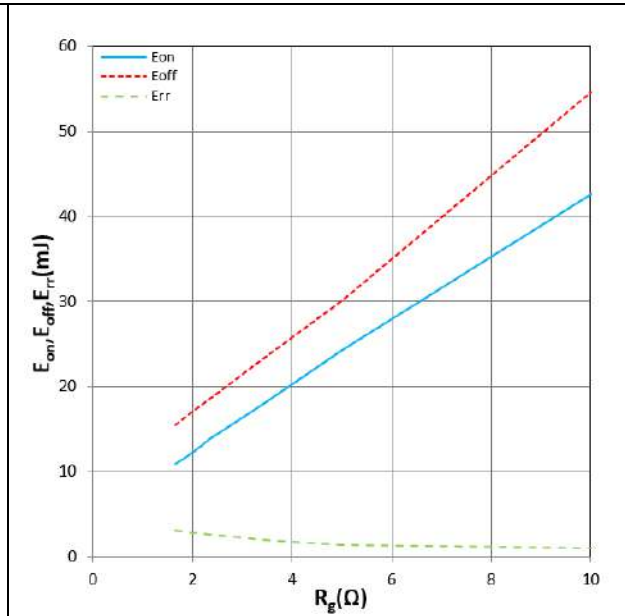
Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS}=V_{DS}$, $I_D=210mA$

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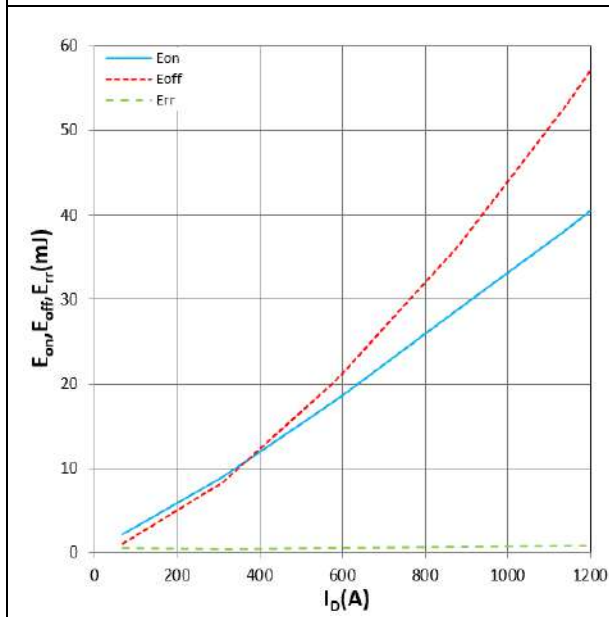
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 Figure 13. E_{on}, E_{off}, E_{rr} vs R_g

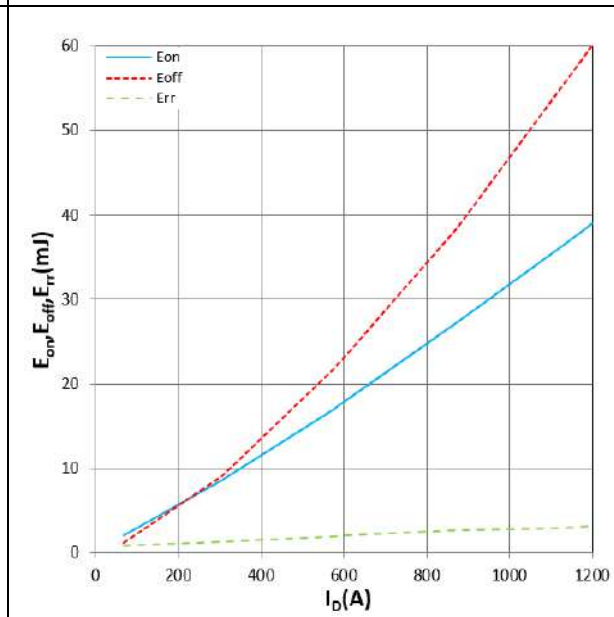
T_j=25°C, V_{DD}=600V, V_{GS}=+18/-5V, I_D=600A
Inductive Load


 Figure 14. E_{on}, E_{off}, E_{rr} vs R_g

T_j=150°C, V_{DD}=600V, V_{GS}=+18/-5V, I_D=600A
Inductive Load


 Figure 15. E_{on}, E_{off}, E_{rr} vs I_D

T_j=25°C, V_{DD}=600V, V_{GS}=+18/-5V
R_{gon}/R_{goff}=3.3/3.3Ω, Inductive Load


 Figure 16. E_{on}, E_{off}, E_{rr} vs I_D

T_j=150°C, V_{DD}=600V, V_{GS}=+18/-5V
R_{gon}/R_{goff}=3.3/3.3Ω, Inductive Load

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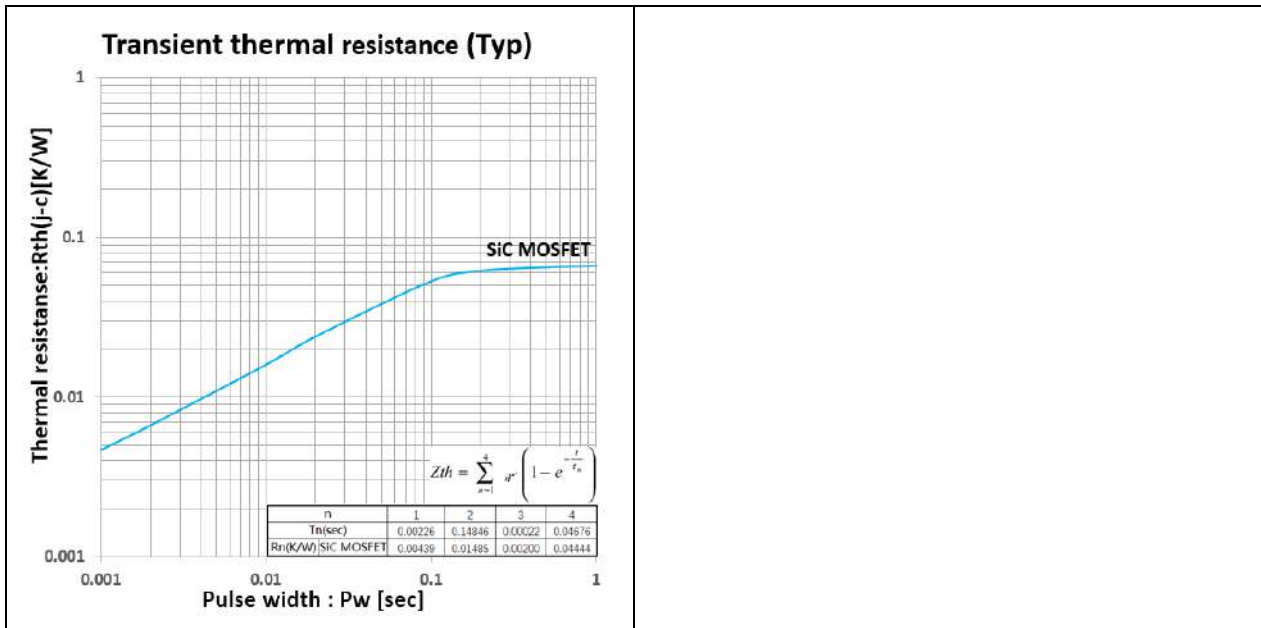


Figure 17. transient thermal impedance
SiC MOSFET

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.

Instruction note

Naming rules for power module product models (Industrial module)

Product Model			
	HC	G	100
Hecheng Code			
Module type	G : IGBT module D : FRD module S : SiC module H : Si/SiC hybrid		
Current level (A)	50~900		
Topology structure	FZ : A switch unit FF : Half bridge FS : Three phase F4 : H Bridge F3L : Three level DF : Boost Circuit FD : Braking Circuit FP : Rectification+Inverter+Control move AL : ANPC CL : Chopper		
Voltage level (x10) (V)	650~2200		
Packaging form+features (A...Z)	A1: 34 mm B1: Easy 1B B2: Easy 2B... D1: Flow0 E0: E0 E3: ED3 E6: EPM2 E9: ED3H	A2: 62 mm B1A B3: Easy 3B... D2: Flow1 E1: Econo 2... E4: E4 E7: EPM3 F0: F0	B1B... D3: Flow2 E2: E2 E5: ED3S E8: EconoPIM3 P2: EPM2
Feature :A:	Special Code Nil: Standard		

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