HCS02FT120H5A1S

1200V/600A 3 Phase SiC MOSFET Module

Description

The HCS02FT120H5A1S is a 3 Phase SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips for xEV or motor drives application.

Fetures

- Blocking Voltage 1200V
- $R_{DS(on)}$=2.5mΩ (V_{GS}=18V, T_j=25°C)
- 175°C Maximum Junction Temperature
- Si_3N_4 AMB Subtrate
- Direct Cooled Pin Fin Base Plate
- Thermistor Inside
- Press FIT Contact Technology

Application

- xEV Applications
- Motor Drives

Circuit Diagram

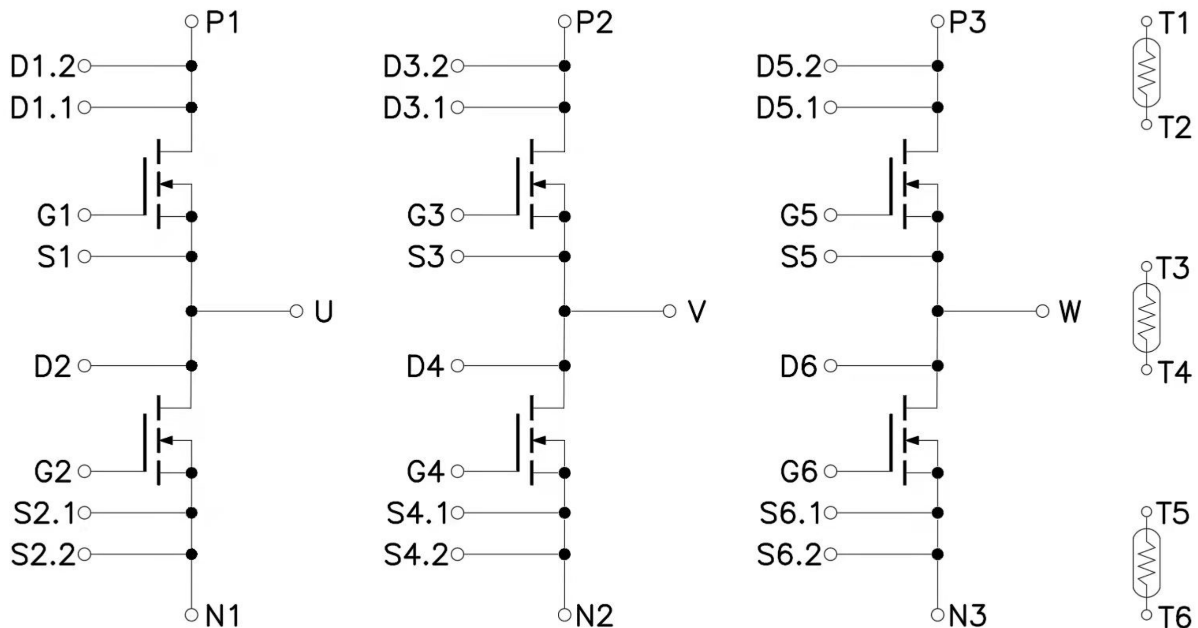

Figure 1. Out Drawing & Circuit Diagram HCS02FT120H5A1S

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Physical Dimensions

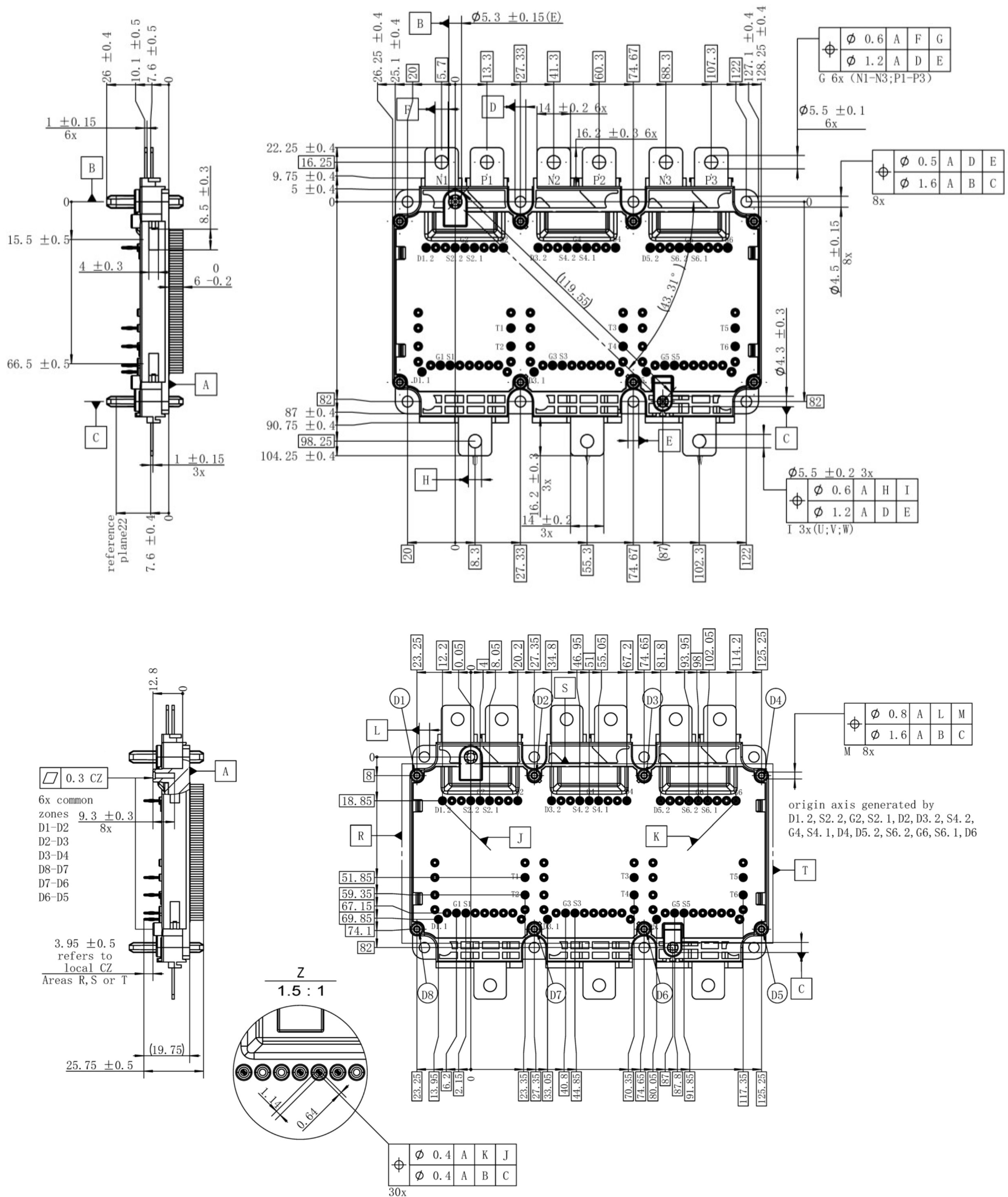

Figure 2. Physical Dimensions

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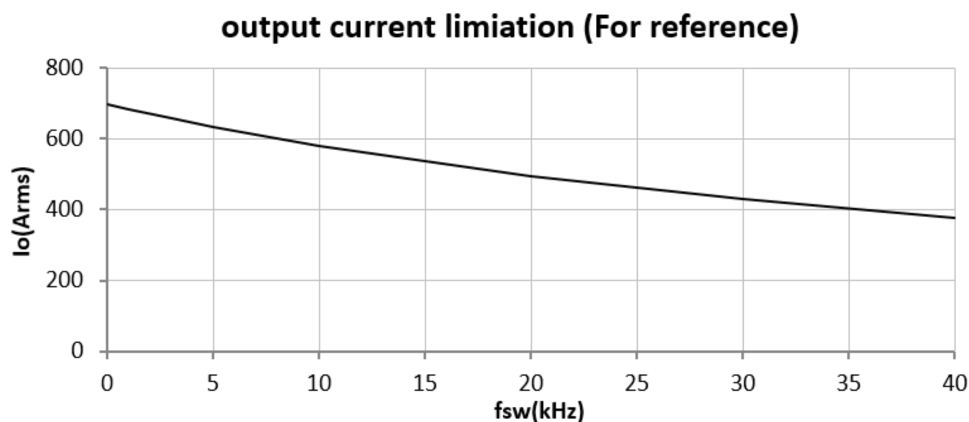
Maximum Ratings (T_j=25℃ Unless Otherwise Specified)

Symbol	Parameter	Conditions	Value	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency • •1Hz, Note1	-10V/+23V	V
I_{DS}	DC Continuous Drain Current	T_f=25°C, V_{GS}=18V	590	A
I_{DS}	DC Continuous Drain Current	T_f=65°C, V_{GS}=18V	505	A
I_{SD}	Source (Body Diode) Current	T_f=25°C,with ON signal	590	A
I_{SD}	Source (Body Diode) Current	T_f=65°C,with ON signal	505	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	1200	A
P_D	Maximum Power Dissipation	Tf=25°C	1667	W
T_j	Junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value: +18V/-5V, +18V/-4V, +15V/-5V, +15V/-4V
Note2: Pulse width limited by maximum junction temperature

Typical Current Output Ability

Condition: SPWM control, V_{cc}=800V,V_{GS}=+18V/-4V, $R_{g(ON)}$=$R_{g(OFF)}$=6.2Ω, T_f=65°C, T_{jmax}=175°C,PF=0.8, Modulation rate=1



Note1: This graph is calculated value for reference based on the limitation of T_{jmax}=175°C. The actual current out ability depends on inverter electrical, thermal and mechanic design. Please confirm it in actual application system.

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Module

Parameter	Conditions	Value	Unit
Isolation voltage	Main terminal to base plate, f =0Hz, t =1sec	4.2	kV
Material of module baseplate	-	Cu + Ni	-
Creepage distance	terminal to heatsink terminal to terminal	9	mm
Clearance	terminal to heatsink terminal to terminal	4.5	mm
Stray inductance module	T_f =65°C	8	nH
Module lead resistance, terminals – chip	T_f=65°C	0.5	mΩ
Mounting torque for module mounting	Screw M4 baseplate to heatsink	1.8 to 2.2	Nm
Weight	-	780	g

NTC Characteristics

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
R25	Resistance	Tc =25°C	-	5	-	kΩ
ΔR/R	Deviation of R_{100}	Tc =100°C, R_{100} =493Ω	-5	-	5	%
P_{25}	Power dissipation	Tc =25°C	-	-	20	mW
$B_{25/50}$	B-value	R2 =R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))]	-	3375	-	K
$B_{25/80}$	B-value	R2 =R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))]	-	3411	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3433	-	K

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MOSFET Electrical Charateristics (T_j=25°C Unless Otherwise Specified, Chip)

Symbol	Parameter	Conditions		Value			Unit
				Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=6mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS}=1200V, V_{GS}=0V		-	6	300	μA
$V_{GS(Th)}$	Gate-source threshold voltage	I_D=162mA V_{DS}=V_{GS}	T_j=25°C	2.0	2.8	3.7	V
			T_j=150°C	-	2.1	-	V
			T_j=175°C	-	2	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS}=18V, V_{DS}=0V		-	6	-1200	nA
		V_{GS}=-4V, V_{DS}=0V		-1200	-6	0	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=600A V_{GS}=18V	T_j=25°C	-	2.5	-	mΩ
			T_j=150°C	-	4.1	-	mΩ
			T_j=175°C	-	4.7	-	mΩ
VDS(on) (Chip)	Static drain-source On-state resistance	I_D=600A V_{GS}=18V	T_j=25°C	-	1.50	-	V
			T_j=150°C	-	2.46	-	V
			T_j=175°C	-	2.82	-	V
C_{iss}	Input capacitance	V_{DS}=1000V V_{GS}=0V f=100kHz		-	25.8	-	nF
C_{oss}	Output capacitance			-	1.28	-	nF
C_{rss}	Reverse transfer capacitance			-	0.11	-	nF
Q_g	Total gate charge	V_{DS}=800VI_D=480AV_{GS}=+18/-4V		-	1332	-	nC
Q_{gs}	Gate to source charge			-	330	-	nC
Q_{gd}	Gate to drain charg			-	528	-	nC
R_{gint}	Internal gate resistance	f=1MHz		-	0.9	-	Ω
$t_{d(on)}$	Turn-on delay tim	V_{DD}=600V I_D=600A V_{GS}=+18/-4V $R_{G(ON)}$=6.2Ω $R_{G(OFF)}$=6.2Ω Inductive load Switching operation	T_j=25°C	-	131	-	ns
			T_j=150°C	-	110	-	
t_r	Rise time		T_j=25°C	-	85	-	ns
			T_j=150°C	-	80	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	40	-	ns
			T_j=150°C	-	42	-	
t_f	Fall time		T_j=25°C	-	58	-	ns
			T_j=150°C	-	64	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	22.71	-	mJ
			T_j=150°C	-	31.22	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	37.06	-	mJ
			T_j=150°C	-	38.31	-	
$R_{th(j-f)}$	FET Thermal Resistance	Junction to cooling fluid ΔV/Δt =10dm³/min, Tf=65°C		-	0.09	-	K/W

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Body Diode Electrical Characteristics (T_j=25°C Unless Otherwise Specified, Chip)

Symbol	Parameter	Conditions		Value			Unit
				Min.	Typ.	Max.	
V_{SD}	Body Diode Forward Voltage	V_{GS}=-4V I_{SD}=600A	T_j=25°C	-	4.8	-	V
			T_j=175°C	-	4.2	-	
T_{rr}	Reverse Recovery Time	V_{DD}=600V I_D=600A V_{GS}=+18/-4V $R_{G(ON)}$=$R_{G(OFF)}$=6.2Ω Inductive loads Switching operation	T_j=25°C	-	32	-	ns
			T_j=150°C	-	47	-	
Q_{rr}	Reverse Recovery Charge		T_j=25°C	-	2.51	-	μC
			T_j=150°C	-	7.26	-	
E_{rr}	Diode Switching Power Dissipation		T_j=25°C	-	0.57	-	mJ
			T_j=150°C	-	1.51	-	

Test Conditions

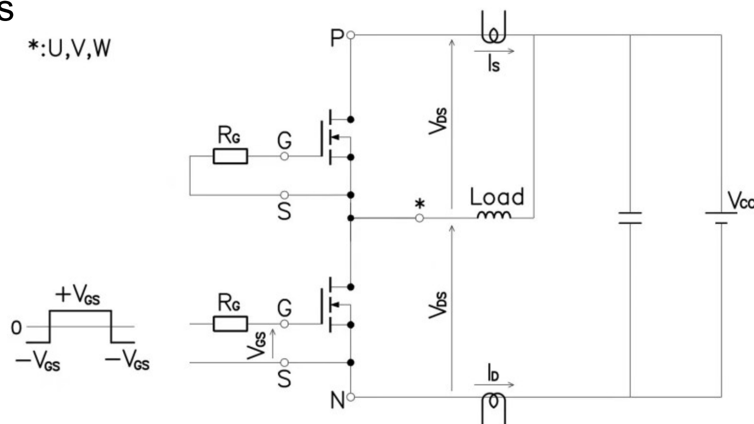

Figure 3. Switching Time Measure Circuit

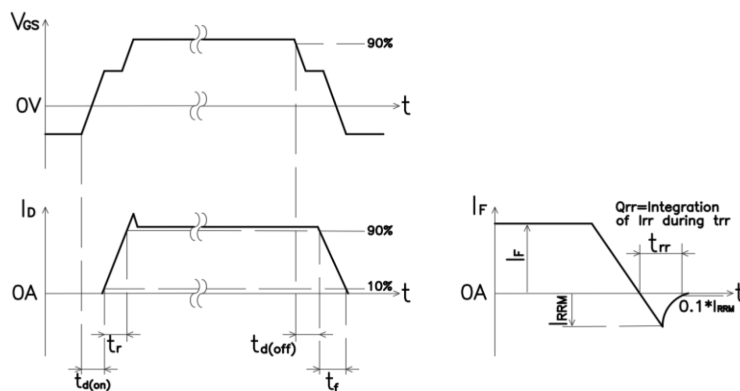

Figure 4. Switching Time Definition

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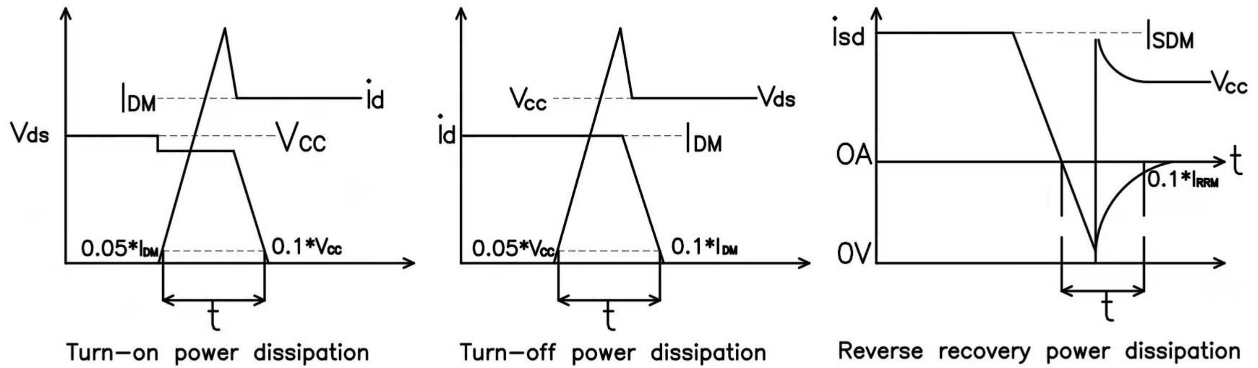

Figure 4. Switching Power Dissipation Definition

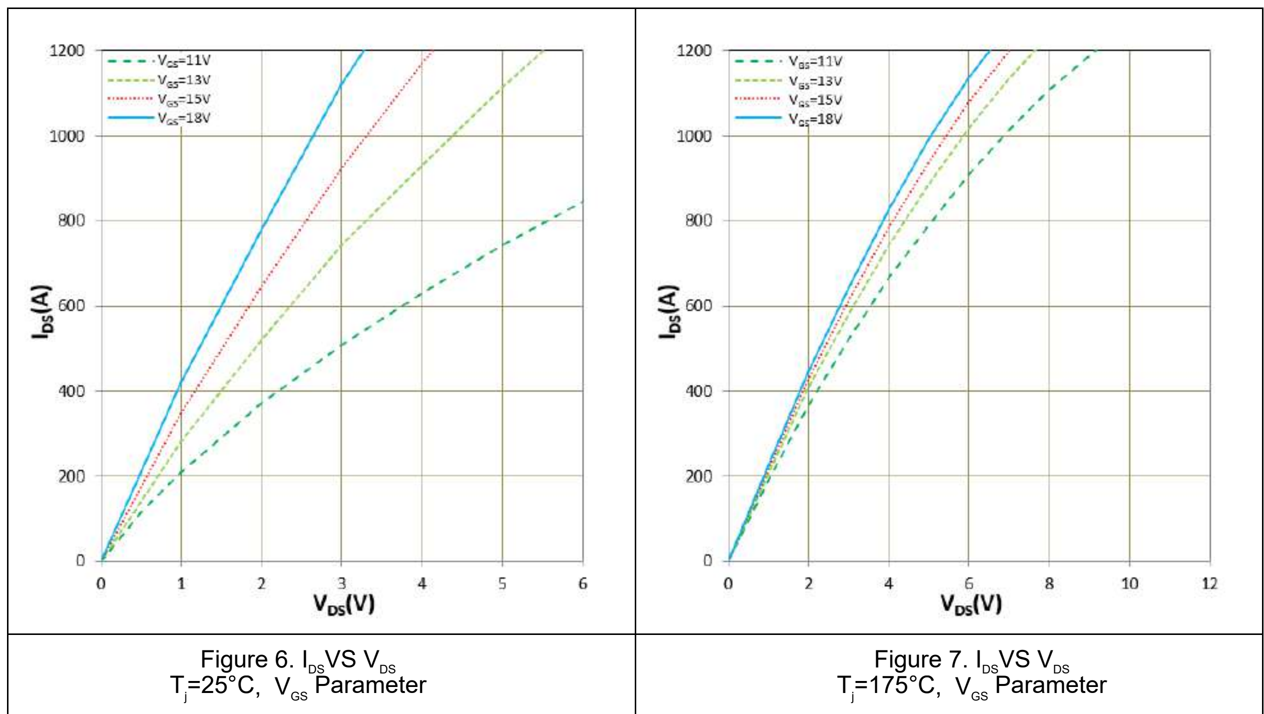

Figure 6. I_{DS} VS V_{DS} T_j=25°C, V_{GS} Parameter	Figure 7. I_{DS} VS V_{DS} T_j=175°C, V_{GS} Parameter

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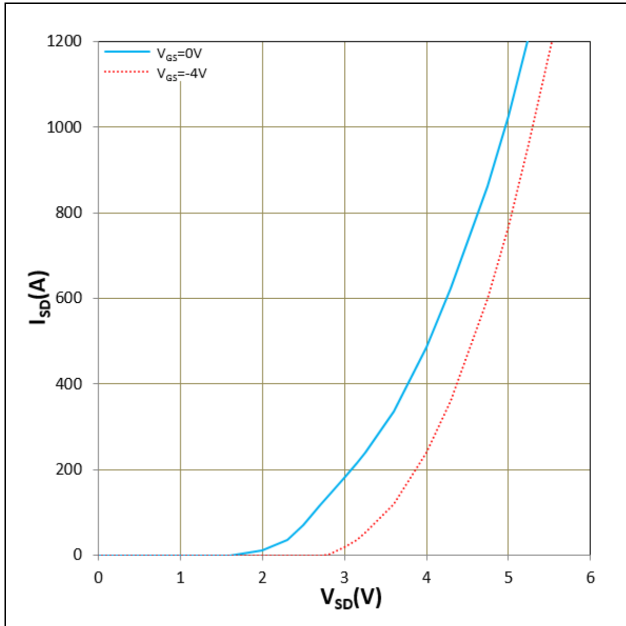

Figure 8. I_{SD} VS V_{SD}
T_j=25°C, V_{GS} Parameter

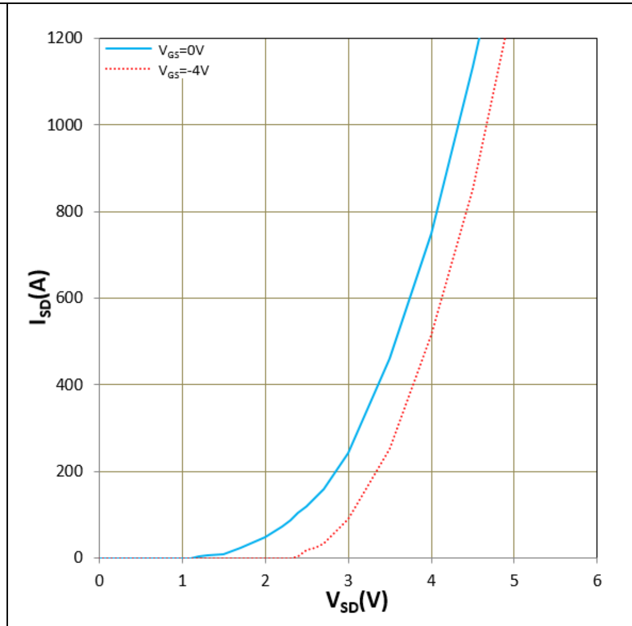

Figure 9. I_{SD} VS V_{SD}
T_j=175°C, V_{GS} Parameter

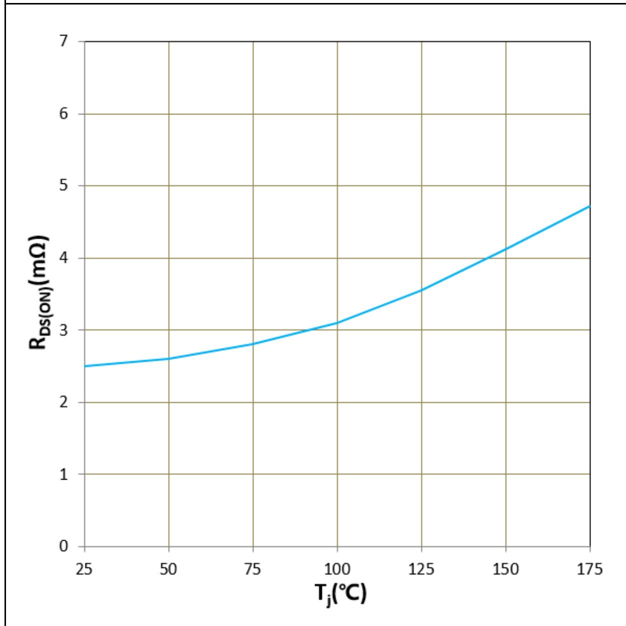

Figure 10. $R_{DS(ON)}$ VS T_j
V_{GS}=+18V, I_D=600A

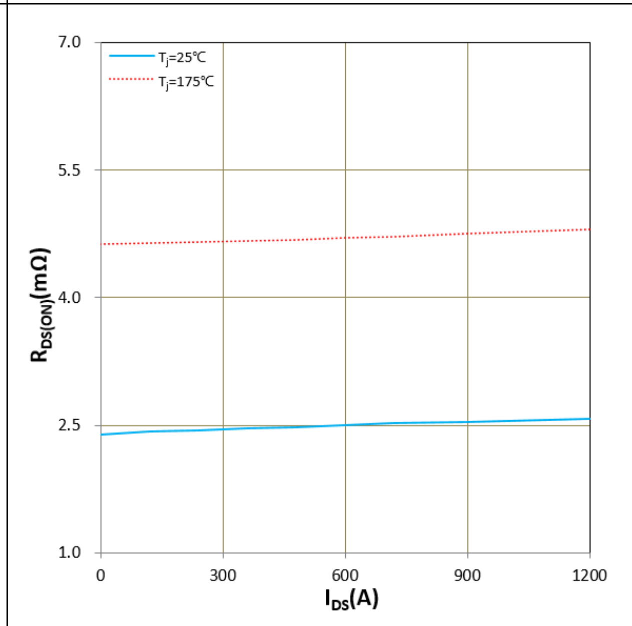

Figure 11. $R_{DS(ON)}$ VS I_{DS}
V_{GS}=+18V

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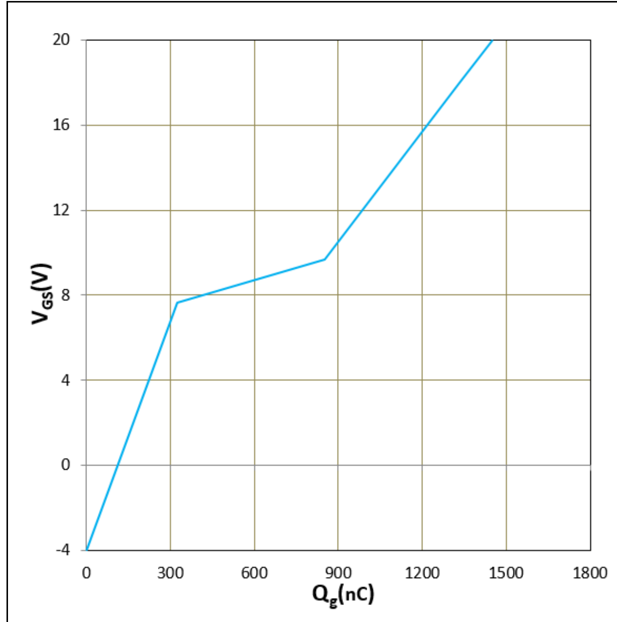

Figure 12. V_{GS} VS Q_g
T_j=25°C, I_D=480A, V_{DS}=800V

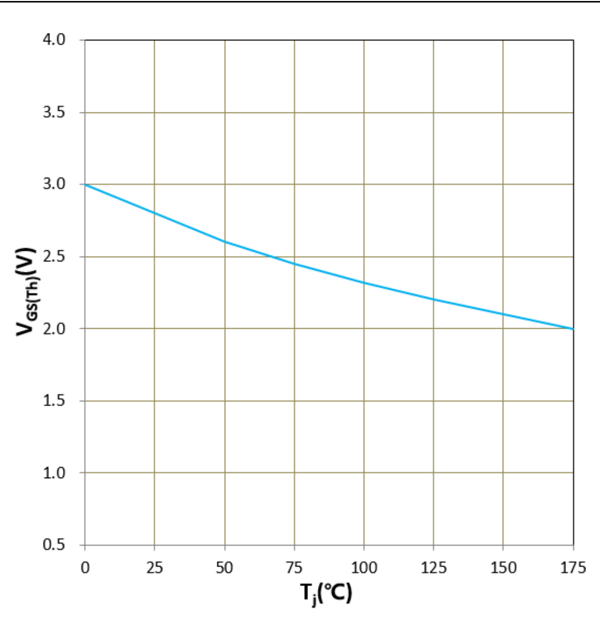

Figure 13. $V_{GS(Th)}$ VS T_j
V_{GS}=V_{DS}, I_D=162mA

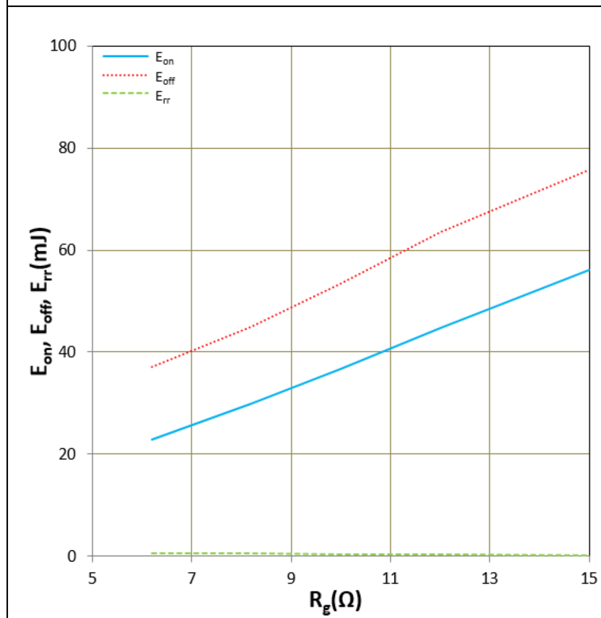

Figure 14. E_{on}, E_{off}, E_{rr} VS R_g
T_j=25°C, V_{DD}=600V, I_D=600A, V_{GS}=+18V/-4V
Inductive Load

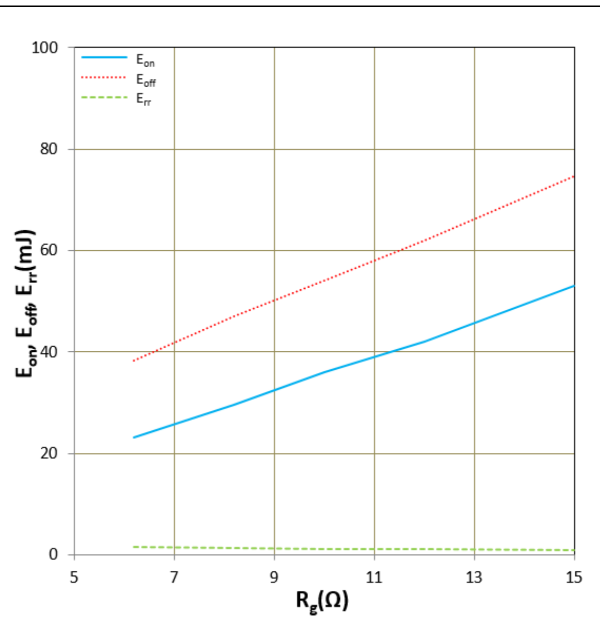

Figure 15. E_{on}, E_{off}, E_{rr} VS R_g
T_j=150°C, V_{DD}=600V, I_D=600A, V_{GS}=+18V/-4V
Inductive Load

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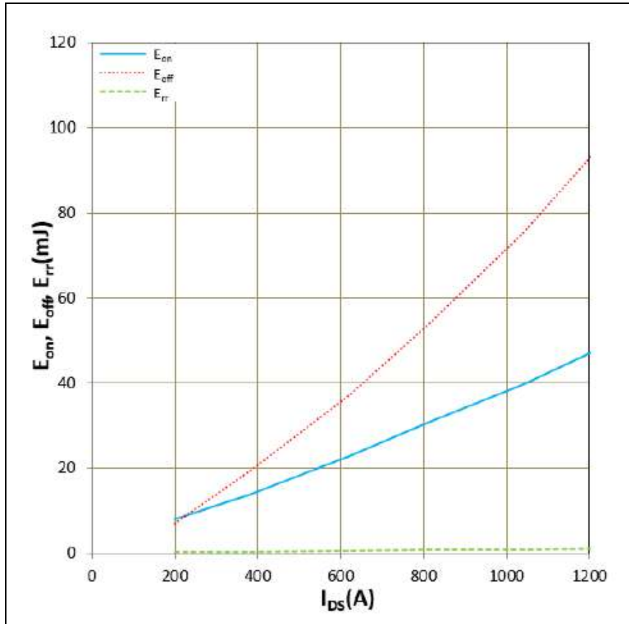


Figure 16. E_{on}, E_{off}, E_{rr} VS I_{DS}
T_j=25°C, V_{DD}=600V, R_G=6.2Ω, V_{GS}=+18V/-4V
Inductive Load

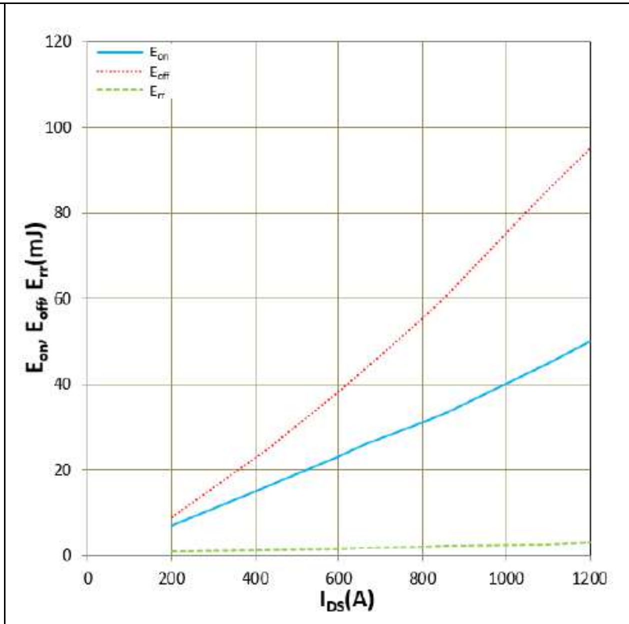


Figure 17. E_{on}, E_{off}, E_{rr} VS I_{DS}
T_j=150°C, V_{DD}=600V, R_G=6.2Ω, V_{GS}=+18V/-4V
Inductive Load

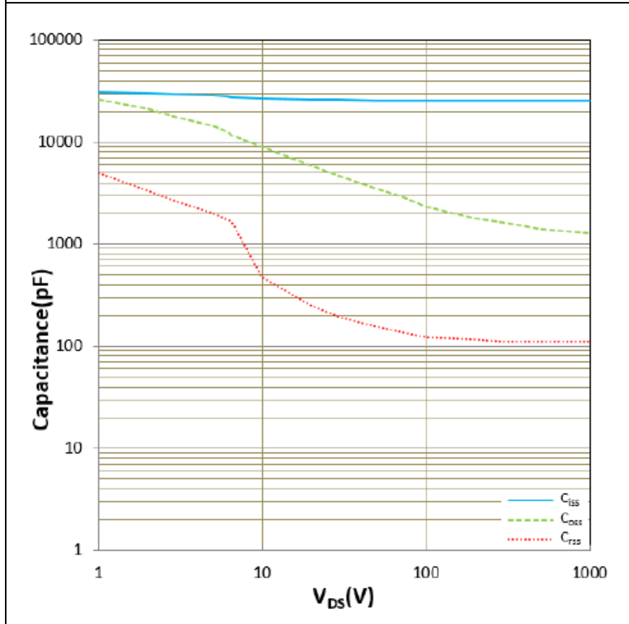
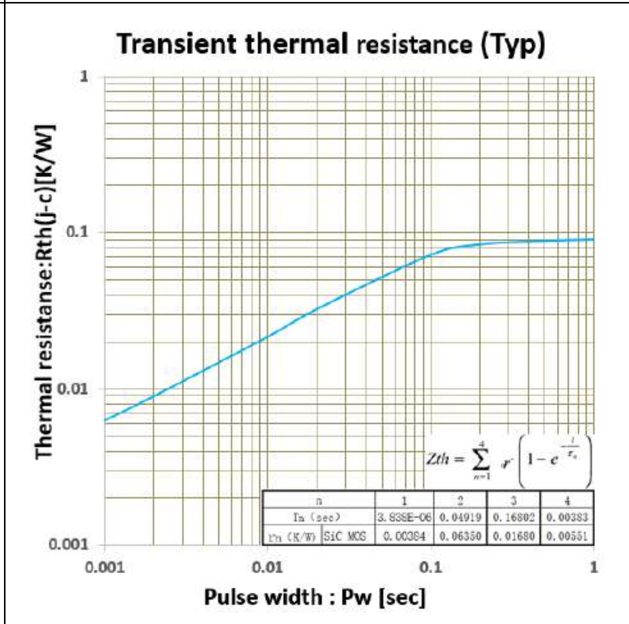


Figure 18. C_{iss}, C_{oss}, C_{rss} VS V_{DS}
T_j=25°C, f=100kHz



n		1	2	3	4
τn (sec)		3.838E-06	0.04919	0.16802	0.00383
rn (K/W)	SiC MOS	0.00384	0.06350	0.01680	0.00551

Figure 19. Transient Themal Impedance

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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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