

# HCS540FF120A2A1

## 1200V/540A Half Bridge SiC MOSFET Module

### Description

The HCS540FF120A2A1 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips and SiC Diode designed for applications such as the Motor drives and Renewable energy.

### Features

- Blocking Voltage: 1700V
- $R_{ds(on)}=6.4m\Omega$
- Low Thermal Resistance with  $Si_3N_4$  AMB
- 175°C Maximum Junction Temperature
- 62mm Half Bridge Module



### Applications

- Motor Drives
- Solar and Wind Inverter Systems
- Vehicle Fast Chargers
- UPS

### Circuit Diagram

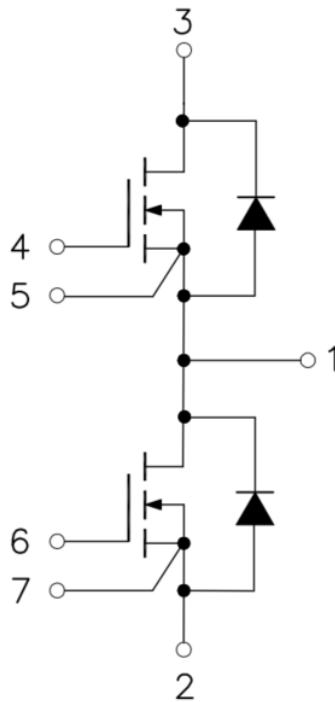


Figure 1. Out Drawing & Circuit Diagram HCS540FF120A2A1

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## Pin Configuration and Marking Information

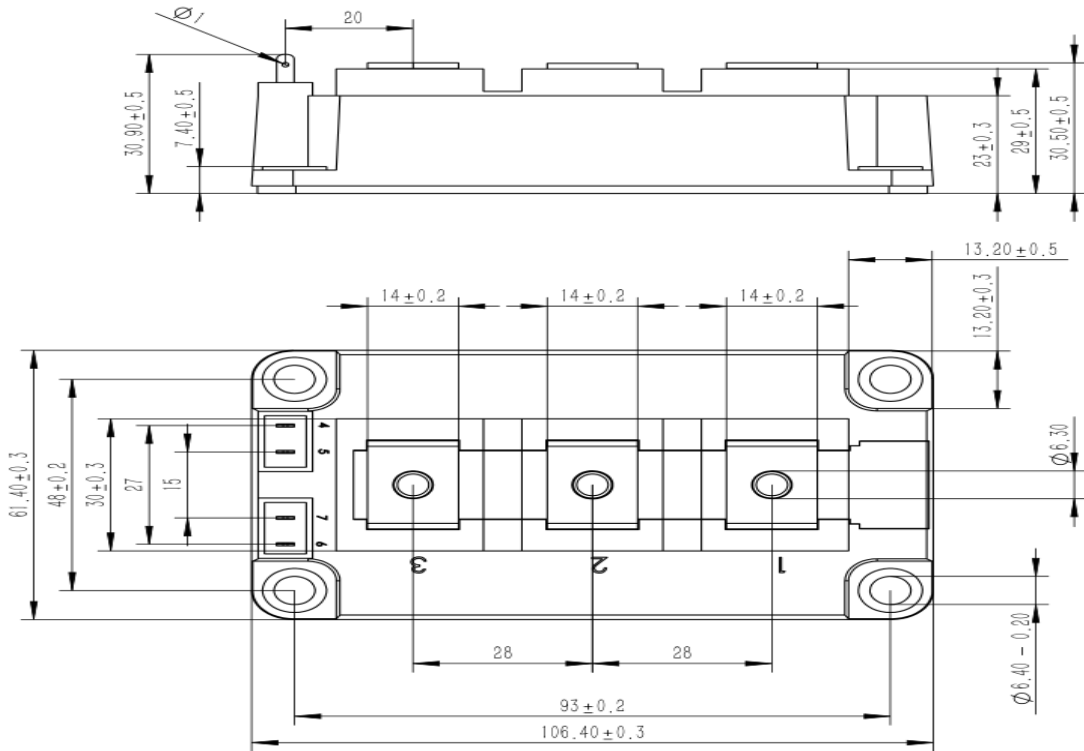


Figure 2. Pin Configuration

## Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =0Hz, t =1min	4.0	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
Module lead resistance, terminals – chip	T <sub>c</sub> =25°C	0.6	mΩ
Mounting torque for module mounting	M6	4 to 6	Nm
Weight	-	320	g

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### Maximum Ratings ( $T_j=25^\circ\text{C}$ Unless Otherwise Specified)

Symbol	Parameter	Conditions	Value	Unit
$V_{\text{DSS}}$	Drain-Source Voltage	G-S Short	1200	V
$V_{\text{GSS}}$	Gate-Source Voltage	D-S Short, AC frequency 1Hz, Note1	-8 to 19	V
$I_{\text{DS}}$	DC Continuous Drain Current	$T_c=25^\circ\text{C}$ , $V_{\text{GS}}=15\text{V}$	610	A
$I_{\text{DS}}$	DC Continuous Drain Current	$T_c=80^\circ\text{C}$ , $V_{\text{GS}}=15\text{V}$	480	A
$I_{\text{SD}}$	Source-Drain Current (Diode)	$T_c=25^\circ\text{C}$ , with ON signal	630	A
$I_{\text{SD}}$	Source-Drain Current (Diode)	$T_c=80^\circ\text{C}$ , with ON signal	500	A
$I_{\text{DSM}}$	Pulse Drain Current	$T_c=65^\circ\text{C}$ , Pulse Width=1ms, $V_{\text{GS}}=18\text{V}$ , Note 2	1200	A
$P_{\text{tot}}$	Total Power Dissipation	$T_c=25^\circ\text{C}$	2205	W
$T_{\text{jmax}}$	Max Junction temperature	-	175	$^\circ\text{C}$
$T_{\text{stg}}$	Storage temperature	-	-40 to 125	$^\circ\text{C}$

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

Note2: Pulse width limited by maximum junction temperature

### Diode Electrical Characteristics $T_j=25^\circ\text{C}$ Unless Otherwise Specified, Chip)

Symbol	Item	Conditions	Value			Unit	
			Min.	Typ.	Max.		
$V_F$	Diode Forward Voltage	$I_F=540\text{A}$ , $V_{\text{GS}}=0\text{V}$	$T_j=25^\circ\text{C}$	-	1.85	-	V
			$T_j=175^\circ\text{C}$	-	3.10	-	
$T_{\text{rr}}$	Diode Reverse Recovery Time	(Switch Side)	$T_j=25^\circ\text{C}$	-	27	-	ns
			$T_j=150^\circ\text{C}$	-	29	-	
$I_{\text{RM}}$	Peak Reverse Recovery Current	$V_{\text{DD}}=600\text{V}$ , $I_D=540\text{A}$ $V_{\text{GS}}=+15\text{V}/-4\text{V}$ $R_{\text{G(ON)}}=R_{\text{G(OFF)}}=2.2\Omega$	$T_j=25^\circ\text{C}$	-	285	-	A
			$T_j=150^\circ\text{C}$	-	317	-	
$Q_{\text{rr}}$	Recovered Charge	(FRD Side) $V_{\text{RR}}=600\text{V}$ , $I_F=540\text{A}$ $V_{\text{GE}}=+15\text{V}/-4\text{V}$ Inductive load Switching operation	$T_j=25^\circ\text{C}$	-	3.4	-	$\mu\text{C}$
			$T_j=150^\circ\text{C}$	-	4.6	-	
$E_{\text{rr}}$	Reverse Recovered Energy	(FRD Side) $V_{\text{RR}}=600\text{V}$ , $I_F=540\text{A}$ $V_{\text{GE}}=+15\text{V}/-4\text{V}$ Inductive load Switching operation	$T_j=25^\circ\text{C}$	-	1.3	-	mJ
			$T_j=150^\circ\text{C}$	-	2.4	-	
$R_{\text{th(j-c)}}$	Thermal Resulance, Junction to Case(Diode)		-	0.065	-	$^\circ\text{C}/\text{W}$	

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## 1200V/540A Half Bridge SiC MOSFET Module

MOSFET Electrical Characteristics ( $T_j=25^\circ\text{C}$  Unless Otherwise Specified, Chip)

Symbol	Item	Conditions	Value			Unit	
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=400\mu A$	1200	-	-	V	
$I_{DSS}$	Zero gate voltage drain current	$V_{DS}=1200V, V_{GS}=0V$	-	4	200	$\mu A$	
$V_{GS(Th)}$	Gate-source threshold voltage	$I_D=108mA, V_{DS}=V_{GS}$	$T_j=25^\circ\text{C}$	2.0	2.8	-	V
			$T_j=175^\circ\text{C}$	-	2.1	-	V
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=15V, V_{DS}=0V$	$T_j=25^\circ\text{C}$	-	-	800	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	$I_D=540A, V_{GS}=+15V$	$T_j=25^\circ\text{C}$	-	3.5	-	m $\Omega$
			$T_j=175^\circ\text{C}$	-	5.8	-	m $\Omega$
$V_{DS(on)}$ (Chip)	Static drain-source On-state resistance	$I_D=540A, V_{GS}=+15V$	$T_j=25^\circ\text{C}$	-	1.90	-	V
			$T_j=175^\circ\text{C}$	-	3.15	-	V
$C_{iss}$	Input capacitance	$V_D=1000V, V_{GS}=0V, f=100kHz, V_{AC}=25mV$	-	25540	-	pF	
$C_{oss}$	Output capacitance		-	1020	-	pF	
$C_{rss}$	Reverse transfer capacitance		-	68	-	pF	
$R_{Gint}$	Internal gate resistor	$f=100kHz, V_{AC}=25mV$	-	1.5	-	$\Omega$	
$Q_g$	Total gate charge	$V_{DD}=800V, I_D=320A, V_{GS}=+15/-4V$	-	1020	-	nC	
$t_{d(on)}$	Turn-on delay time	$V_{DD}=600V$ $I_D=540A$ $V_{GS}=+15/-4V$ $R_{G(ON)}=2.2\Omega$ $R_{G(OFF)}=2.2\Omega$ Inductive load Switching operation	$T_j=25^\circ\text{C}$	-	67	-	ns
			$T_j=150^\circ\text{C}$	-	61	-	
$t_r$	Rise time		$T_j=25^\circ\text{C}$	-	37	-	ns
			$T_j=150^\circ\text{C}$	-	32	-	
$t_{d(off)}$	Turn-off delay time		$T_j=25^\circ\text{C}$	-	112	-	ns
			$T_j=150^\circ\text{C}$	-	135	-	
$t_f$	Fall time		$T_j=25^\circ\text{C}$	-	29	-	ns
			$T_j=150^\circ\text{C}$	-	46	-	
$E_{on}$	Turn-on power dissipation		$T_j=25^\circ\text{C}$	-	8.9	-	mJ
			$T_j=150^\circ\text{C}$	-	7.2	-	
$E_{off}$	Turn-off power dissipation	$T_j=25^\circ\text{C}$	-	6.5	-	mJ	
		$T_j=150^\circ\text{C}$	-	6.9	-		
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case	-	0.068	-	K/W	

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### Test Conditions

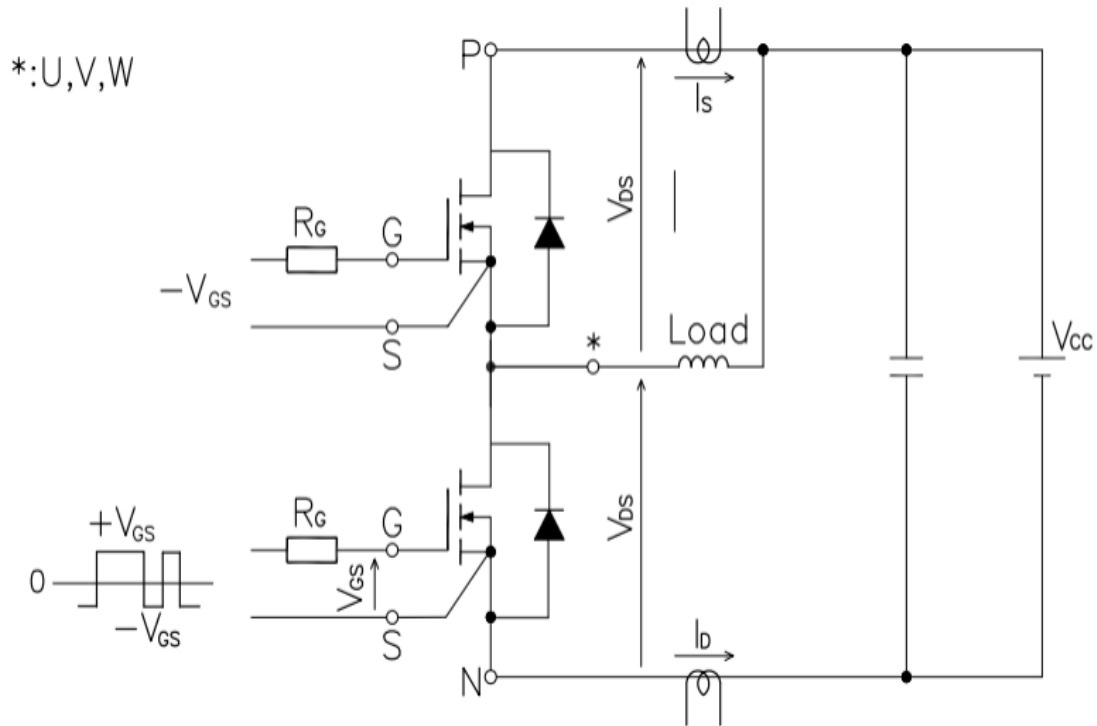


Figure 3. Switching Time Measure Circuit

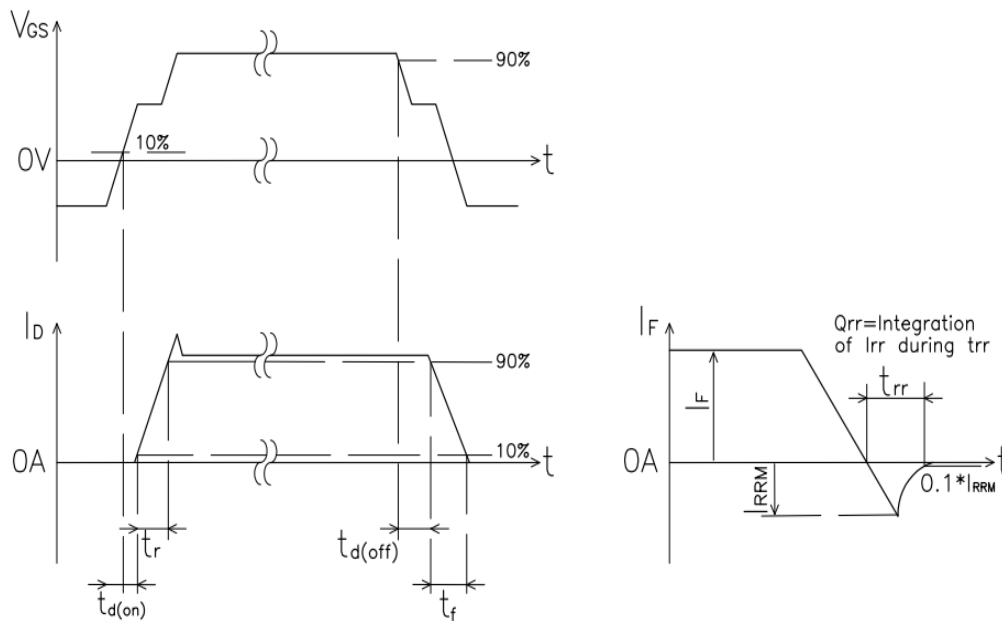


Figure 4. Switching Time Definition

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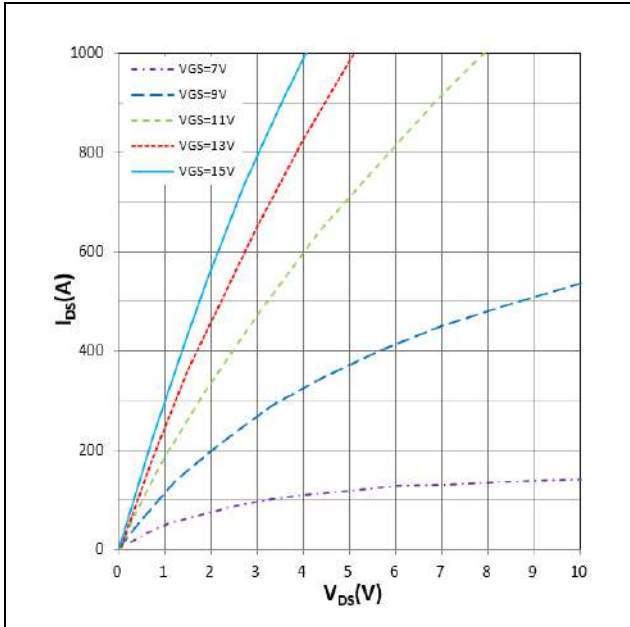


Figure 5.  $I_{DS}$  VS  $V_{DS}$   
 $T_J=25^{\circ}\text{C}$

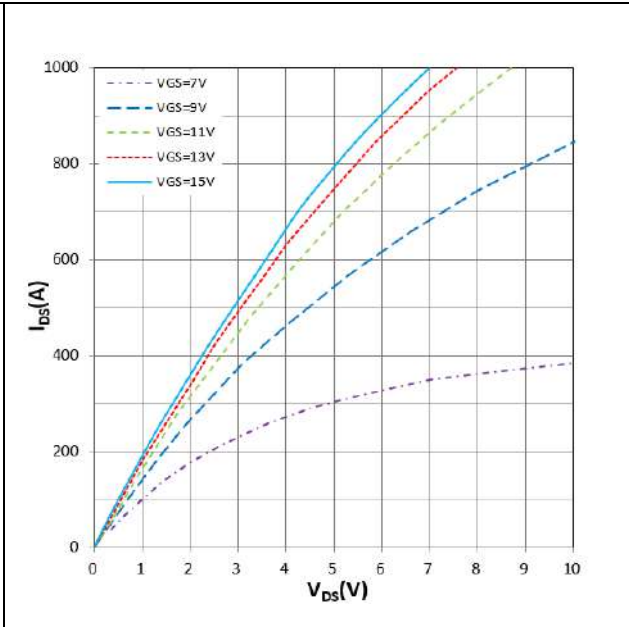


Figure 6.  $I_{DS}$  VS  $V_{DS}$   
 $T_J=175^{\circ}\text{C}$

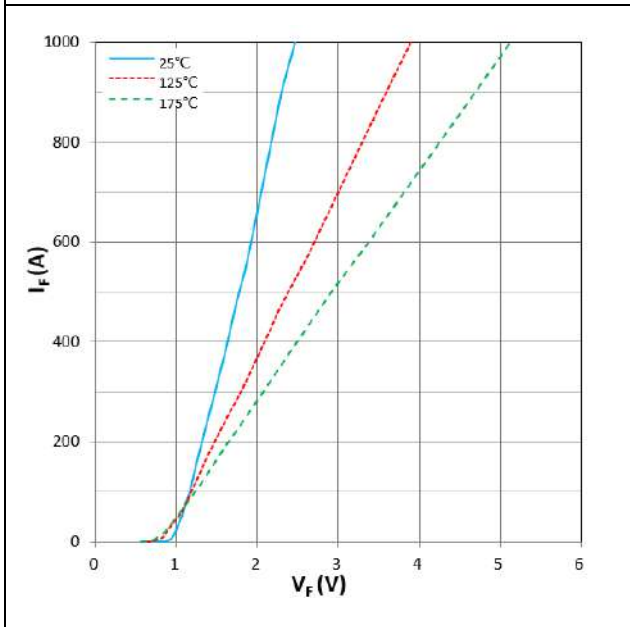


Figure 7.  $I_F$  VS  $V_F$   
 $V_{GS}=0\text{V}$

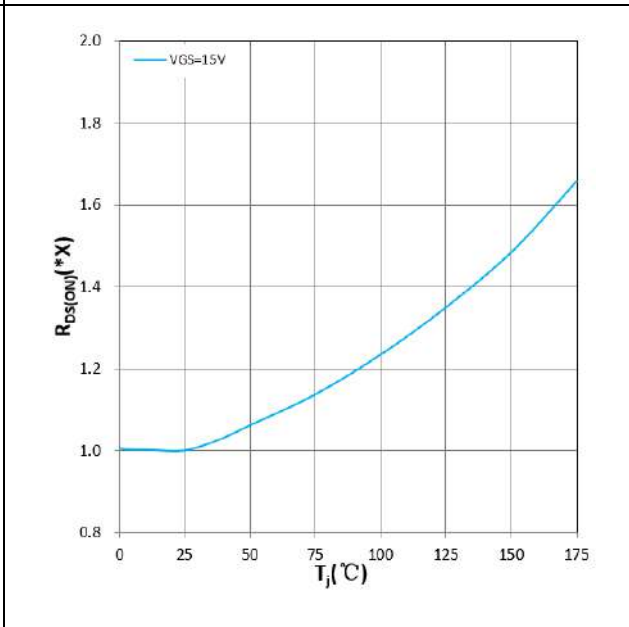


Figure 8.  $R_{DS(ON)}$  VS  $T_J$   
 $V_{GS}=+15\text{V}$ ,  $I_D=540\text{A}$ ,  $1.0X=3.5\text{m}\Omega$

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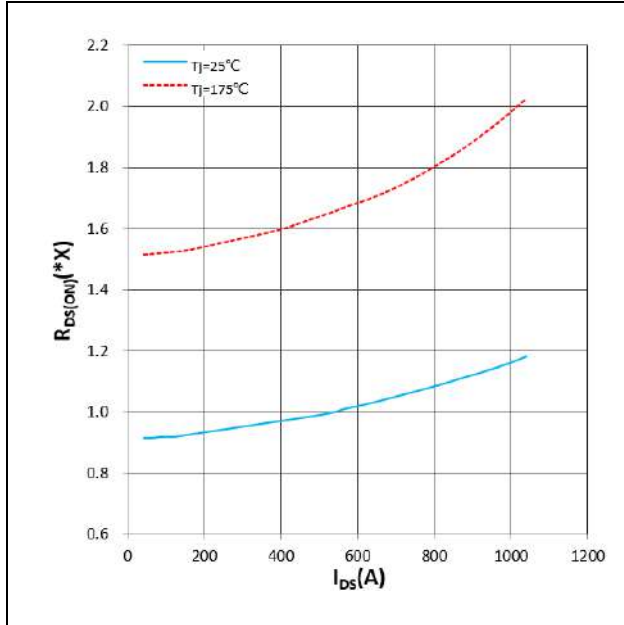


Figure 9.  $R_{DS(on)}$  VS  $I_{DS}$   
 $V_{GS}=+15\text{V}$ ,  $1.0X=3.5\text{m}\Omega$

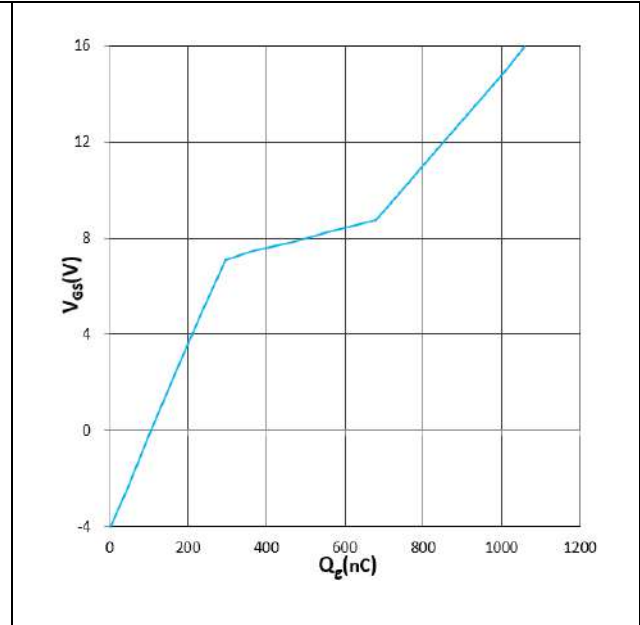


Figure 10.  $V_{GS}$  VS  $Q_g$   
 $V_{DS}=800\text{V}$ ,  $I_D=320\text{A}$ ,  $T_j=25^\circ\text{C}$

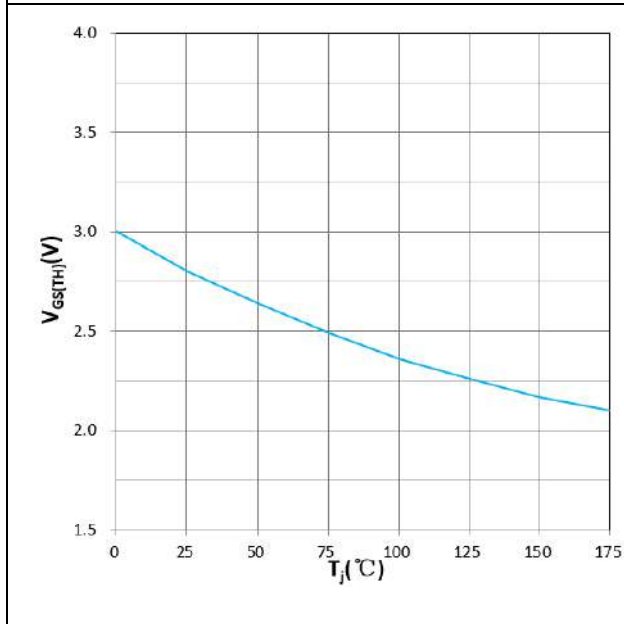


Figure 11.  $V_{GS(TH)}$  VS  $T_j$   
 $V_{GS}=V_{DS}$ ,  $I_D=108\text{mA}$

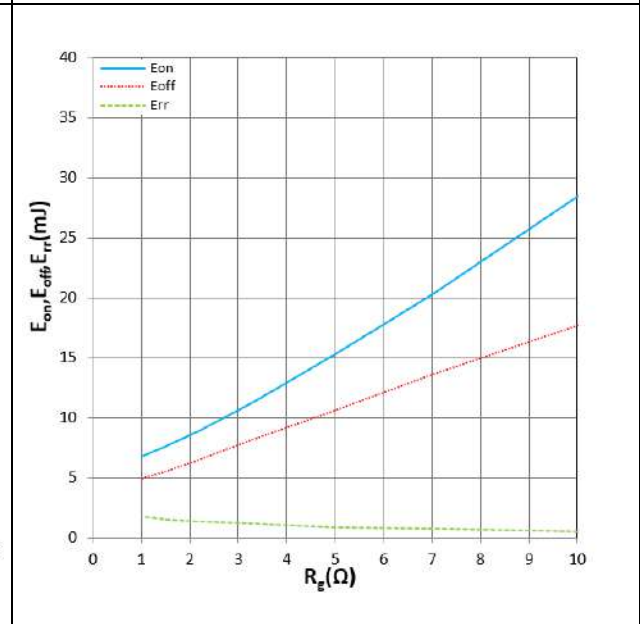


Figure 12.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  VS  $R_g$   
 $T_j=25^\circ\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+15\text{V}/-4\text{V}$ ,  $I_D=540\text{A}$   
 Inductive Load

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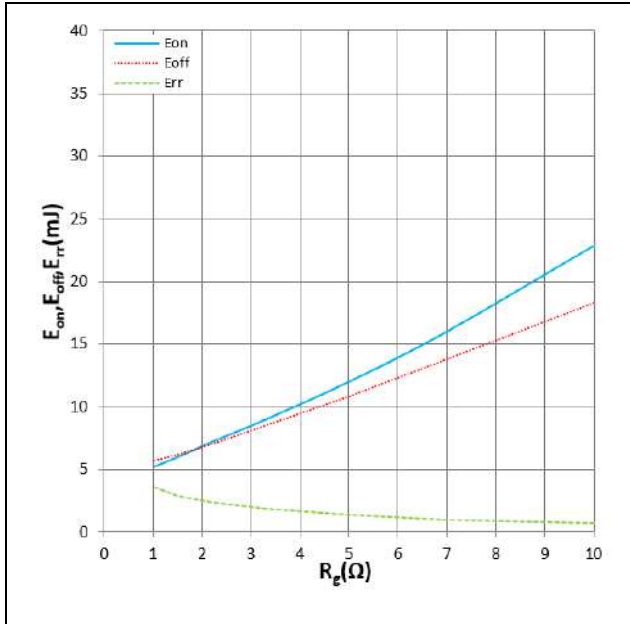


Figure 13.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  VS  $R_g$   
 $T_j=150^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+15\text{V}/-4\text{V}$ ,  $I_D=540\text{A}$   
 Inductive Load

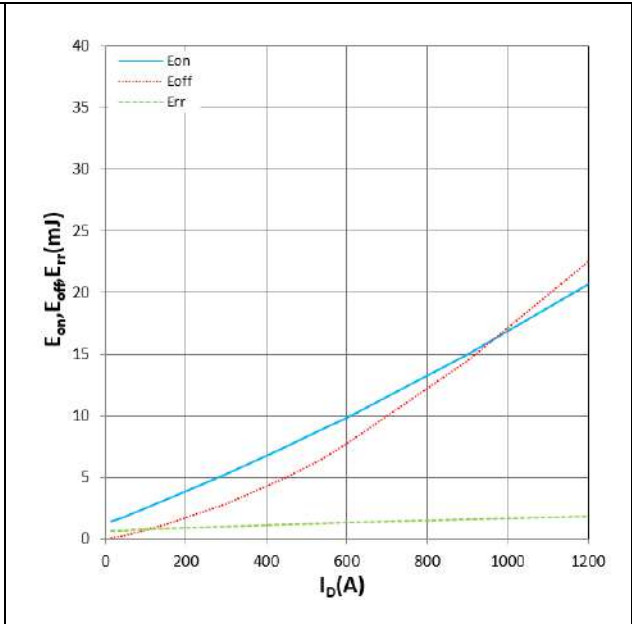


Figure 14.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  VS  $I_{DS}$   
 $T_j=25^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+15\text{V}/-4\text{V}$   
 $R_{G(ON)}/R_{G(OFF)}=2.2/2.2\Omega$ , Inductive Load

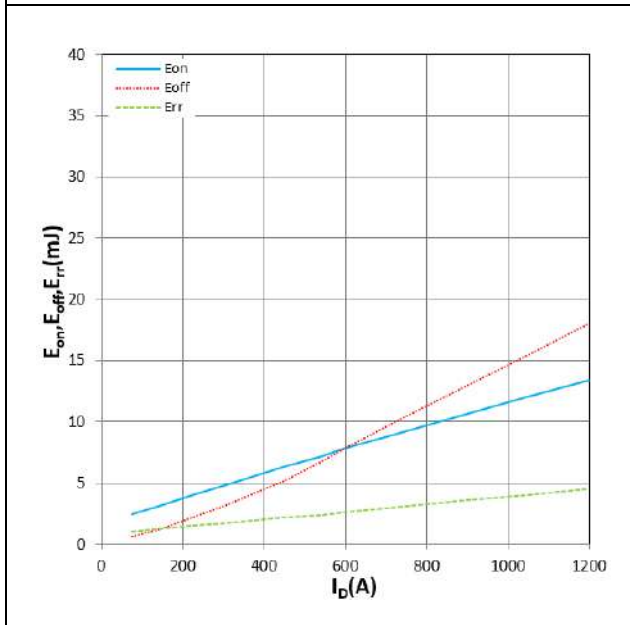


Figure 15.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  VS  $I_{DS}$   
 $T_j=150^{\circ}\text{C}$ ,  $V_{DD}=600\text{V}$ ,  $V_{GS}=+15\text{V}/-4\text{V}$   
 $R_{G(ON)}/R_{G(OFF)}=2.2/2.2\Omega$ , Inductive Load



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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](mailto: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							
	<b>HC</b>	<b>G</b>	<b>100</b>	<b>FF</b>	<b>120</b>	<b>E3</b>	<b>A</b>
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 A2: 62 mm D0: Flow0 D1: Flow1 D2: Flow2 E1: Easy 1B E2: Easy 2B E3: Econo Dual E4 : E4 E5 : ED3S E6 : EconoPIM2 E7 : EconoPIM3 E9 : ED3H F0 : F0							
Feature :A: Special Code Nil: Standard							

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