HCS36FS140E0Q1

1400V/36mΩ3 PhaseSiC MOSFETModule

Description

The HCS36FS140E0Q1is a 3PhaseSiC MOSFET Power Module. It integrates high performanceSiC MOSFET chipsdesigned for the applications such as DC/DCConverter,Motor converter,UPS, High Frequency Switching application.

Features

- Blocking voltage:1400V
- $R_{ds(on)}$=36mΩ
- Low Switching Losses
- 175℃ maximum junction temperature
- Thermistor inside

Applications

- DC/DC converter
- Motor converter
- Uninterruptible Power Supplier
- High Frequency Switching application

Circuit diagram

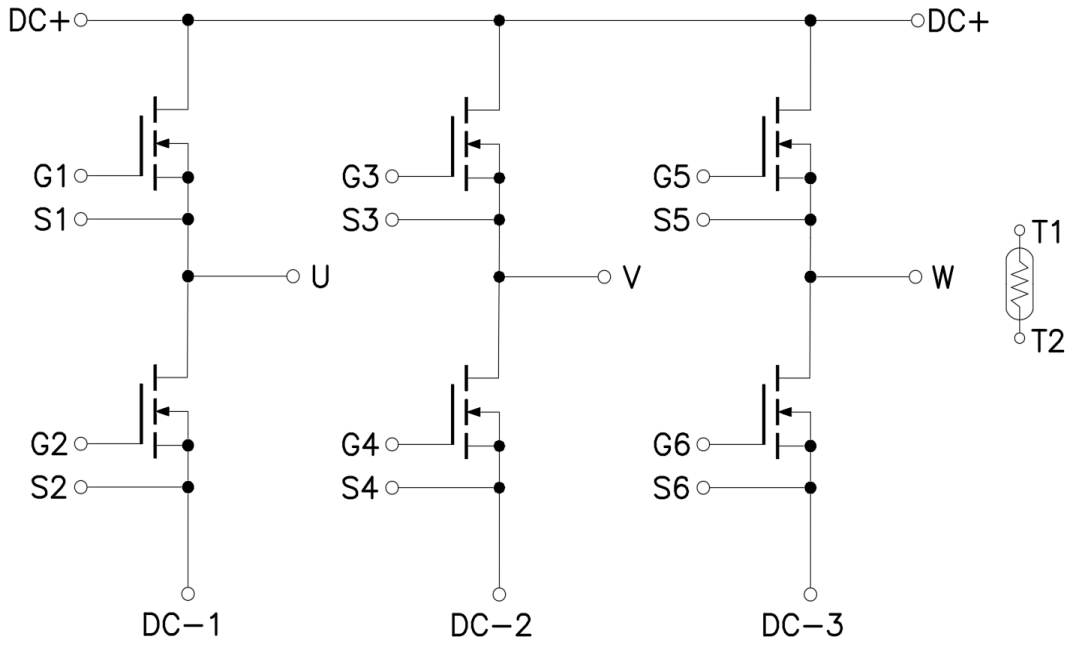

Figure 1. Out drawing & circuit diagramforHCS36FS140E0Q1

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Pin Configuration and Marking Information

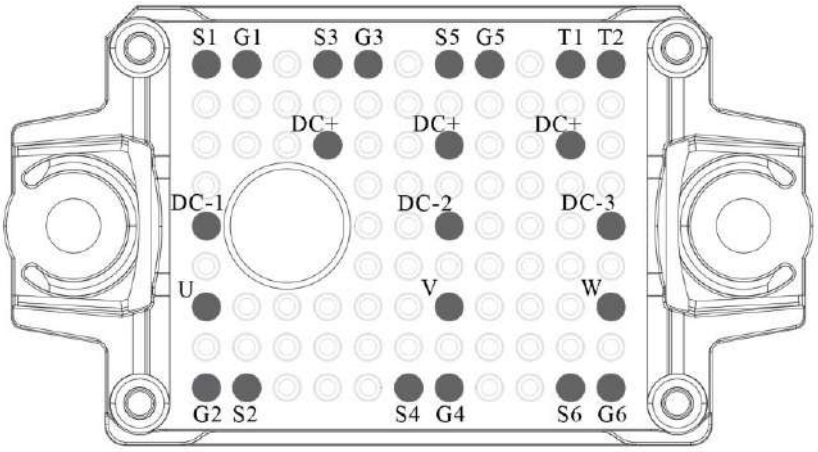

Figure 2. Pin configuration

Symbol	Description
U,V,W	Output terminal of 3 Phase
S2,S4,S6	Low side source signal terminal
G2,G4,G6	Low side gate signal terminal
DC+(3Pin)	DC+ Bus connection
DC–1,2,3	DC– Bus connection
S1,S3,S5	High side source signal terminal
G1,G3,G5	High side gate signal terminal
T1	Thermistor connection 1
T2	Thermistor connection 2

Module

Parameter	Conditions	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	-	400	-
Weight	-	24	g

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

Symbol	Parameter	Condition	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1400	V
$V_{DS\ nom}$	Continuous Operating DC Voltage	Not include surge voltage	1100	V
V_{GSS}	Gate-Source Voltage(+)	D-S Short	20	V
V_{GSS}	Gate-Source Voltage(-)	D-S Short	-5	V
$V_{GSSSurge}$	G-S Voltage(t_{surge}<300nsec)	D-S Short, Note1	-10 to 25	V
I_{DS}	DC Continuous Drain Current	T_f =145°C, Note2	25	A
I_{SD}	Source (Body Diode) Current	T_f =145°C, with ON signal	25	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note3	50	A
T_j	junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +20V/-5V;+18V/-4V;+15V/-4V

Note2: Case temperature(Tc) is defined on the surface of AMB substrate bottom just under the chips

Note3: 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
R/R	Deviation of R_{100}	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	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 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=1mA		1400	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1400V, V_{GS}=0V		-	-	300	μA
$V_{GS(th)}$	Gate-Source threshold Voltage	I_D=20mA, V_{DS}=V_{GS}		2.0	2.5	4.0	V
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V, T_j=25°C		-	-	200	nA
I_{GSS-}		V_{GS}=-5V, V_{DS}=0V, T_j=25°C		-200	-	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=25A , V_{GS}=20V	T_j=25°C	-	36	45	mΩ
			T_j=175°C	-	70	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=25A , V_{GS}=20V	T_j=25°C	-	0.9	1.13	V
			T_j=175°C	-	1.75	-	V
C_{iss}	Input Vapacitance	V_{DS}=1000V, V_{GS}=0V, f=200kHz		-	3192	-	pF
C_{oss}	Output Vapacitance			-	132	-	pF
C_{rss}	Reverse transfer Capacitance			-	7	-	pF
Q_G	Total gate charge	V_{DD}=800V, I_D=40A, V_{GS}=+20/-5V		-	118	-	nC
R_{Gint}	Internal Gate Resistance	T_j=25°C		-	1.9	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD}=800V I_D=25A V_{GS}=+18/-4V R_G=5.1☒ Inductive load switching operation	T_j=25°C	-	19	-	ns
			T_j=150°C	-	20	-	
t_r	Rise time		T_j=25°C	-	9	-	ns
			T_j=150°C	-	8	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	26	-	ns
			T_j=150°C	-	33	-	
t_f	Fall time		T_j=25°C	-	13	-	ns
			T_j=150°C	-	13	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	225	-	μJ
			T_j=150°C	-	313	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	312	-	μJ
			T_j=150°C	-	20	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	0.52	-	K/W
$R_{th(c-f)}$	Contact thermal resistance	With thermal conductive grease /MOSFET		-	0.15	-	K/W

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: Target)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-5V I_{SD} =25A	T_j =25°C	-	3.9	-	V
			T_j =175°C	-	3.4	-	
T_{rr}	Reverse recovery time	V_{DD} =800V I_D =25A V_{GS} =+18/-4V R_G =5.1 Ω Inductive load switching operation	T_j =25°C	-	27	-	ns
			T_j =150°C	-	28	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	0.66	-	μC
			T_j =150°C	-	1.77	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	380	-	μJ
			T_j =150°C	-	848	-	

Test Conditions

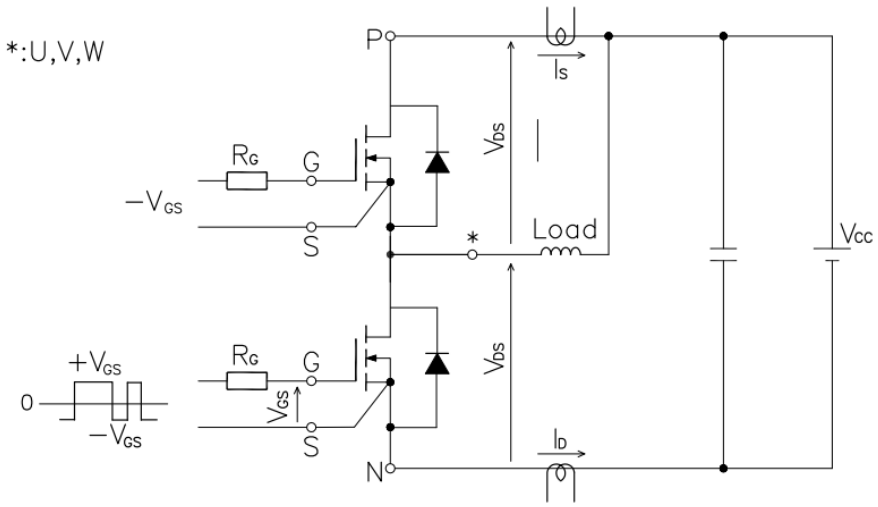

Figure 3. Switching time measure circuit

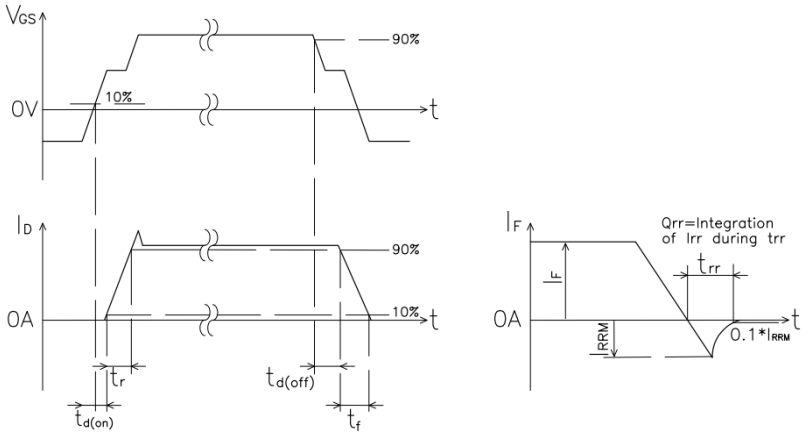

Figure 4. Switching time definition

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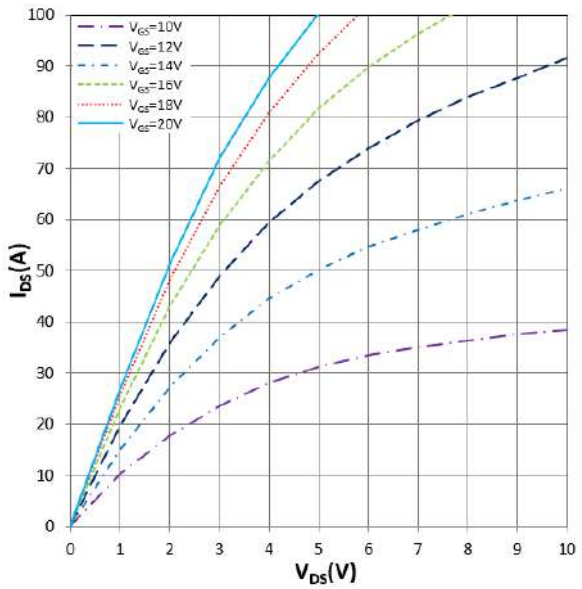

Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

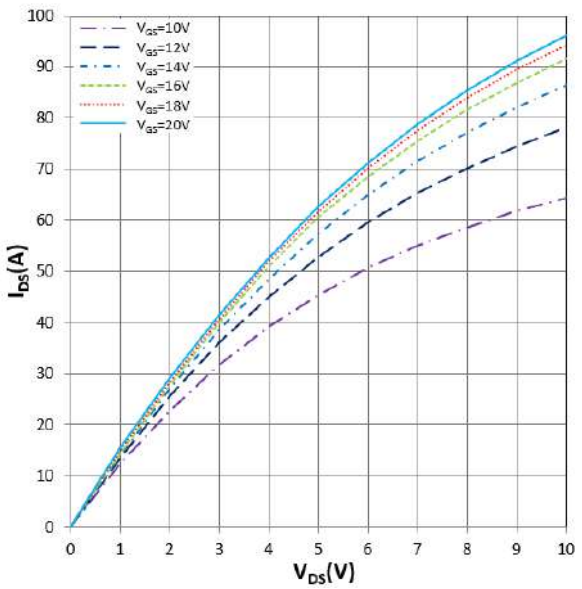

Figure 6. I_{DS} vs V_{DS}
T_j =175°C, V_{GS} parameter

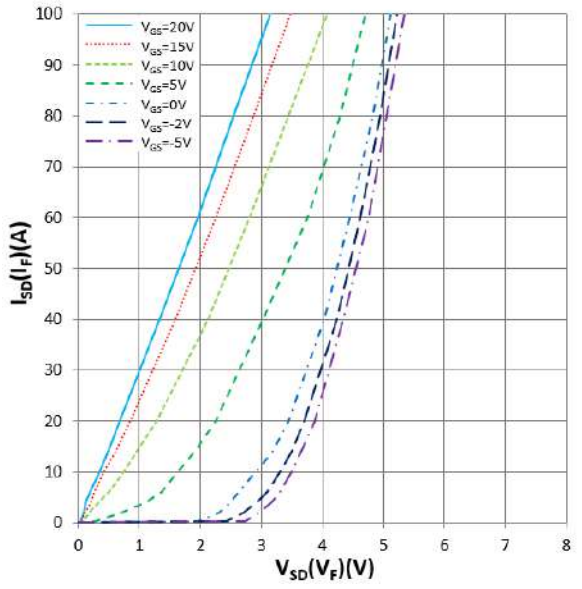

Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j =25°C, V_{GS} parameter

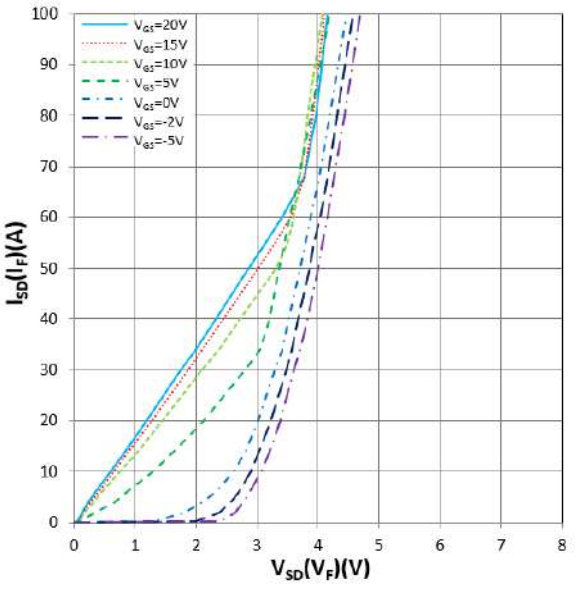

Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j =175°C, V_{GS} parameter

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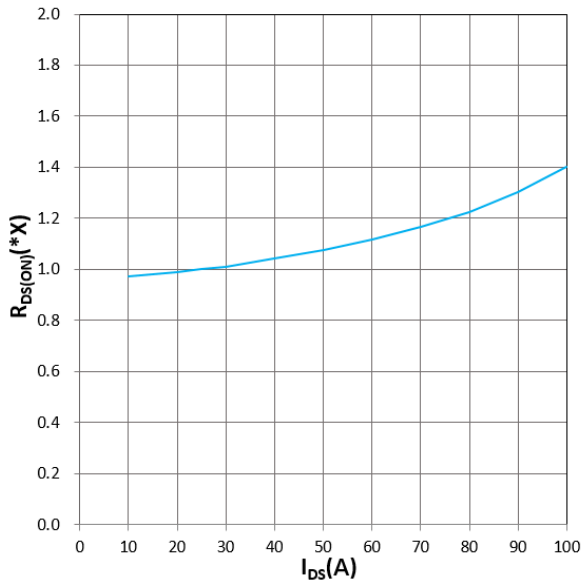

Figure 9. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =20V, 1.0X =36m☒

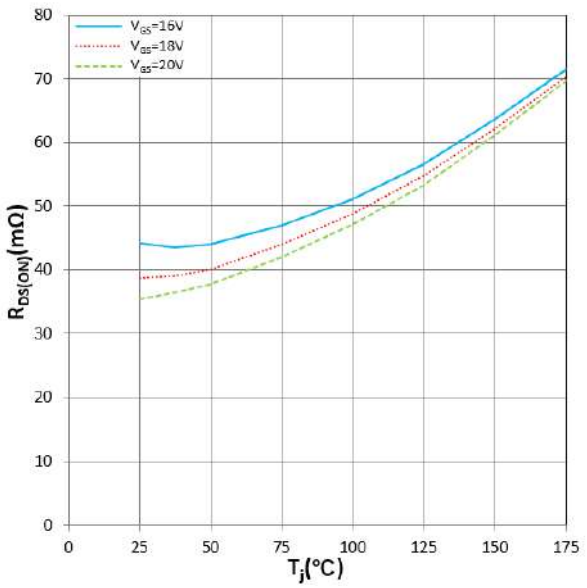

Figure 10. $R_{DS(ON)}$ vs T_j
I_D =25A

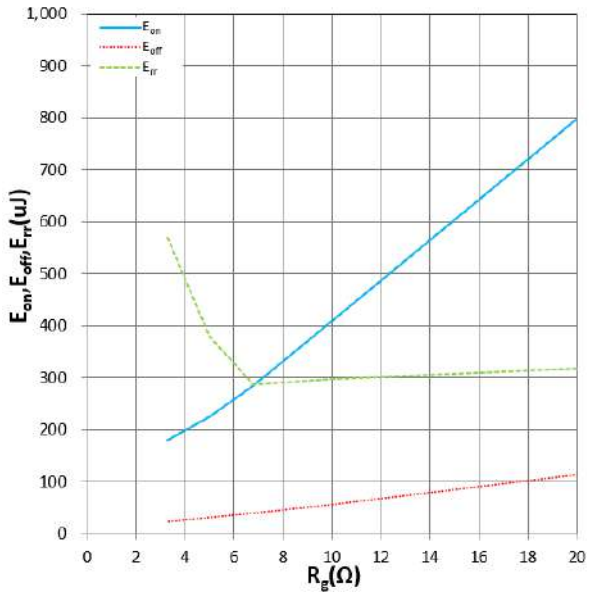

Figure 11. E_{on}, E_{off}, E_{rr} vs R_G
T_j =25°C, V_{DD} =800V, I_D =25A, V_{GS} =+18/-4V

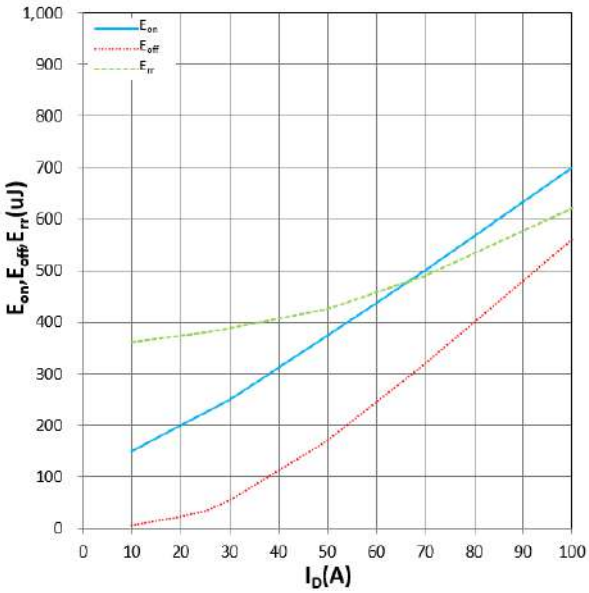

Figure 12. E_{on}, E_{off}, E_{rr} vs I_D
T_j =25°C, V_{DD} =800V, R_G =5.1☒ V_{GS} =+18/-4V

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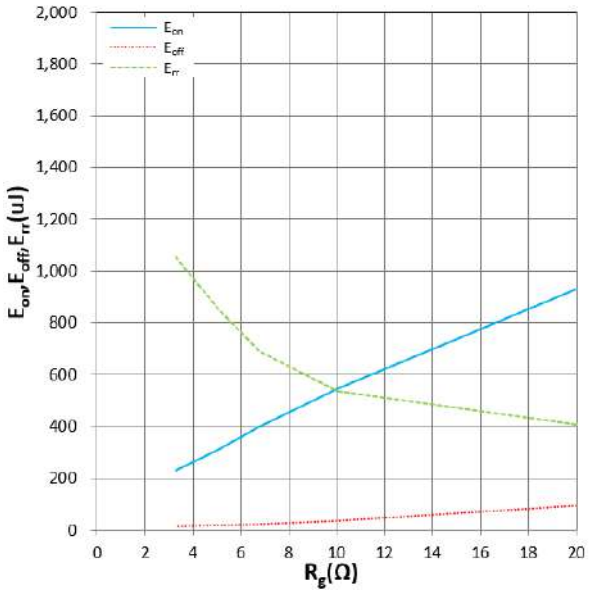

Figure 13. E_{on}, E_{off}, E_{rr} vs R_G
T_j =150°C, V_{DD} =800V, I_D =25A, V_{GS} =+18/-4V

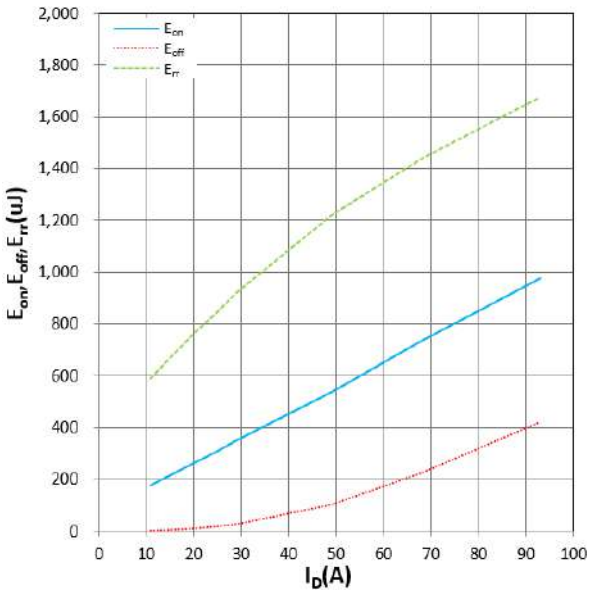

Figure 14. E_{on}, E_{off}, E_{rr} vs I_D
T_j =150°C, V_{DD} =800V, R_G =5.1Ω V_{GS} =+18/-4V

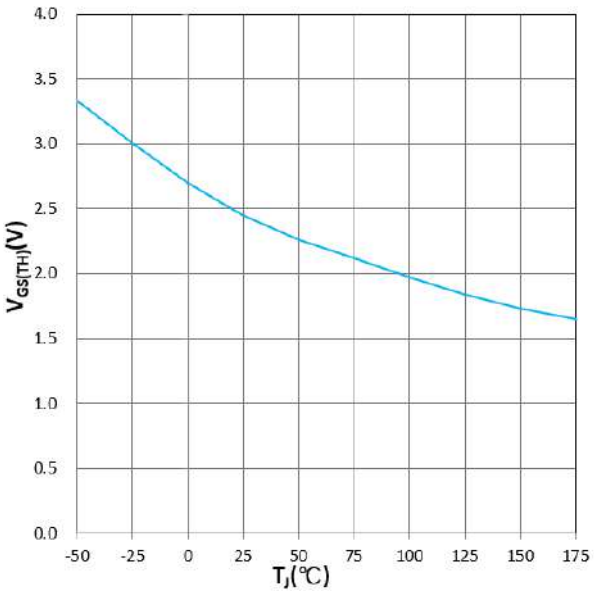

Figure 15. $V_{GS(TH)}$ vs T_J
V_{DS} =V_{GS}, I_{DS} =20mA

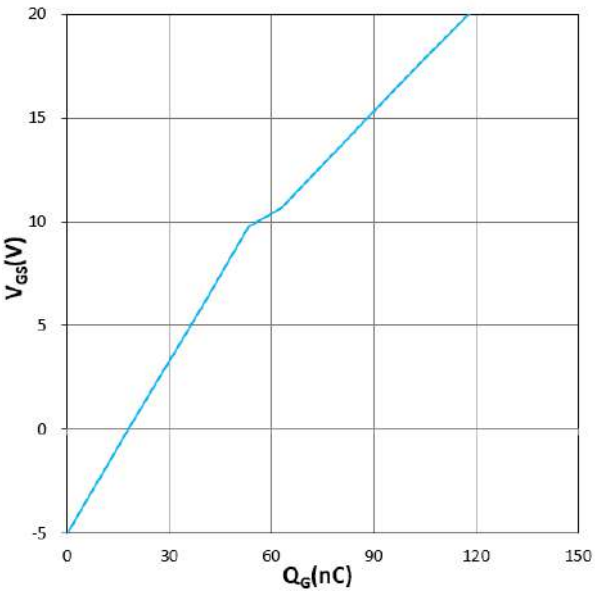

Figure 16. V_{GS} vs Q_G
V_{DD} =800V, I_D =40A

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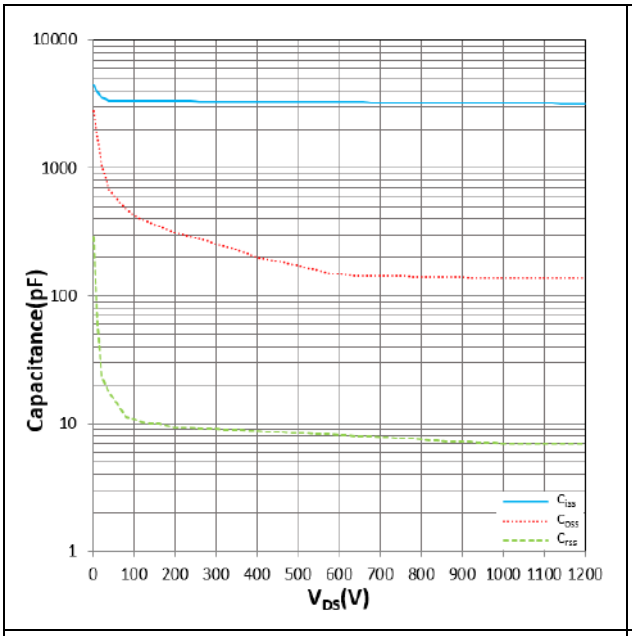


Figure 17. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
T_j =25°C

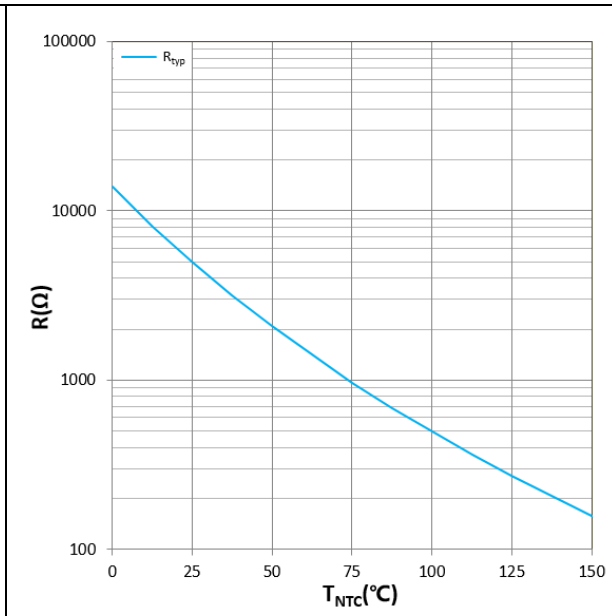
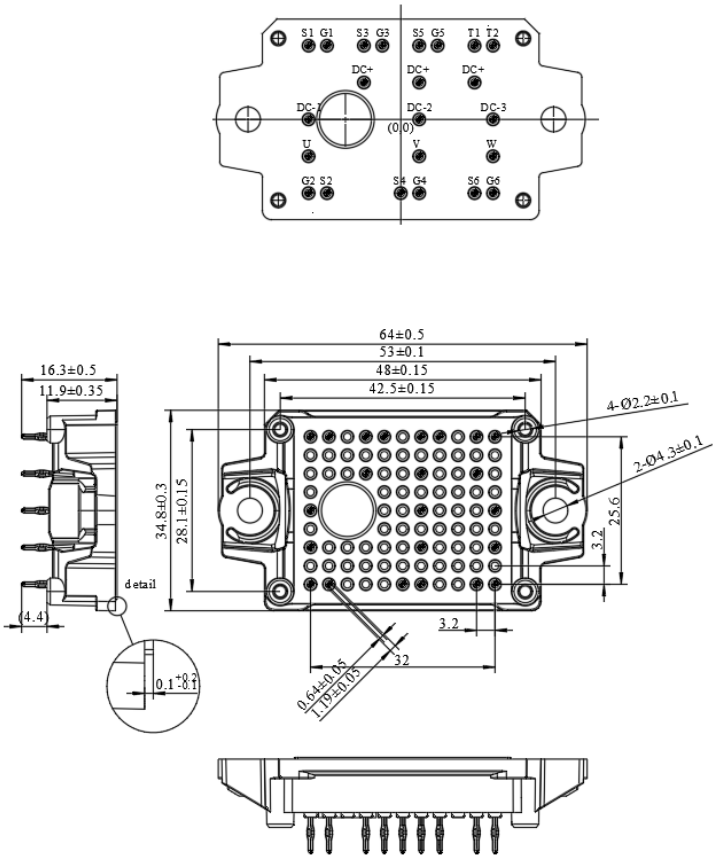


Figure 18. R vs T_{NTC}

Package dimensions



Pin table		
Pin	X	Y
T2	16	12.8
T1	12.8	12.8
G5	6.4	12.8
S5	3.2	12.8
G3	-3.2	12.8
S3	-6.4	12.8
G1	-12.8	12.8
S1	-16	12.8
DC+	12.8	6.4
DC+	3.2	6.4
DC+	-6.4	6.4
DC-3	16	0
DC-2	3.2	0
DC-1	-16	0
W	16	-6.4
V	3.2	-6.4
U	-16	-6.4
G6	16	-12.8
S6	12.8	-12.8
G4	3.2	-12.8
S4	0	-12.8
S2	-12.8	-12.8
G2	-16	-12.8

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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.

Instruction note

Naming rules for power module product models（Industrial module）

Product Model

	HC	S	36	FS	140	E0	Q1

Hecheng Code

Module type G : IGBT module
D : FRD module
S : SiC module
H : Si/SiC hybrid

On-state resistance (mΩ) 01~80

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	
B1： Easy 1B	B1A	B1B…
B2： Easy 2B…	B3： Easy 3B…	
D1： Flow0	D2： Flow1	D3： Flow2
E0 : E0	E1： Econo 2…	E2： E2
E3： ED3	E4 : E4	E5 : ED3S
E6 : EPM2	E7 : EPM3	E8 : EconoPIM3
E9 : ED3H	F0 : F0	P2 : EPM2

Feature :A: Special Code Nil: Standard

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