HCH10AL120E2C1

1200V 3-Level Hybrid Power Module

Description

The HCH10AL120E2C1 is a 3-level Power Module. It integrates 1200V SiC MOSFET chipsand 1200V IGBT chips designed for the applications such as Solar Inverter, High frequency switching, Energy storage System setc.

Features

- Blocking voltage:1200V
- $R_{ds(on)}$: 9.5mΩ (V_{GS} =15V)/8.3mΩ (V_{GS} =18V)
- Low Switching Losses
- High current density
- PressFIT Contact Technology
- 175°C maximum junction temperature
- Thermistor inside

Applications

- Solar inverterSystems
- Three-level applications
- Energy Storage Systems
- High Frequency Switching application

Circuit diagram

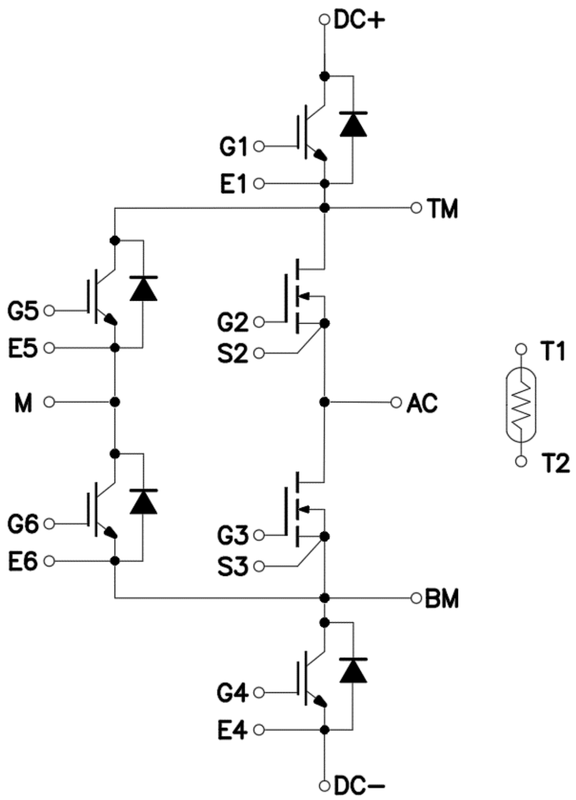

Figure 1. Out drawing & circuit diagramfor HCH10AL120E2C1

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Pin Configuration

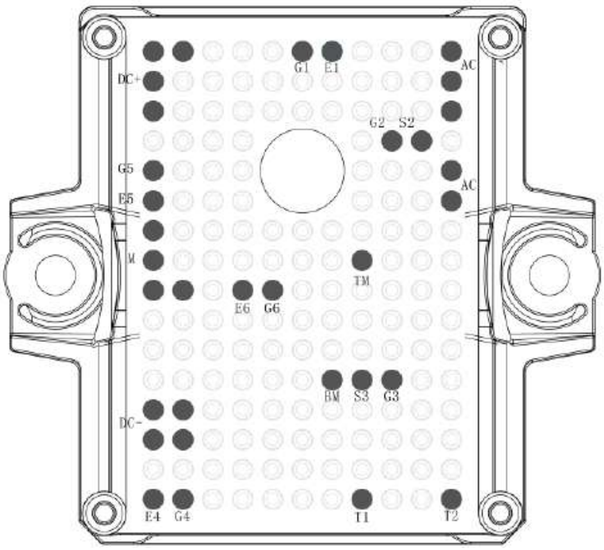

Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation voltage	Main terminal to base plate, RMS, f =50Hz, t =1min	3.0	kV
Creepage distance	terminal to heatsink	11.5	mm
	terminal to terminal	6.3	
Clearance	terminal to heatsink	10.0	
	terminal to terminal	5.0	
Comparative tracking index	-	> 400	
Mounting torque for module mounting	Screw M4 baseplate to heatsink	1.8 to 2.2	Nm
Storage temperature	-	-40 to 125	°C
Weight	-	40	g

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_C =25°C	-	5	-	kΩ
R/R	Deviation of R100	T_C =100°C, R_{100} =493Ω	-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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Maximum Ratings (SiC MOSFET， T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	G-S Voltage	D-S Short, Note1	-10 to 22	V
I_{DS}	DC Continuous Drain Current	T_C=125°C	100	A
I_{SD}	Source (Body diode) Current	T_C=125°C	32	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	200	A
T_j	junction temperature	-	-40 to 175	°C

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

Note2: Pulse width limited by maximum junction temperature

Maximum Ratings (IGBT and FRD， T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	G-E Short	1200	V
V_{GES}	Gate-Emitter Voltage	C-E Short	±20	V
I_{CN}	DC Continuous Collector Current	T_C=135°C	100	A
I_{CM}	Pulse Collector Current	t_p=1ms, Note1	200	A
I_F	Diode forward Current	T_C=100°C	100	A
I_{FRM}	Repetitive peak forward Current	t_p=1ms, Note1	200	A
T_j	junction temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

MOSFET Electrical characteristics (T_j=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value Min.	Value Typ.	Value Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=200uA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V		-	2	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=70mA, V_{DS}=V_{GS}, T_j=25°C		1.8	2.7	-	V
		I_D=70mA, V_{DS}=V_{GS}, T_j=175°C		-	2.05	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V, T_j=25°C		-	200	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=100A V_{GS}=15V	T_j=25°C	-	9.5	-	mΩ
			T_j 175°C	-	14.3	-	mΩ
		I_D=100A V_{GS}=+18V	T_j 25°C	-	8.3	12.5	mΩ
			T_j 175°C	-	12.6	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=100A V_{GS}=15V	T_j 25°C	-	0.95	-	V
			T_j 175°C	-	1.43	-	V
		I_D=100A V_{GS}=+18V	T_j 25°C	-	0.83	1.25	V
			T_j 175°C	-	1.26	-	V
C_{iss}	Input Capacitance	V_D=800V, V_{GS}=0V f=1MHz, V_{AC}=25mV		-	11.6	-	nF
C_{oss}	Output Capacitance			-	0.	-	nF
C_{rss}	Reverse transfer Capacitance			-	3520.	-	nF

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Q_G	Total gate charge	V_{DD}=800V, I_D=120A, V_{GS}=-5/+15V		-	360	-	nC
R_{Gint}	Internal Gate Resistance	f =1Mhz, V_{AC} =25mV		-	0.65	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =600V I_D =100A V_{GS} =+15V/-4V R_g=5.1 Ω Inductive load switching operation	T_j =25°C	-	43	-	ns
			T_j =150°C	-	40	-	
t_r	Rise time		T_j =25°C	-	23	-	ns
			T_j =150°C	-	19	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	112	-	ns
			T_j =150°C	-	120	-	
t_f	Fall time		T_j =25°C	-	15	-	ns
			T_j =150°C	-	40	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	2.	-	mJ
			T_j =150°C	-	222.	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	311.	-	mJ
			T_j =150°C	-	501.	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	590	-	K/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied) , Note1			-	.320	-	K/W

Note1: Assumes Thermal Conductivity of grease is 2.8W/m·K and thickness is 50um. .12

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} =100A	T_j =25°C	-	5.1	-	V
			T_j =175°C	-	4.6	-	
T_{rr}	Reverse recovery time	V_{DD} =600V I_D =100A V_{GS} =+15/-4V R_g =5.1 Ω Inductive load switching operation	T_j =25°C	-	26	-	ns
			T_j =150°C	-	50	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	0.	-	μC
			T_j =150°C	-	753.	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	200.	-	mJ
			T_j =150°C	-	120.	-	

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IGBTElectrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	I_C =100A V_{GE} =15V	T_j =25°C	-	1.56	-	V
			T_j =175°C	-	1.81	-	V
$V_{GE(th)}$	Gate-Emitter threshold Voltage	I_C =2.6mA, V_{CE} =10V		-	5.9	-	V
Q_G	Gate charge	V_{GE} =-15V to +15V		-	2.0	-	uC
R_{Gint}	Internal gate resistor	-	T_j =25°C	-	13	-	Ω
C_{ies}	Input Capacitance	V_{CE} =25V, V_{GE} =0V f =1MHz	T_j =25°C	-	3.56	-	nF
C_{res}	Reverse transfer Capacitance			-	0.04	-	nF
I_{CES}	Collector- Emitter Cut off Current	V_{CE} =1200V, V_{GE} =0V	T_j =25°C	-	-	0.01	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE} =20V, V_{CE} =0V	T_j =25°C	-	-	0.1	uA

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$t_{d(on)}$	Turn-on delay time	V_{CC} =600V I_C = 100A V_{GE} =+15V/-15V R_g =1.5Ω Inductive load	T_j =25°C	-	100	-	ns
			T_j =125°C	-	108	-	
			T_j =175°C	-	114	-	
t_r	Rise time		T_j =25°C	-	31	-	ns
			T_j =125°C	-	34	-	
			T_j =175°C	-	37	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	228	-	ns
			T_j =125°C	-	299	-	
			T_j =175°C	-	342	-	
t_f	Fall time		T_j =25°C	-	210	-	ns
			T_j=125°C	-	308	-	
			T_j =175°C	-	384	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	1.	-	mJ
			T_j =125°C	-	241.	-	
			T_j =175°C	-	802.	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	01	-	mJ
			T_j =125°C	-	6.7	-	
			T_j =175°C	-	12.	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)			-	215.	-	K/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied) , Note1			-	10.	-	K/W

Note1: Assumes Thermal Conductivity of grease is 2.8W/m·K and thickness is 50um. 160.

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Freewheeling Diode Electrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_F	Diode Forward Voltage	I_F =100A, V_{GE} =0V	T_j =25°C	-	1.9	-	V
			T_j =175°C	-	1.75	-	
t_{rr}	Reverse recovery time	(Switch side) V_{CC} =600V I_C =100A V_{GE} = +15V/-15V R_g =1.5Ω (FRD side) V_{rr} =600V I_F =100A V_{GE} = +15V/-15V Inductive load switching operation	T_j =25°C	-	0.36	-	us
			T_j =125°C	-	0.53	-	
			T_j =175°C	-	0.71	-	
I_{RM}	Peak reverse recovery Current		T_j =25°C	-	103	-	A
			T_j =125°C	-	131	-	
			T_j =175°C	-	154	-	
Q_{rr}	Recovered charge		T_j=25°C	-	9.32	-	uC
			T_j =125°C	-	16.7	-	
			T_j =175°C	-	27.2	-	
E_{rr}	Reverse recovered energy		T_j =25°C	-	3.74	-	mJ
			T_j =125°C	-	6.90	-	
			T_j =175°C	-	8.77	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-	0.28	-	K/W
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied) , Note1			-	0.12	-	K/W

Note1: Assumes Thermal Conductivity of grease is 2.8W/m·K and thickness is 50um.

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Test Conditions

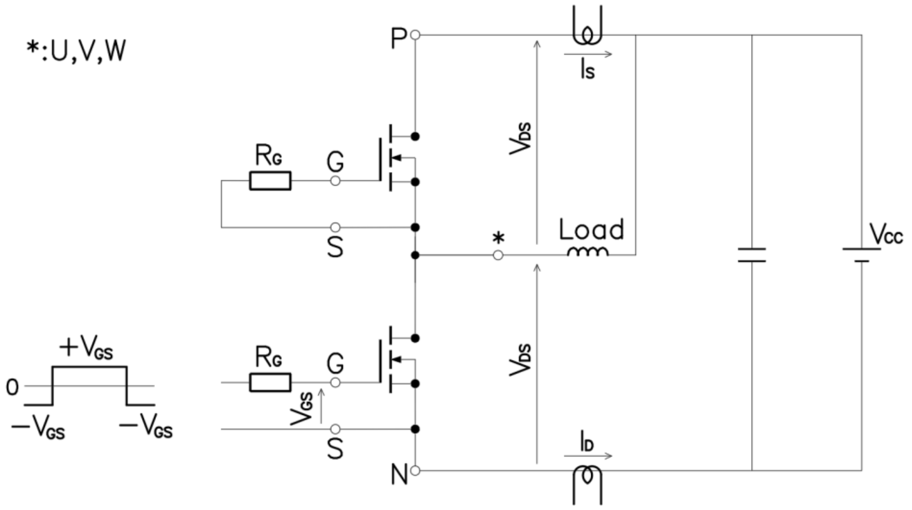

Figure 3. Switching time measure circuit

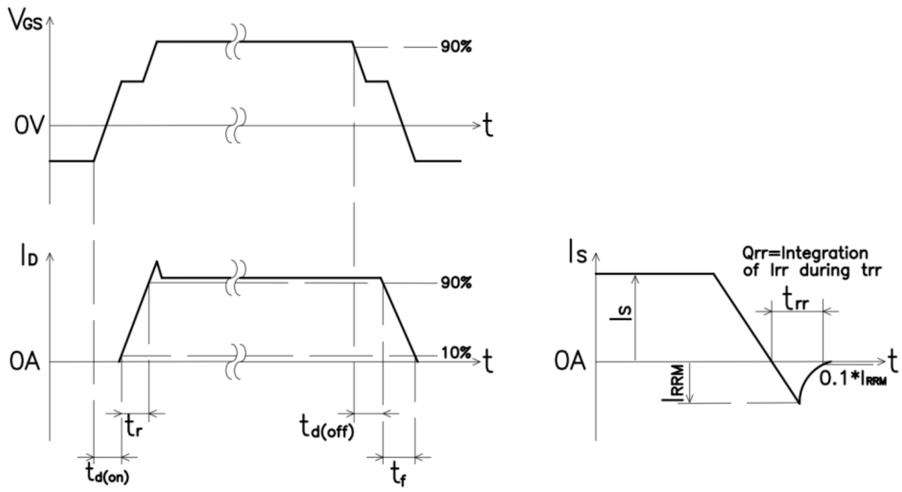

Figure 4.Switching time definition

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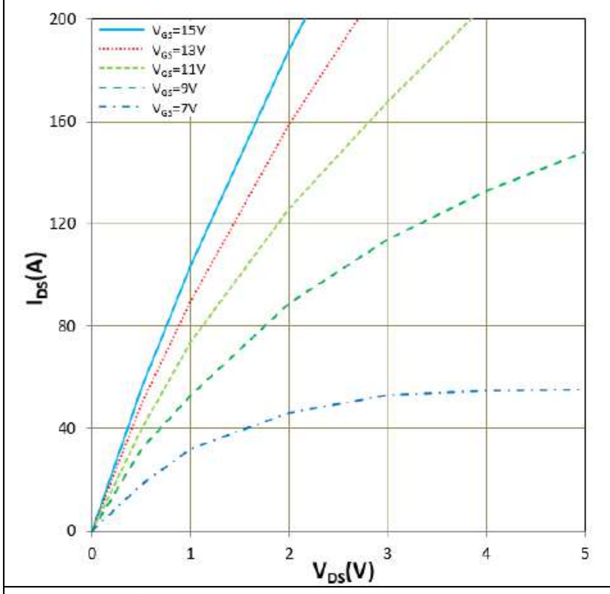

Figure 5. I_{DS} vs V_{DS}, SiC MOSFET
T_j =25°C, V_{GS} parameter

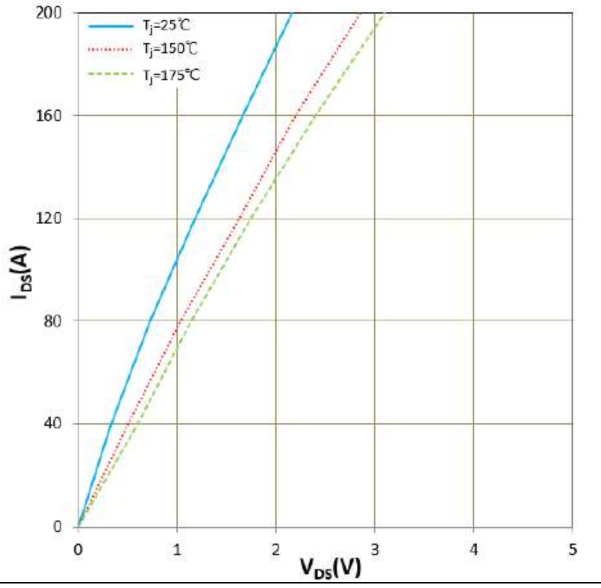

Figure 6. I_{DS} vs V_{DS}, SiC MOSFET
V_{GS} =+15V

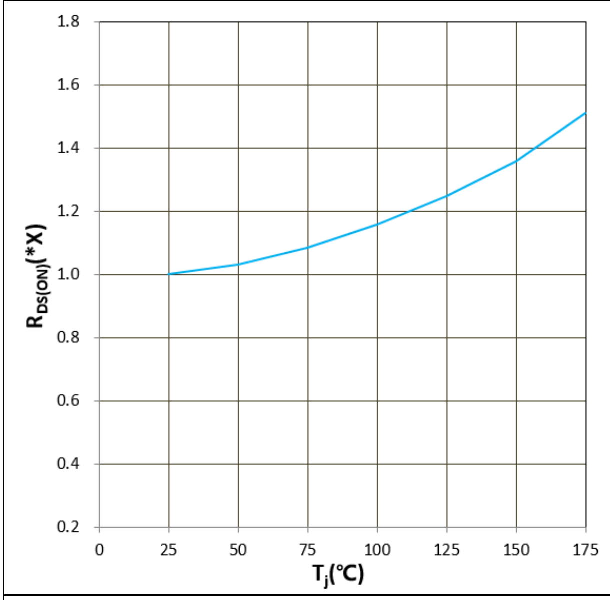

Figure 7. $R_{DS(ON)}$ vs T_j, SiC MOSFET
V_{GS} =+15V, I_D =100A, 1.0X =9.5m⊠

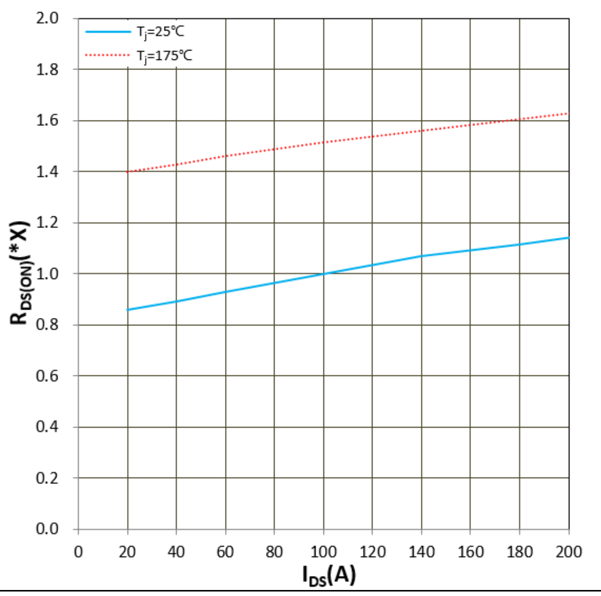

Figure 8. $R_{DS(ON)}$ vs I_{DS}, SiC MOSFET
V_{GS} =+15V, 1.0X =9.5m⊠

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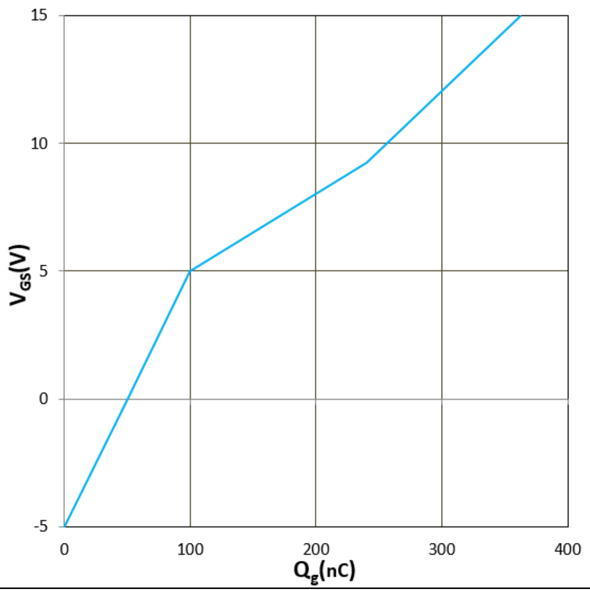

Figure 9. V_{GS} vs Q_g, SiC MOSFET
V_{DS} =800V, I_D =120A , T_j =25°C

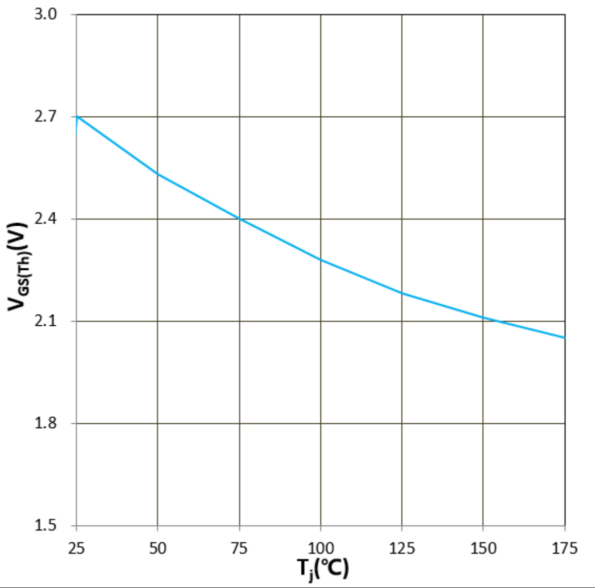

Figure 10. $V_{GS(TH)}$ vs T_j, SiC MOSFET
V_{GS} =V_{DS}, I_D =70mA

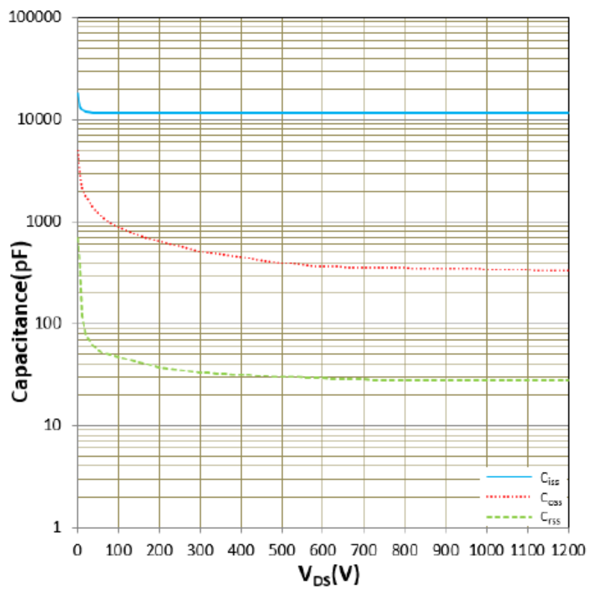

Figure 11. C_{iss}, C_{oss}, C_{rss} vs V_{DS}, SiC MOSFET
T_j =25°C, V_{GS} =0V, f =1MHz

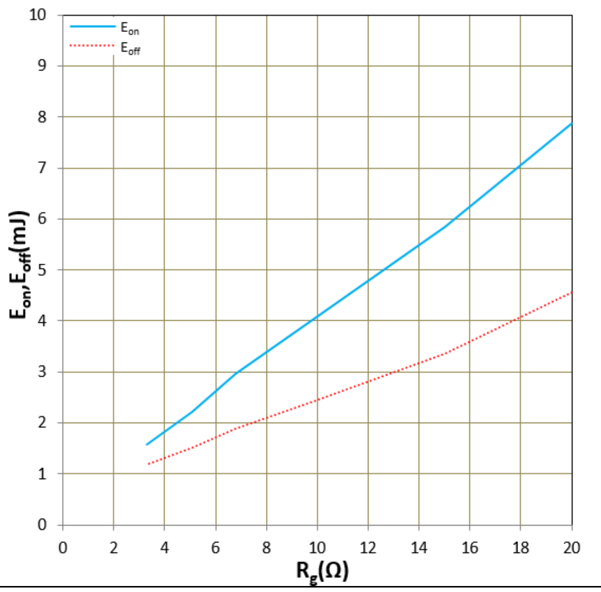

Figure 12. E_{on}, E_{off} vs R_g, SiC MOSFET
T_j =25°C, V_{CC} =600V, I_D=100A, V_{GS}=+15V/-4V

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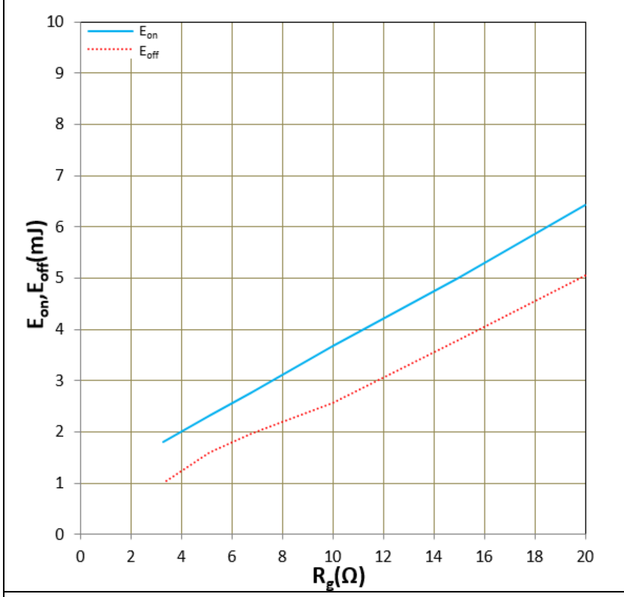


Figure 13. E_{on}, E_{off} vs R_g, SiC MOSFET
T_j =150°C, V_{CC} =600V, I_D =100A , V_{GS} =+15V/-4V

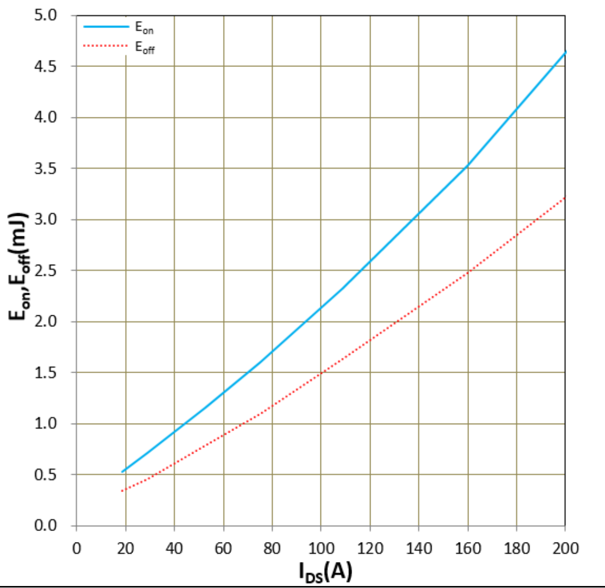


Figure 14. E_{on}, E_{off} vs I_{DS}, SiC MOSFET
T_j =25°C, V_{CC} =600V, R_g =5.1⊠ V_{GS} =+15V/-4V

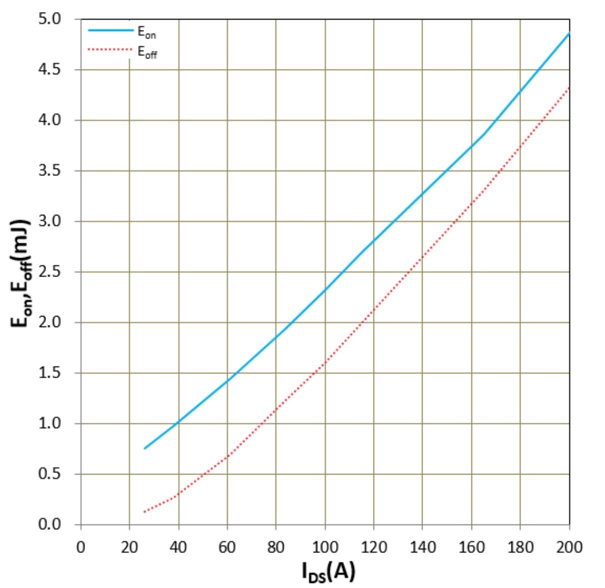
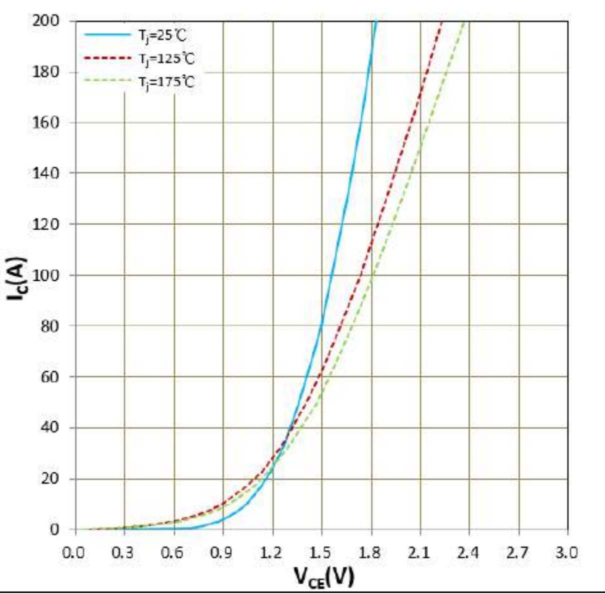


Figure 15. E_{on}, E_{off} vs I_{DS}, SiC MOSFET
T_j =150°C, V_{CC} =600V, R_g =5.1⊠ V_{GS} =+15V/-4V



igure 16. Ic vs V_{GE}, IGBT
V_{GE} =15V

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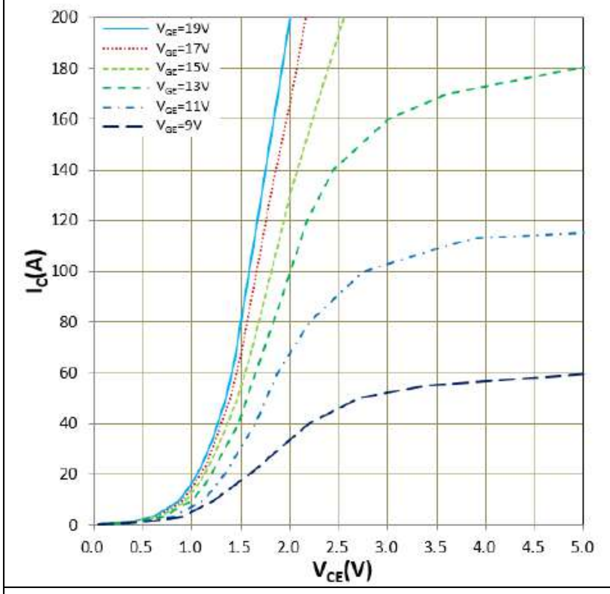


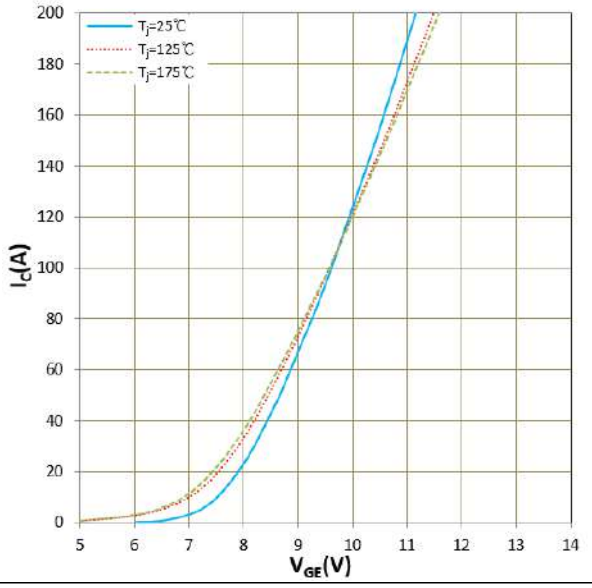
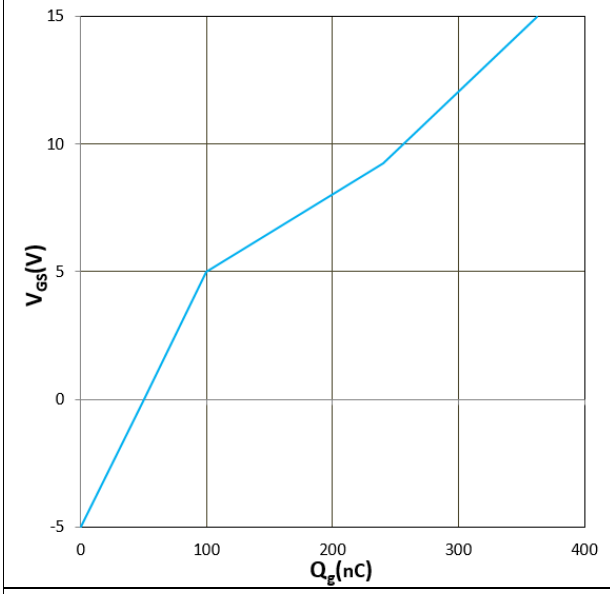


Figure 17. Ic vs V_{CE}, IGBT
T_j=175°C

Figure 18. Ic vs V_{GE}, IGBT
V_{CE}=20V



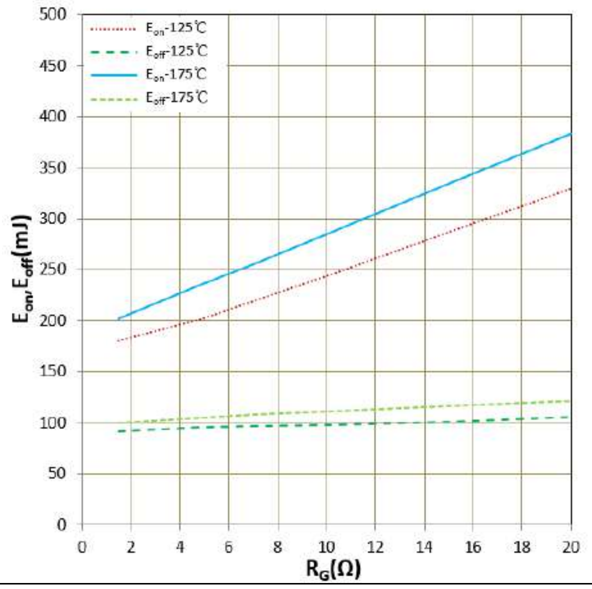


Figure 19. V_{GE} vs Q_g, IGBT
V_{CC} =600V, I_D =100A , T_j =25°C

Figure 20. E_{on}, E_{off} vs I_C, IGBT
V_{CC} =600V, V_{GE} =±15V, R_g =1.5Ω

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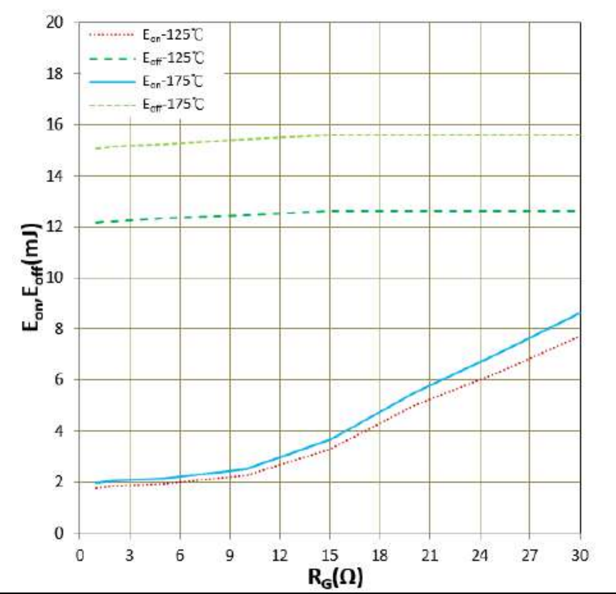

Figure 21. E_{on}, E_{off} vs R_g, IGBT
V_{CC} =600V, V_{GE} =±15V, I_C =100A

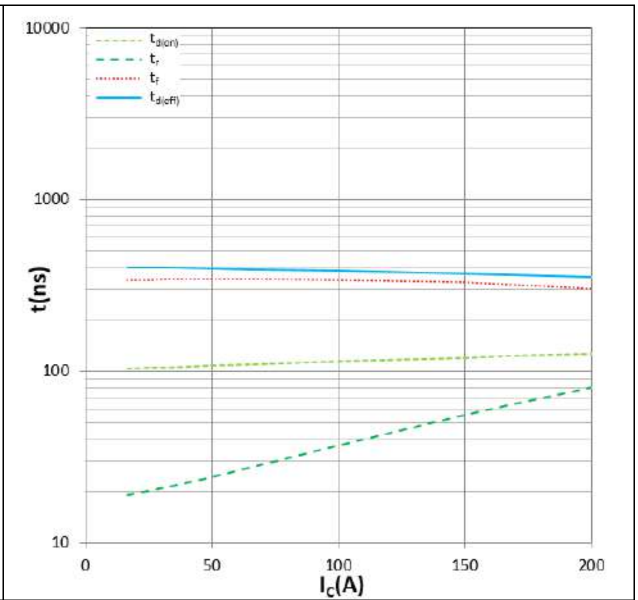

Figure 22. Switching time vs I_C, IGBT
V_{CC} =600V, V_{GE} =±15V, R_g =1.5Ω, T_j =175°C

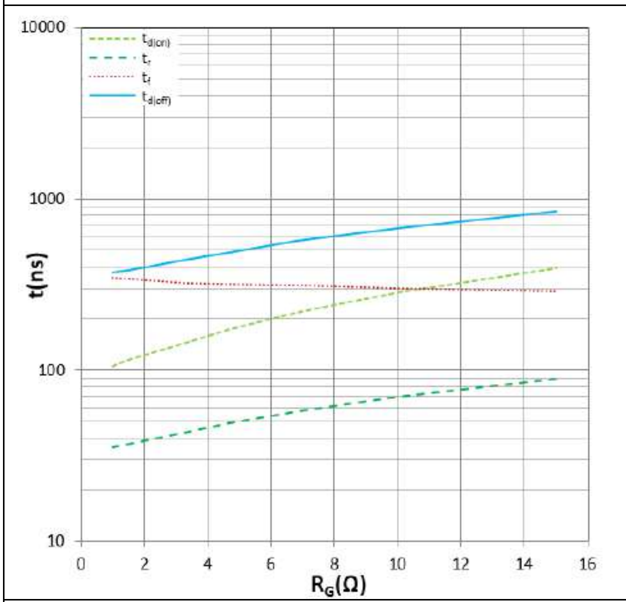

Figure 23. Switching time vs R_g, IGBT
V_{CC} =600V, V_{GE} =±15V, I_C =100A, T_j =175°C

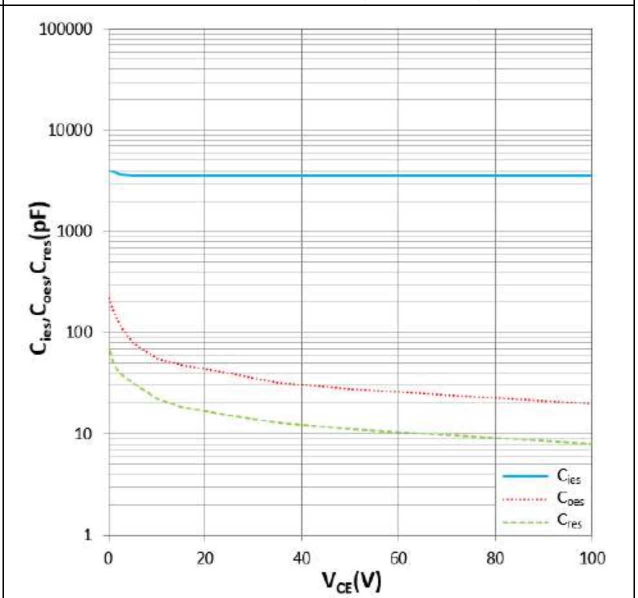

Figure 24. C_{ies}, C_{oss}, C_{res} vs V_{CE}, IGBT
T_j =25°C, V_{GE} =0V, f =1MHz

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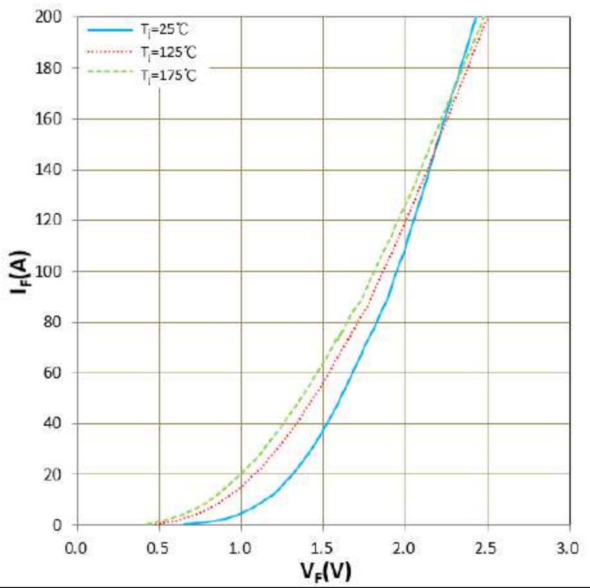

Figure 25. I_F vs V_F, Freewheeling Diode

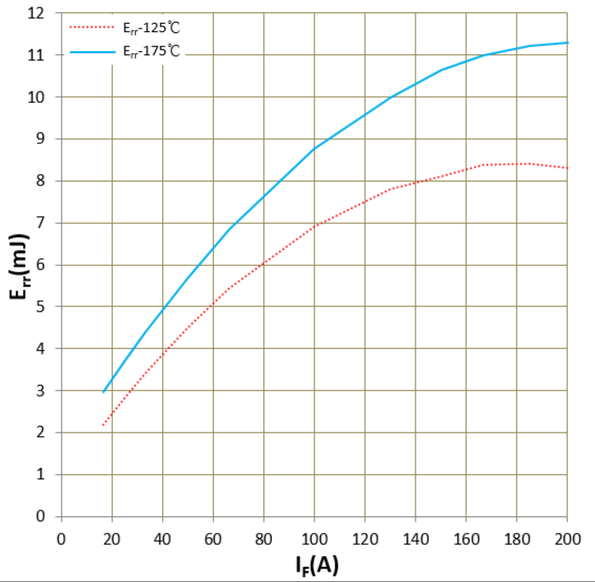

Figure 26. E_{rr} vs I_F, Freewheeling Diode
V_{CC}=600V, R_g=1.5Ω

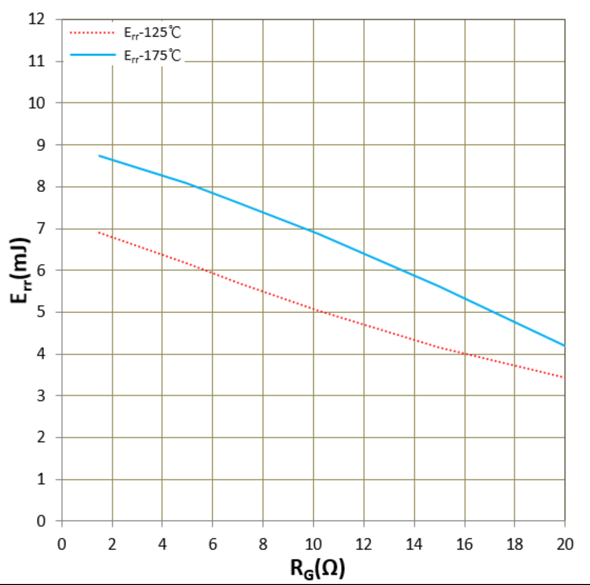

Figure 27. E_{rr} vs R_g, Freewheeling Diode
V_{CC}=600V, I_C=100A

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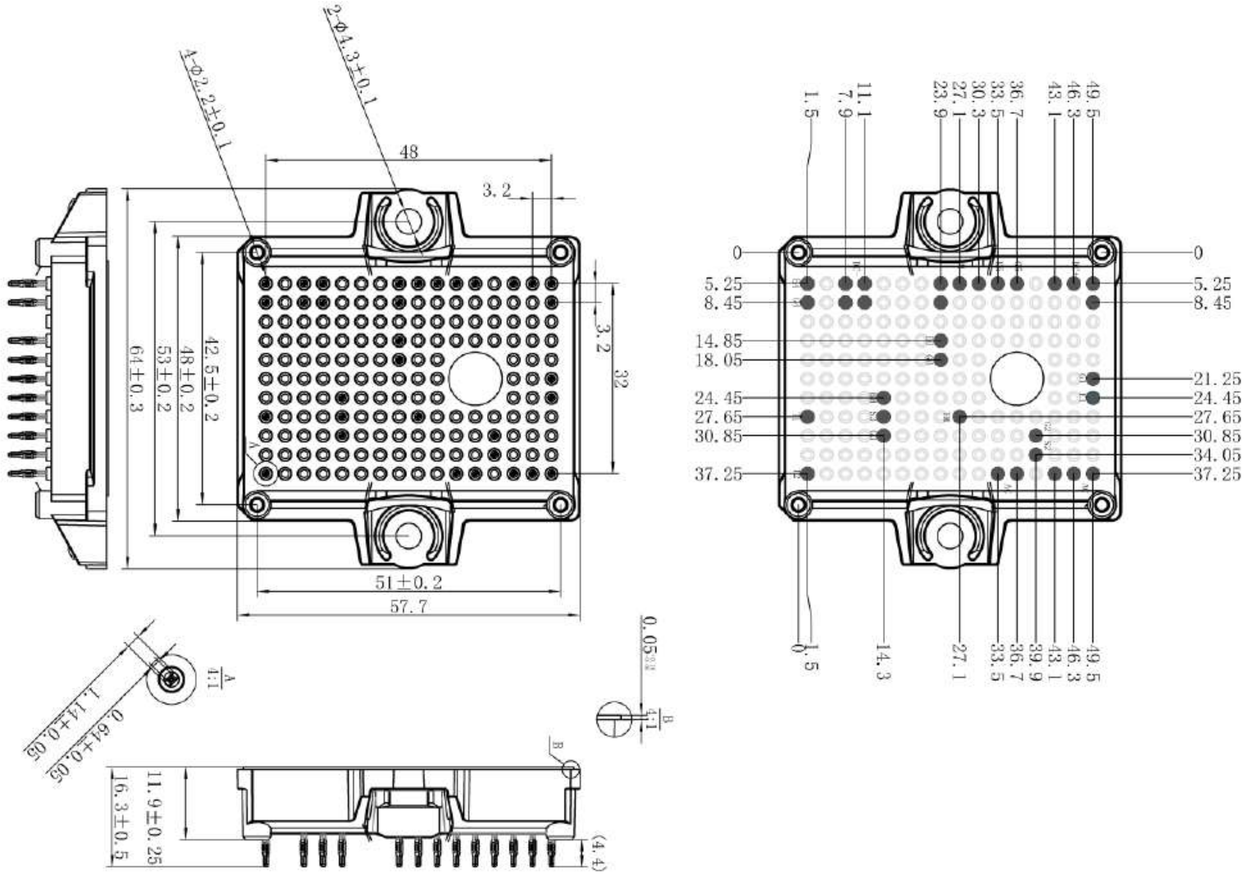
1200V 3-Level Hybrid Power Module

Package dimensions



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	H	10	AL	120	E2	C1

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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