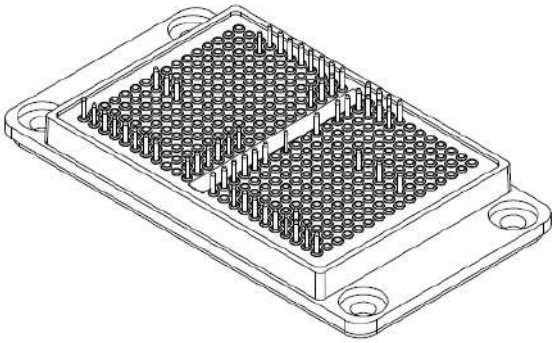
HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Features

- Neutral Point Clamped Three−Level Inverter Module
- Low Inductive Layout
- Solderable Pins



Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Low Conduction Losses Over Temperature

Applications

- Solar Inverters
- Uninterruptable Power Supplies Systems

HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Table 1 Absolute Maximum Ratings (Ta = 25 °C)

Parameter	Symbol	Value	Unit
IGBT (Q1, Q4)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage	V_{GE}	±23	V
Continuous Collector Current @ Tc = 75°C，T_j = 150°C	I_C	350	A
Pulsed Collector Current @ T_j = 150°C	I_{CP}	700	A
Junction Temperature	T_j	-40 to +175	°C
IGBT (Q2, Q3)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage	V_{GE}	±23	V
Continuous Collector Current @ Tc = 75°C，T_j = 150°C	I_C	350	A
Pulsed Collector Current @ T_j = 150°C	I_{CP}	700	A
Junction Temperature	T_j	-40 to +175	°C
DIODE (D1,D2,D3,D4)			
Peak Repetitive Reverse Voltage	V_{RRM}	1000	V
Continuous Forward Current @ Tc = 75°C，T_j = 150°C	I_F	131	A
Repetitive Peak Forward Current @ T_j = 150°C	I_{FRM}	262	A
Junction Temperature	T_j	-40 to +175	°C
DIODE (D5,D6)			
Peak Repetitive Reverse Voltage	V_{RRM}	1000	V
Continuous Forward Current @ Tc = 75°C，Tj = 150°C	I_F	131	A
Repetitive Peak Forward Current @ Tj = 150°C	I_{FRM}	262	A
Junction Temperature	T_j	-40 to +175	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz	Viso	4000	V_{RMS}
RECOMMENDED TEMPERATURE			
Storage Temperature	T_{stg}	-40 to +125	°C
Operating Temperature	T_{vjop}	-40 to +150	°C

HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Table 2 Characteristics Values

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
IGBT (Q1, Q4)							
Collector−Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, I_C = 600 A	T_j = 25°C	-	1.56	-	V
		V_{GE} = 15 V, I_C = 600 A	T_j= 150°C	-	1.88	-	
Gate−Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 9 mA	T_j = 25°C	-	3.87	-	V
Total Gate Charge	Q_g	V_{GE} = ±15 V, V_{CE} = 600 V	T_j = 25°C	-	1.93	-	µC
Gate-Source Leakage Current	I_{GES}	V_{GE} = 20 V, V_{CE} = 0 V	T_j = 25°C	-	-	1	µA
Collector−Emitter Voltage	$V_{(BR)CES}$	V_{GE} = 0 V	T_j = 25°C	1000	-	-	V
Collector−Emitter Cutoff Current	I_{CES}	V_{CE} = 1000 V, V_{GE} = 0 V	T_j = 25°C	-	-	100	µA
Input Capacitance	C_{iss}	V_{GE} = 0 V, V_{CE} = 20 V, f = 100 KHz	T_j = 25°C	-	28.7	-	nF
Output Capacitance	C_{oss}		T_j = 25°C	-	1.70	-	
Reverse Transfer Capacitance	C_{rss}		T_j = 25°C	-	0.27	-	
Turn-on Delay Time(inductive load)	$t_{d\ on}$	V_{GE} = -7 V / +15 V, V_{CE} = 675 V, I_C = 330 A, R_{Gon} = 0.5 Ω, R_{Goff} = 5.1 Ω	T_j = 25°C	-	100	-	ns
			T_j = 150°C	-	105	-	
Rise Time (inductive load)	t_r		T_j = 25°C	-	20	-	
			T_j = 150°C	-	25	-	
Turn-off Delay Time(inductive load)	$t_{d\ off}$		T_j = 25°C	-	1100	-	
			T_j = 150°C	-	1200	-	
Fall Time (inductive load)	t_f		T_j = 25°C	-	30	-	
			T_j = 150°C	-	35	-	
Turn-on Switching Loss	E_{on}		T_j = 25°C	-	10.7	-	mJ
			T_j = 150°C	-	16.66	-	
Turn-off Switching Loss	E_{off}		T_j = 25°C	-	8.5	-	
			T_j = 150°C	-	14.01	-	
Thermal Resistance − Chip−to−Case	R_{thJC}	Thermal grease, λ = 2.8 W/mK		-	0.099	-	°C/W

HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
DIODE (D5,D6)							
Diode Forward Voltage	V_F	I_F = 300 A	T_j = 25°C	-	2.26	-	V
		I_F = 300 A	T_j = 150°C	-	2.30	-	
Reverse Recovery Time	T_{RR}	V_{GE} = -7 V / +15 V, V_{CE} = 675 V, I_C = 330 A, R_{Gon} = 0.5 Ω, R_{Goff} = 5.1 Ω	T_j = 25°C	-	95	-	ns
			T_j = 150°C	-	200	-	
Reverse Recovery Charge	Q_{RR}		T_j = 25°C	-	14.5	-	µC
			T_j = 150°C	-	35.3	-	
Peak Reverse Recovery Current	I_{RRM}		T_j = 25°C	-	300	-	A
			T_j = 150°C	-	450	-	
Reverse Recovery Energy	E_{REC}		T_j = 25°C	-	5.25	-	mJ
			T_j = 150°C	-	11.75	-	
Thermal Resistance − Chip−to−Case	R_{thJC}	Thermal grease ,λ = 2.8 W/mK		-	0.243	-	°C/W
IGBT (Q2, Q3)							
Collector−Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, I_C = 600 A	T_j = 25°C	-	1.56	-	V
		V_{GE} = 15 V, I_C = 600 A	T_j = 150°C	-	1.88	-	
Gate−Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 9 mA	T_j = 25°C	-	3.87	-	V
Total Gate Charge	Q_g	V_{GE} = ±15 V, V_{CE} = 600 V	T_j = 25°C	-	1.93	-	µC
Gate-Source Leakage Current	I_{GES}	V_{GE} = 20 V, V_{CE} = 0 V	T_j = 25°C	-	-	100	nA
Collector−Emitter Voltage	$V_{(BR)CES}$	V_{GE} = 0 V	T_j = 25°C	1000	-	-	V
Collector−Emitter Cutoff Current	I_{CES}	V_{CE} = 1000 V, V_{GE} = 0 V	T_j = 25°C	-	-	100	µA
Input Capacitance	C_{iss}	V_{GE} = 0 V, V_{CE} = 20 V, f = 100KHz	T_j = 25°C	-	28.7	-	nF
Output Capacitance	C_{oss}		T_j = 25°C	-	1.70	-	
Reverse Transfer Capacitance	C_{rss}		T_j = 25°C	-	0.27	-	
Turn-on Delay Time(inductive load)	$t_{d\ on}$	V_{GE} = -7 V / +15 V, V_{CE} = 675 V, I_C = 330 A, R_{Gon} = 0.51 Ω, R_{Goff} = 5.1 Ω	T_j = 25°C	-	90	-	ns
			T_j = 150°C	-	100	-	
Rise Time (inductive load)	t_r		T_j = 25°C	-	25	-	
			T_j = 150°C	-	30	-	
Turn-off Delay Time(inductive load)	$t_{d\ off}$		T_j = 25°C	-	1120	-	
			T_j = 150°C	-	1250	-	

HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Fall Time (inductive load)	t_f	V_{GE} = -7 V / +15 V, V_{CE} = 675 V, I_C = 330 A, R_{Gon} = 0.51 Ω, R_{Goff} = 5.1 Ω	T_j = 25°C	-	28	-	ns
			T_j = 150°C	-	37	-	
Turn-on Switching Loss	E_{on}		T_j = 25°C	-	9.35	-	mJ
			T_j = 150°C	-	14.64	-	
Turn-off Switching Loss	E_{off}		T_j = 25°C	-	8.37	-	
			T_j = 150°C	-	14.75	-	
Thermal Resistance −Chip−to−Case	R_{thJC}	Thermal grease ,λ = 2.8 W/mK		-	0.099	-	°C/W

INVERSE DIODE (D1,D2,D3,D4)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	I_F = 300 A	T_j = 25°C	-	2.27	-	V
		I_F = 300 A	T_j = 150°C	-	2.30	-	
Reverse Recovery Time	T_{RR}	V_{GE} = -7 V / +15 V, V_{CE} = 675 V, I_C = 330 A, R_{Gon} = 0.51 Ω, R_{Goff} = 5.1 Ω	T_j = 25°C	-	100	-	ns
			T_j = 150°C	-	200	-	
Reverse Recovery Charge	Q_{RR}		T_j = 25°C	-	15	-	µC
			T_j = 150°C	-	36	-	
Peak Reverse Recovery Current	I_{RRM}		T_j = 25°C	-	280	-	A
			T_j = 150°C	-	350	-	
Reverse Recovery Energy	E_{REC}		T_j = 25°C	-	5.27	-	mJ
			T_j = 150°C	-	11.01	-	
Thermal Resistance −Chip−to−Case	R_{thJC}	Thermal grease ,λ = 2.8 W/mK		-	0.243	-	°C/W

HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Table 3 NTC-Thermistor

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Rated Resistance	R_{25}	T_C = 25°C	-	22	-	kΩ
Deviation of R100	△R/R	T_C = 100°C, R_{100} = 1486 Ω	-5	-	5	%
Power Dissipation	P25	TNTC = 25°C	-	-	20	mW
B-value	$B_{25/50}$	B (25/50), tolerance ±3%	-	3950	-	K
B-value	$B_{25/100}$	B (25/100), tolerance ±3%	-	3998	-	K

Table 4 Module Characteristics

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Stray Inductance	L_{CE}		-	15	-	nH
Mounting Torque Screw:M5	M		3.0	-	5.0	N.m
Creepage Distance		terminal to heatsink		11.5		
Clearance		terminal to heatsink		9.4		
CTI				≥600		
Flatness of base plate					0.3	mm
Weight				250		g

HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Typical Characteristics

Fig.1 Typical output characteristics IGBT
$I_C = f(V_{CE})$
V_{GE} = 15V (Q1, Q2, Q3, Q4)

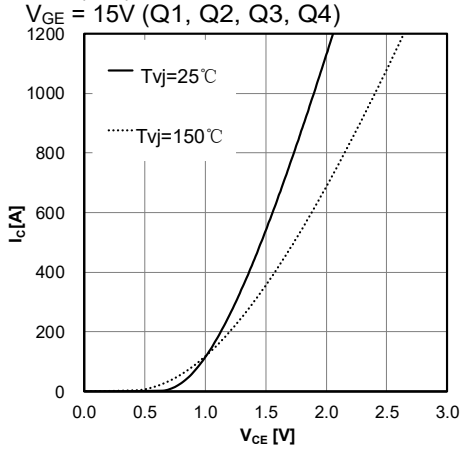


Fig.2 Typical output characteristics IGBT
Tvj = 150°C (Q1, Q2, Q3, Q4)

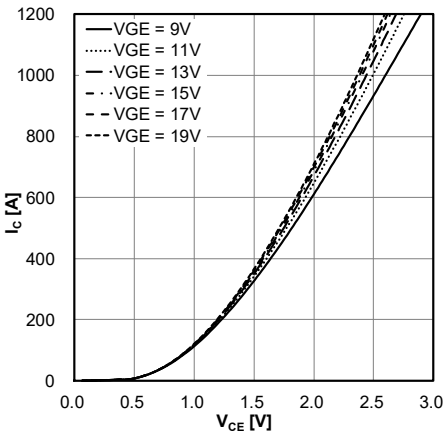


Fig.3 Body diode characteristics (D1, D2, D3, D4)

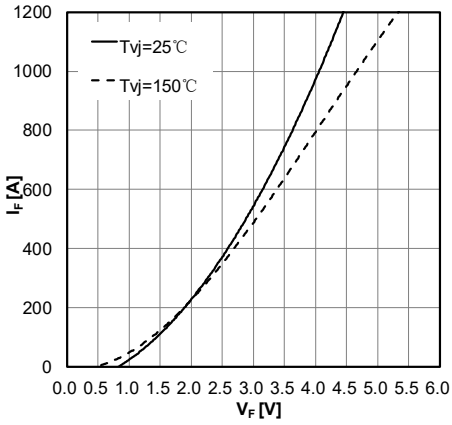


Fig.4 Transient thermal impedance (Q1, Q2, Q3, Q4)

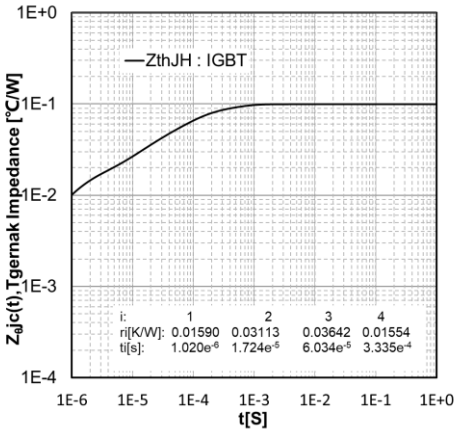


Fig.5 Capacity characteristic
$C = f(V_{CE})$, V_{GE} = 0 V, Tvj = 25°C, f = 100 KHz
(Q1, Q2, Q3, Q4)

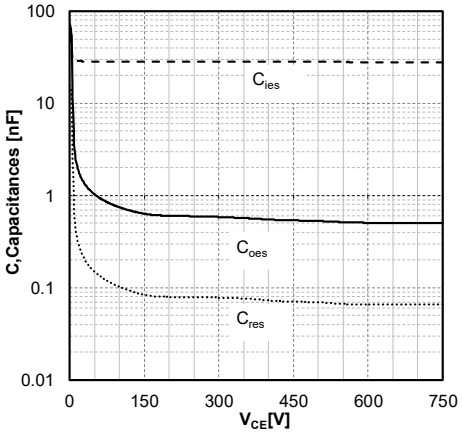
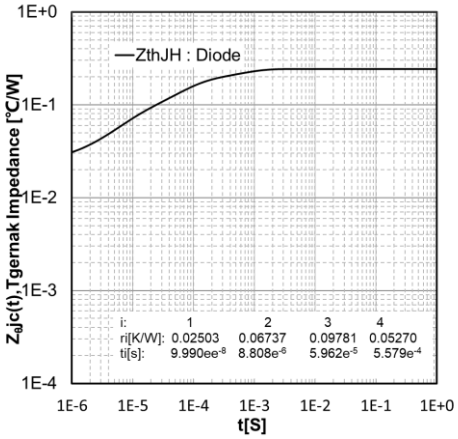


Fig.6 Transient thermal impedance (D1, D2, D3, D4)



HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Typical Characteristics

Fig.7 Diode forward characteristics (D5, D6)

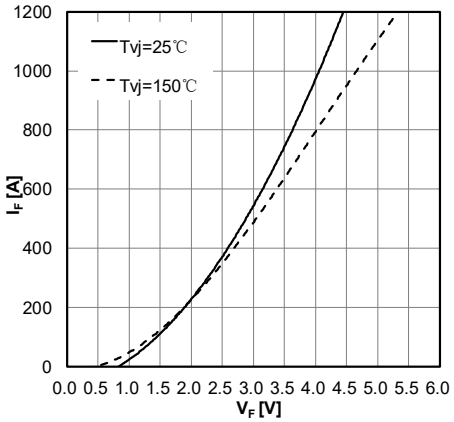
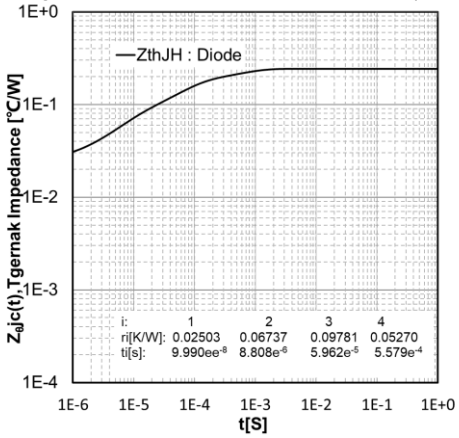


Fig.8 Transient thermal impedance (D5, D6)



Q1 || D5 or Q4 || D6

Fig.9 Switching losses IGBT, Inverter (typical)
E_{on} = f (I_C), E_{off} = f (I_C),
V_{GE} = +15 V / -7 V, R_{Gon} = 0.5 Ω, R_{Goff} = 5.1Ω
V_{CE} = 675 V

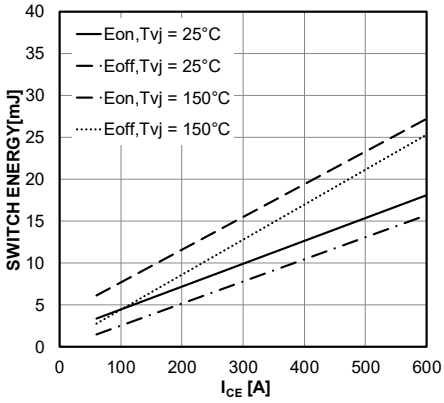


Fig.10 Switching losses IGBT, Inverter (typical)
E_{on} = f (R_G),
V_{GE} = +15 V / -7 V, I_C = 330 A, V_{CE} = 675 V

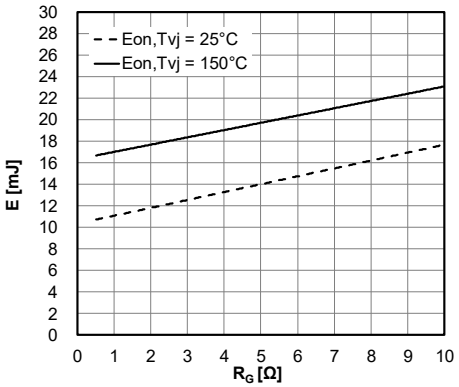


Fig.11 Switching losses IGBT, Inverter (typical)
E_{off} = f (R_G),
V_{GE} = +15 V / -7 V, I_C = 330 A, V_{CE} = 675 V

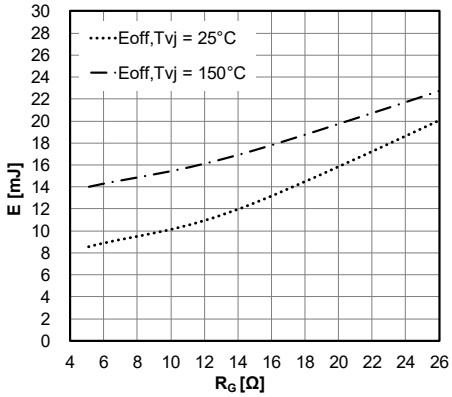
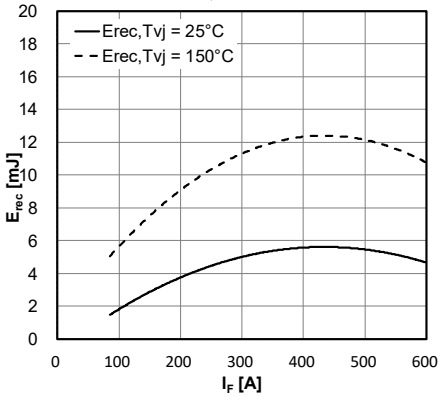


Fig.12 Switching losses IGBT, Inverter (typical)
E_{REC} = f (I_C),
V_{GE} = +15 V / -7 V, R_{Gon} = 0.5 Ω, V_{CE} = 675 V



HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Typical Characteristics

Q2||D3+D4 or Q3||D1+D2

Fig.13 Switching losses IGBT, Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$,
V_{GE} = +15 V / -7 V, R_{Gon} = 0.51 Ω, R_{Goff} = 5.1 Ω,
V_{CE} = 675 V

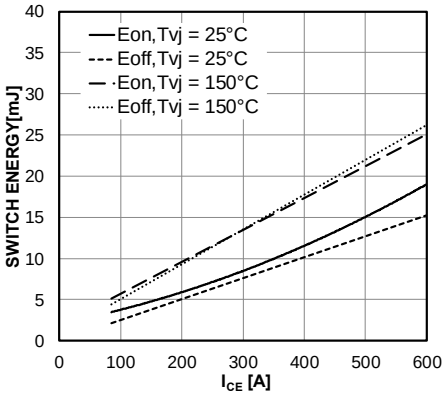


Fig.14 Switching losses IGBT, Inverter (typical)
$E_{on} = f(R_G)$,
V_{GE} = +15 V / -7 V, I_C = 330 A, V_{CE} = 675 V

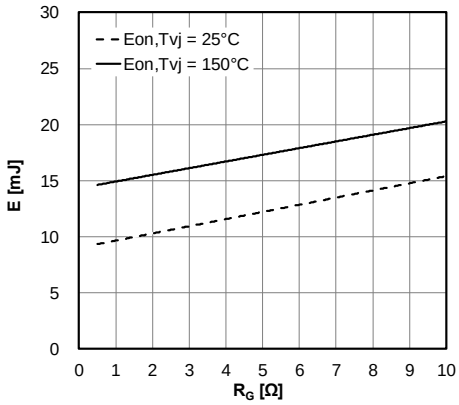


Fig.15 Switching losses IGBT,Inverter (typical)
$E_{off} = f(R_G)$,
V_{GE} = +15 V / -7 V, I_C = 330 A, V_{CE} = 675 V

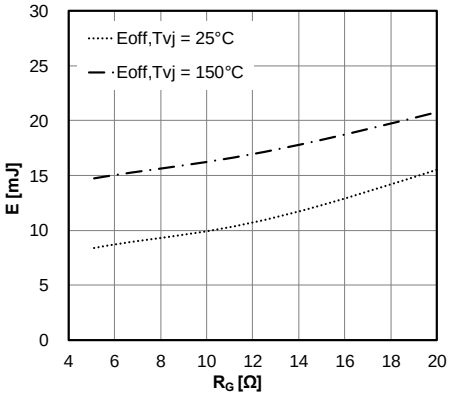


Fig.16 Switching losses IGBT, Inverter (typical)
$E_{REC} = f(I_C)$,
V_{GE} = +15 V / -7 V, R_{Gon} = 0.5 Ω, V_{CE} = 675 V

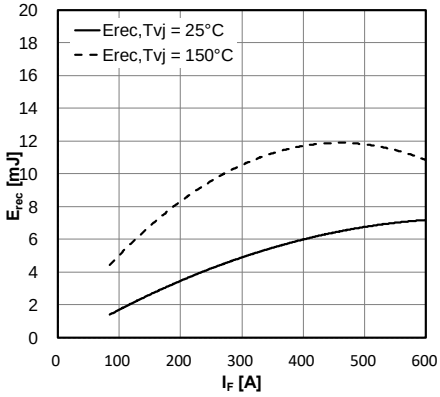


Fig.17 NTC-Thermistor-temperature characteristic (typical)

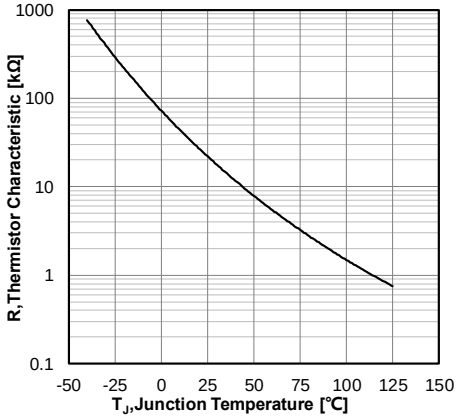
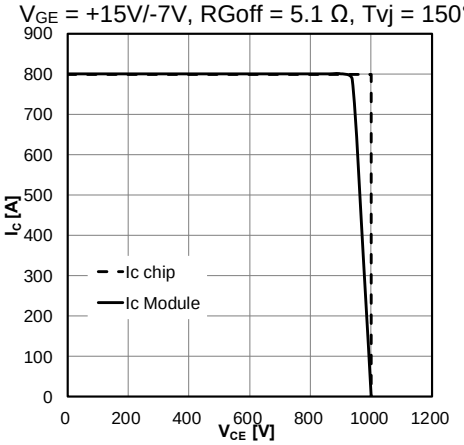


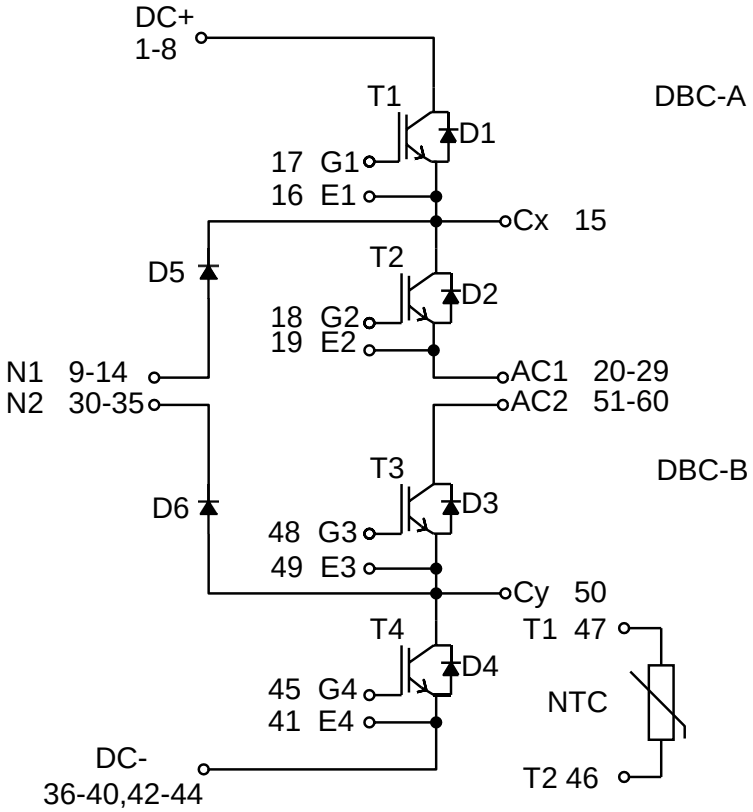
Fig.18 Reverse bias safe operating area IGBT, Inverter (RBSOA)
$I_c = f(V_{CE})$,
V_{GE} = +15V/-7V, RGoff = 5.1 Ω, Tvj = 150°C



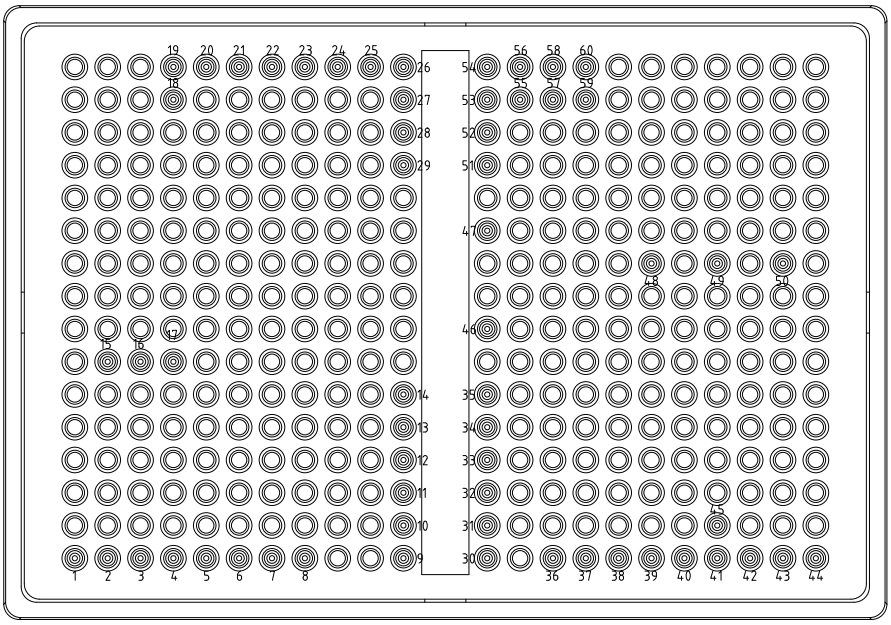
HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Circuit Diagram



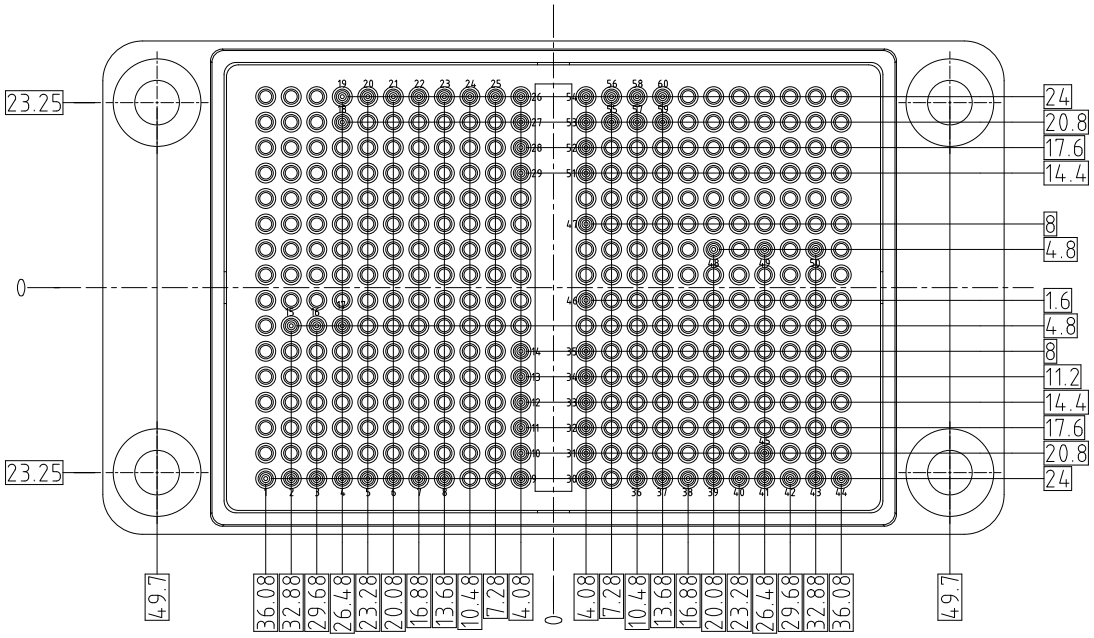
Pin Connections

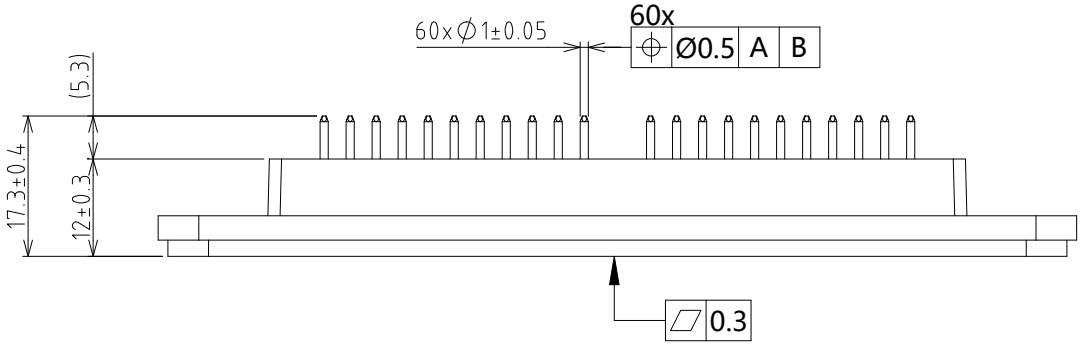


HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Package Outlines

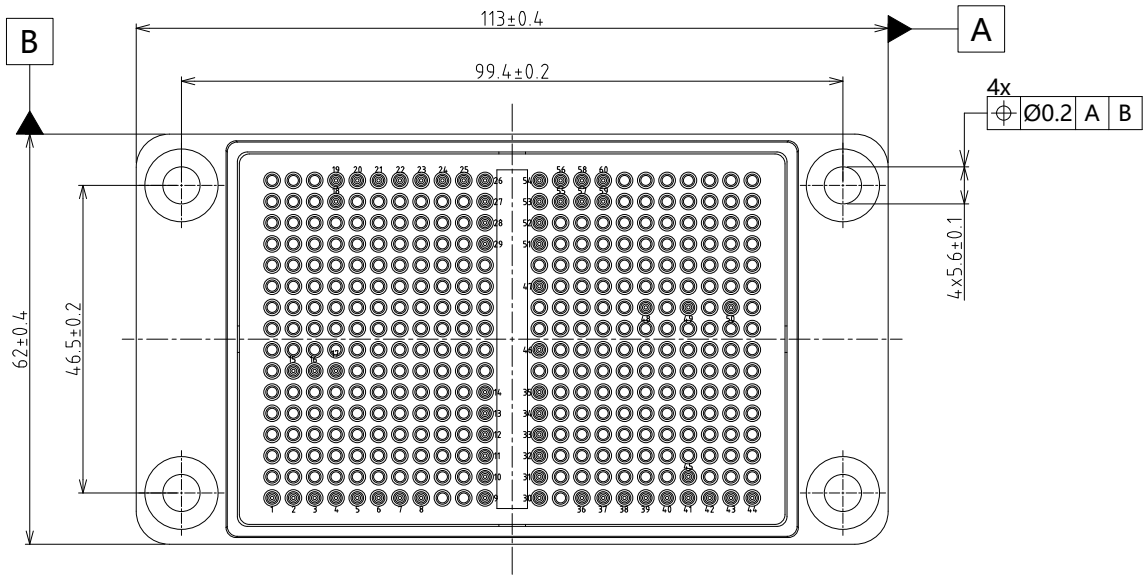




HCG600FL100E3F1

1000V / 600A E3 (size similar to Easy 3 with Cu Baseplate)

Package Outlines



Revision History

Document Version	Description of Changes
RevX.0.1	Released

Zhejiang HIITIO New Energy Co., Ltd
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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.