HCG600FH120D3E1

1200V / 600A D3（size similar to Econo Dual with Cu Baseplate）

Features

- Low $V_{CE(SAT)}$
- $V_{CE(SAT)}$ with positive temperature coefficient

Applications

- Inverter for motor drives AC and DC servo drives
- High power converters
- UPS systems

Table 1 Key Performance and Package Parameters

Type	V_{CE}	I_C (T_C= 85°C)	$V_{CE(SAT)}$ (T_{vj} = 25°C, I_C = 600A, V_{GE} = 15V)	T_{vjmax}	Package
IGBT	1200V	600A	1.59 V	175°C	D3

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Table 2 Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector emitter voltage	V_{CE}	T_{vj} = 25°C	1200	V
Continuous DC collector current	I_{CDC}	T_C = 85°C	600	A
Repetitive peak collector current	I_{CRM}	Tp=1ms	1200	
Continuous DC forward Current	I_F		600	A
Repetitive peak forward current	I_{FRM}	Tp=1ms	1200	A
I^2t-value	I^2t	Tp=10ms,V_R=0V, T_{vj} = 175°C	40000	A^2S
Gate Emitter voltage	V_{GE}	T_{vj} = 25°C	±20	V
Junction temperature	T_{vj}		-40 to +175	°C
Storage temperature	T_{stg}		-40 to +125	
Operating virtual junction temperature	T_{vjop}		150	°C

Table 3 Thermal Resistance

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
IGBT Thermal resistance junction - case	R_{thJC}	Per IGBT	-	0.069	-	°C / W
IGBT Thermal resistance case - heatsink	R_{thCH}	Thermal grease, λgrease= 0.67 W/(m*K)	-	0.062		°C / W
Diode Thermal resistance junction - case	R_{thJC}	Per diode	-	0.094	-	°C / W
Diode Thermal resistance case - heatsink	R_{thCH}	Thermal grease, λgrease= 0.67 W/(m*K)	-	0.059	-	°C / W

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Table 4 Static Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Collector emitter voltage	$V_{(BR)CES}$	T_{vj} = 25°C	1200	-	-	V
Collector emitter saturation voltage	V_{CEsat} (terminal)	V_{GE} = 15V, I_C = 600A T_{vj} = 25°C	-	1.59	-	V
		V_{GE} = 15V, I_C = 600A T_{vj} = 175°C	-	1.89	-	
	V_{CEsat} (chip)	V_{GE} = 15V, I_C = 600A, T_{vj} = 175°C	-	1.78	-	
Diode forward voltage	V_F (terminal)	V_{GE} = 0V, I_C = 600A T_{vj} = 25°C	-	1.74	-	V
		V_{GE} = 0V, I_C = 600A T_{vj} = 175°C	-	1.89	-	
	V_F (chip)	V_{GE} = 0V, I_C = 600A, T_{vj} = 175°C	-	1.78	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 12mA	-	5.8	-	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V T_{vj} = 25°C	-	-	100	uA
Gate-emitter leakage current	I_{GES}	V_{GE} = 20V, V_{CE} = 0V	-	-	100	nA
Input capacitance	C_{ies}	V_{GS} = 0 V V_{DS} = 25 V f = 100kHz	-	83.6	-	nF
Output capacitance	C_{oes}		-	2.4	-	
Reverse transfer capacitance	C_{res}		-	0.5	-	
Gate input resistance	R_G	f = 1M Hz	-	0.48	-	Ω
Gate charge	Q_G	V_{GE} = -15 V to 15 V V_{CE} = 600 V	-	4.0	-	μC

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Table 5 Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on delay time	t_{don}	T_{vj} = 25°C , V_{CC} = 600V, I_C = 600A , V_{GE} = -15/15V , $R_{G(on)}$=0.51Ω,$R_{G(off)}$= 0.51Ω	-	220	-	ns
Rise time	t_r		-	75	-	
Turn-off delay time	t_{doff}		-	440	-	
Fall time	t_f		-	158	-	
Turn-on energy	E_{on}		-	31	-	mJ
Turn-off energy	E_{off}		-	64	-	
Total switching energy	E_{ts}		-	95	-	
Turn-on delay time	t_{don}	T_{vj} = 175°C , V_{CC} = 600V, I_C = 600A , V_{GE} = -15/15V , $R_{G(on)}$= 0.51Ω,$R_{G(off)}$= 0.51Ω	-	378	-	ns
Rise time	t_r		-	99	-	
Turn-off delay time	t_{doff}		-	583	-	
Fall time	t_f		-	373	-	
Turn-on energy	E_{on}		-	69	-	mJ
Turn-off energy	E_{off}		-	96	-	
Total switching energy	E_{ts}		-	165	-	
Short circuit current	I_{SC}	T_{vj} = 175°C , V_{CC} = 800V,V_{GE} = 15V , V_{CEmax} = V_{CES} -L_{sCE}*di/dt T_P ≤ 6 us	-	1800	-	A

Table 6 Diode Recovery Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse recovery time	T_{rr}	T_{vj} = 25°C , V_{CC} = 600V, I_C = 600A , V_{GE} = -15/15V , $R_{G(on)}$ = 0.51Ω, $R_{G(off)}$ =0.51Ω	-	300	-	ns
Peak reverse recovery current	I_{rr}		-	400	-	A
Reverse recovery charge	Q_{rr}		-	48	-	μC
Reverse recovery energy	E_{rec}		-	19	-	mJ
Reverse recovery time	T_{rr}	T_{vj} = 175°C , V_{CC} = 600V, I_C = 600A , V_{GE} = -15/15V , $R_{G(on)}$ = 0.51Ω, $R_{G(off)}$ =0.51Ω	-	630	-	ns
Peak reverse recovery current	I_{rr}		-	360	-	A
Reverse recovery charge	Q_{rr}		-	113	-	μC
Reverse recovery energy	E_{rec}		-	40	-	mJ

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Table 7 Module Characteristics

Parameter	Symbol	Conditions	Value	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, t = 1min	3.4	kV
Material of module baseplate			Cu+Ni	
Internal isolation		Basic insulation	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	14.5	mm
Creepage distance	d_{Creep}	terminal to terminal	12	mm
Clearance	d_{Clear}	terminal to heatsink	11.5	mm
Clearance	d_{Clear}	terminal to terminal	10	mm
Mounting torque of screws to heat sink	Ms	M5	3.0-6.0	N·m
Mounting torque of screws to terminals	Mt	M6	3.0-6.0	N·m
Comparative tracking index	CTI		>175	

Table 8 NTC-Thermistor

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Rated resistance	R_{25}	T_{NTC} = 25°C	-	5	-	kΩ
Deviation of R100	△R/R	T_{NTC} = 100°C, R_{100} = 493 Ω	-5	-	5	%
B-value	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15K))]$	-	3375	-	K

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Characteristics Diagrams

Fig.1 Typical Output Characteristic, IGBT, Inverter
I_C= f (V_{CE}) / (terminal)
V_{GE} = 15V

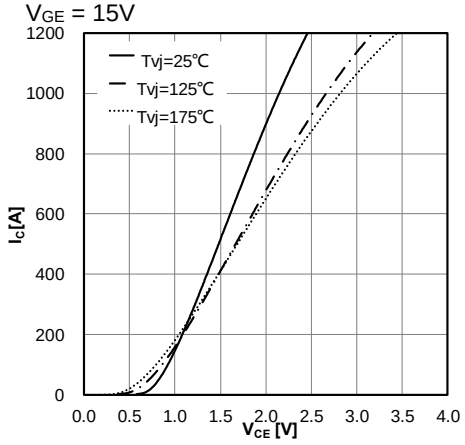


Fig.2 Typical Output Characteristic, IGBT, Inverter
I_C = f (V_{CE}) / (terminal)
T_{Vj} = 175°C

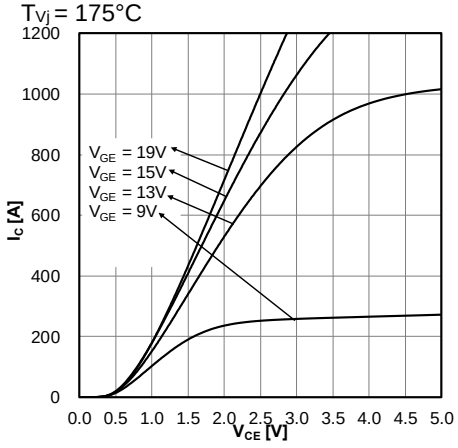


Fig.3 Typical Output Characteristic, IGBT, Inverter
I_C = f (V_{GE})
V_{CE} = 20V

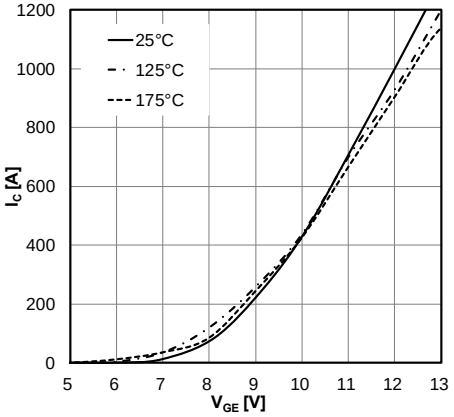


Fig.4 Switching losses, IGBT, Inverter
E = f(I_C)
R_{Goff} = 0.51Ω, R_{Gon} = 0.51Ω, V_{CE} = 600V, V_{GE} = ±15V

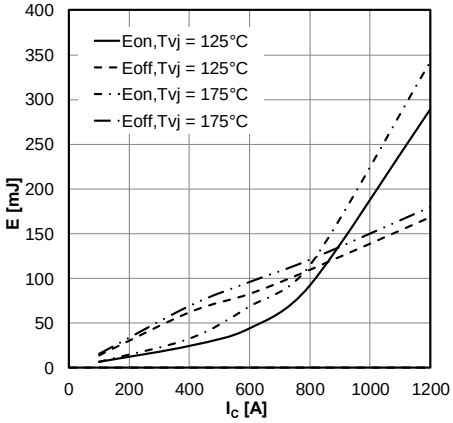


Fig.5 Switching losses, IGBT, Inverter
E = f (R_G)
I_C = 600A, V_{CE} = 600V, V_{GE} = ±15V

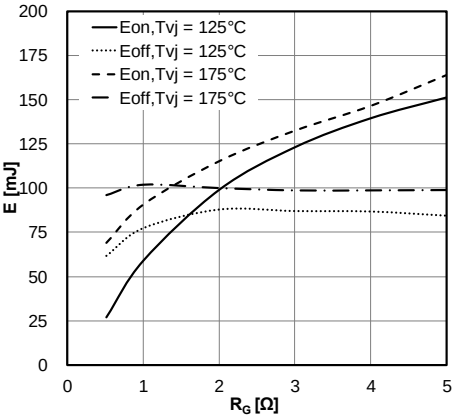
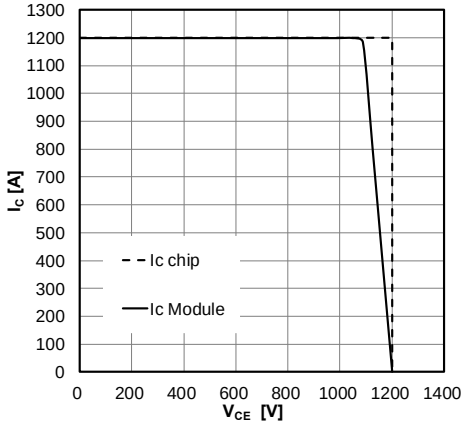


Fig.6 Reverse bias safe operating area (RBOSA), IGBT, Inverter
I_C = f (V_{CE})
R_{Goff} = 0.51Ω, V_{GE} = ±15V, T_{vj} = 175°C



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Characteristics Diagrams

Fig.7 Capacity characteristic, IGBT, Inverter
C= f (V_{CE})
f = 100 KHz, V_{GE} = 0V, T_{vj}= 25°C

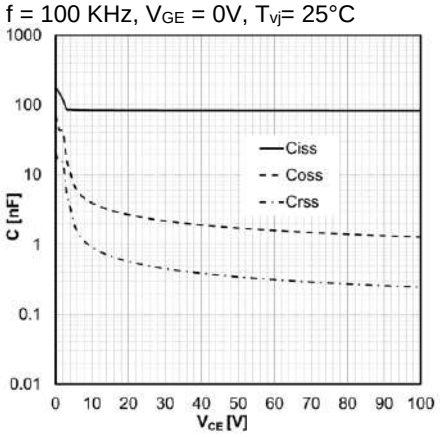


Fig.8 Temperature characteristic, NTC - Thermistor

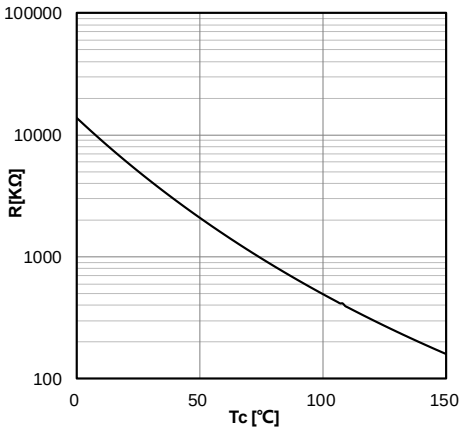


Fig.9 Forward characteristic, Diode, Inverter
I_F = f (V_F) / (terminal)

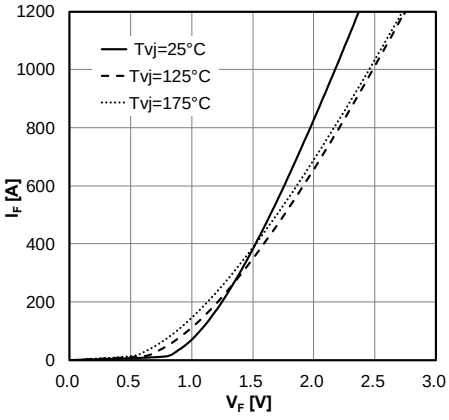


Fig.10 Switching losses, Diode, Inverter
E_{rec} = f (I_F)
V_{CE} = 600V, R_{Goff} = 0.51Ω, R_{Gon} = 0.51Ω, V_{GE} = ±15V

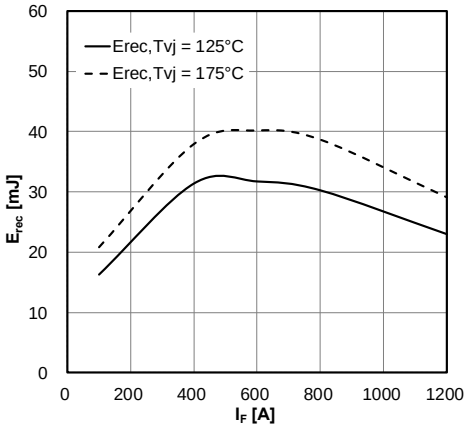
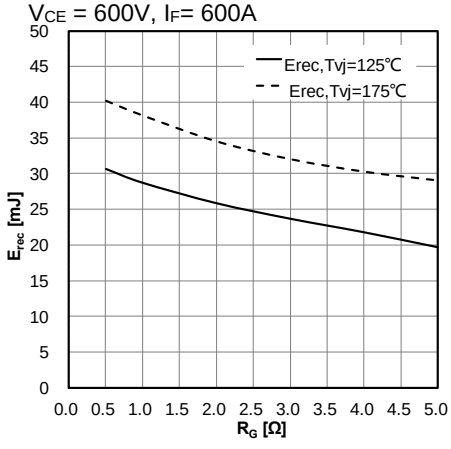


Fig.11 Switching losses, Diode, Inverter
E_{rec} = f (R_G)
V_{CE} = 600V, I_F= 600A



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Characteristics Diagrams

Fig.12 Transient thermal impedance IGBT, Inverter
Z_{thJC} = f (t)

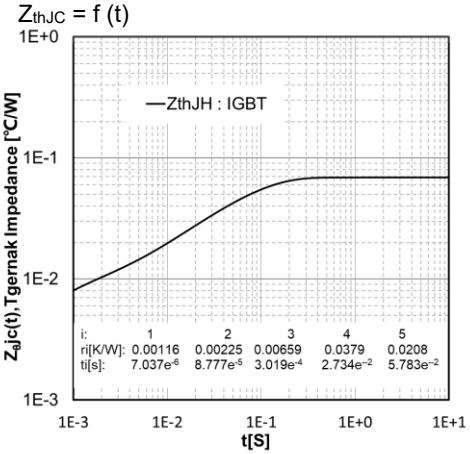
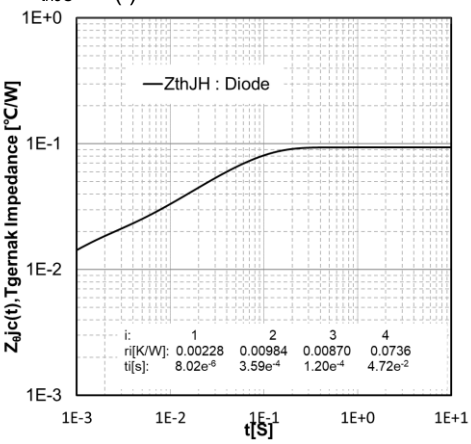


Fig.13 Transient thermal impedance Diode, Inverter
Z_{thJC} = f (t)



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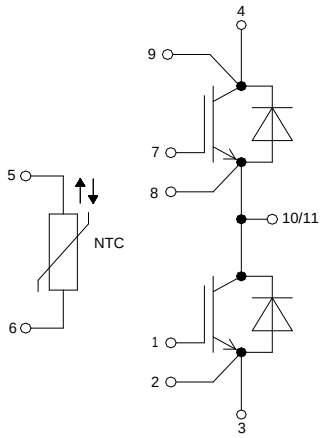
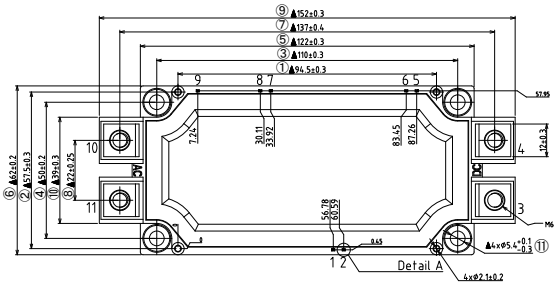
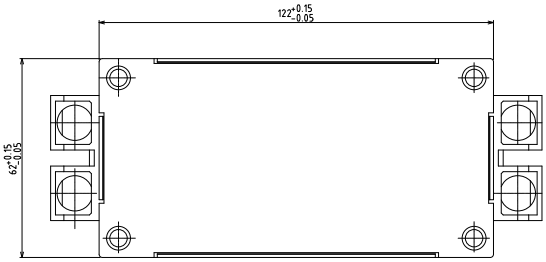
Package Information

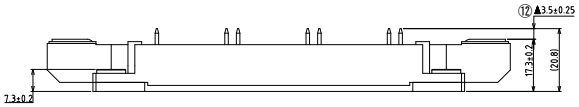
Circuit Diagram

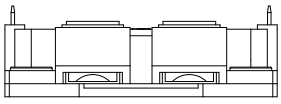


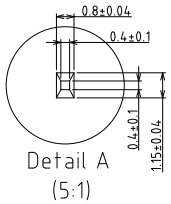
Package Outlines











Revision History

Document Version	Description of Changes
RevX.0.1	Released

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