HCG600FH120D3E1EA

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	$V_{CE(SAT)}$ (T_{vj} = 25°C, I_C = 600A, V_{GE} = 15V)	T_{vjmax}	Package
IGBT	1200V	600A	1.50V	175°C	D3

Table 2 Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Conditions	Value	Unit
Collector emitter voltage	V_{CE}	T_{vj} = 25°C	1200	V
Continuous DC collector current	I_{CDC}	T_C = 70°C	600	A
Repetitive peak collector current	I_{CRM}	Tp=1ms	1200	A
Continuous DC forward current	I_F		600	A
Repetitive peak forward current	I_{FRM}	Tp=1ms	1200	A
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	°C
Operating virtual junction temperature	T_{vjop}		-40 to +150	°C

HCG600FH120D3E1EA

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

Table 3 Thermal Resistance

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
IGBT Thermal resistance junction - case	R_{thJC}	Per IGBT	-	0.07	-	°C / W
Diode Thermal resistance junction - case	R_{thJC}	Per diode	-	0.10	-	°C / W

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	-	1.50	-	V
		V_{GE} = 15V, I_C = 600A, T_{vj} = 175°C	-	1.82	-	
	V_{CEsat} (Chip)	V_{GE} = 15V, I_C = 600A, T_{vj} = 25°C	-	1.40	-	
		V_{GE} = 15V, I_C = 600A, T_{vj} = 175°C	-	1.70	-	
Diode forward voltage	V_F (terminal)	V_{GE} = 0V, I_C = 600A, T_{vj} = 25°C	-	1.75	-	V
		V_{GE} = 0V, I_C = 600A, T_{vj} = 175°C	-	1.70	-	
	V_F (Chip)	V_{GE} = 0V, I_C = 600A, T_{vj} = 25°C	-	1.70	-	
		V_{GE} = 0V, I_C = 600A, T_{vj} = 175°C	-	1.60	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 18mA	5.00	5.60	6.20	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} = ±20, V_{CE} = 0V,	-100	-	100	nA
Input capacitance	C_{ies}	V_{GE} = 0 V, V_{CE} = 25 V, f = 100kHz	-	106	-	nF
Output capacitance	C_{oes}		-	2.3	-	
Reverse transfer capacitance	C_{res}		-	0.49	-	
Gate input resistance	R_G	f = 1M Hz	-	0.5	-	Ω
Gate charge	Q_G	V_{GE} = -15 V to 15 V, V_{CE} = 600 V	-	4.36	-	μC

HCG600FH120D3E1EA

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

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		-	72	-	
Turn-off delay time	t_{doff}		-	590	-	
Fall time	t_f		-	200	-	
Turn-on energy	E_{on}		-	17.7	-	mJ
Turn-off energy	E_{off}		-	74.0	-	
Total switching energy	E_{ts}		-	91.7	-	
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	-	250	-	ns
Rise time	t_r		-	90	-	
Turn-off delay time	t_{doff}		-	725	-	
Fall time	t_f		-	385	-	
Turn-on energy	E_{on}		-	39.7	-	mJ
Turn-off energy	E_{off}		-	104	-	
Total switching energy	E_{ts}		-	143.7	-	
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	-	312	-	ns
Peak reverse recovery current	I_{rrm}		-	324	-	A
Reverse recovery charge	Q_{rr}		-	36.8	-	μC
Reverse recovery energy	E_{rec}		-	20.6	-	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	-	527	-	ns
Peak reverse recovery current	I_{rrm}		-	460	-	A
Reverse recovery charge	Q_{rr}		-	93.1	-	μC
Reverse recovery energy	E_{rec}		-	43.2	-	mJ

HCG600FH120D3E1EA

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

Table 7 Module characteristics

Parameter	Symbol	Conditions	Value	Typ
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	
Mounting torque of screws to heat sink	M	M5	3.0-6.0	N·m
Mounting torque of screws to terminals	M	M6	3.0-6.0	N·m
Creepage distance	d_{Creep}	terminal to heatsink	15.0	mm
Creepage distance	d_{Creep}	terminal to terminal	13.0	mm
Clearance	d_{Clear}	terminal to heatsink	12.5	mm
Clearance	d_{Clear}	terminal to terminal	10.0	mm
Comperative tracking index	CTI		>200	

Table 8 NTC-Thermistor

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Rated resistance	R25	TC = 25°C	-	5	-	kΩ
Deviation of R100	△R/R	TC = 100°C, R100 = 493 Ω	-5	-	5	%
B-value	B25/50	R2 = R25 exp [B25/50(1/T2 1/(298,15K))]	-	3375	-	K

HCG600FH120D3E1EA

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

Characteristics Diagrams

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

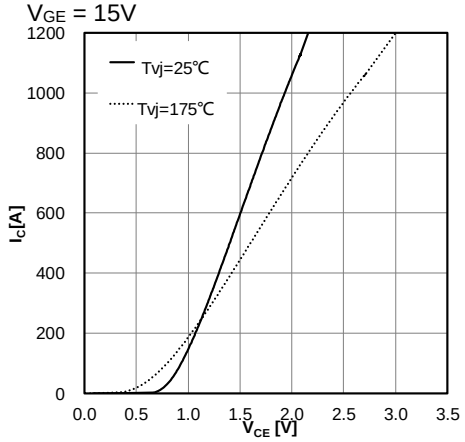


Fig.2 Typical Output Characteristic, IGBT, Inverter
I_C = f(V_{CE}) / (terminal)
T_{Vj} = 175°C

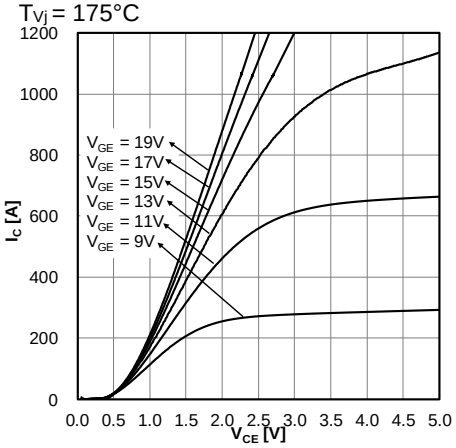


Fig.3 Typical Output Characteristic, IGBT, Inverter
I_C = f(V_{GE})
V_{CE} = 20V

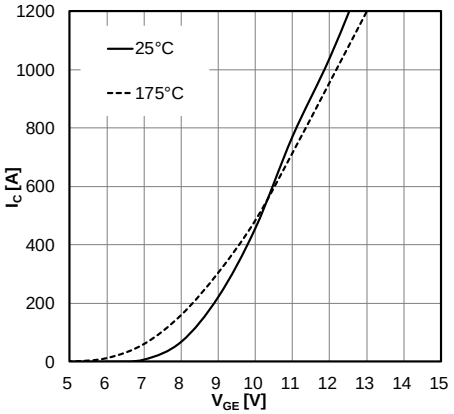


Fig.4 Switching losses, IGBT, Inverter
E = f(I_C)
R_{Goff} = 0.51Ω, R_{Gon} = 0.51Ω, V_{CE} = 600V, V_{GE} = ±15V

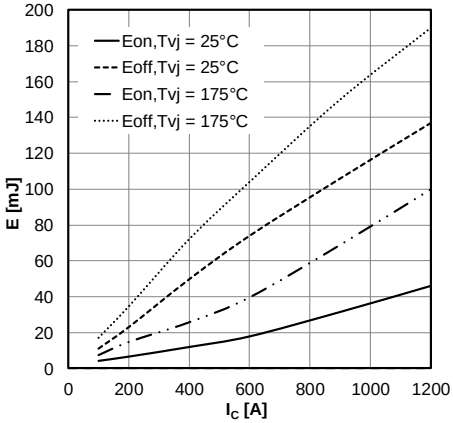


Fig.5 Switching losses, IGBT, Inverter
E = f(R_G)
I_C = 600A, V_{CE} = 600V, V_{GE} = ±15V

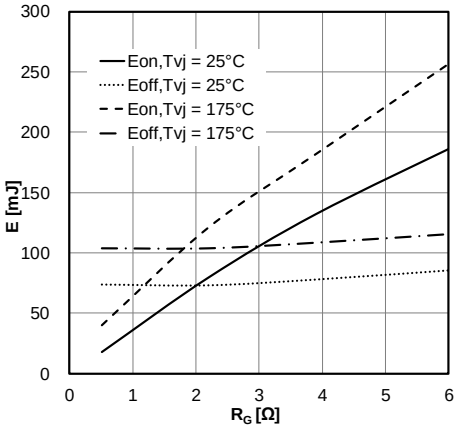
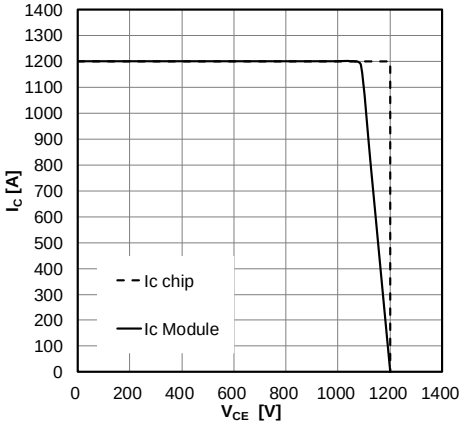


Fig.6 Reverse bias safe operating area(RBOSA), IGBT, Inverter
I_C = f(V_{CE})
R_{Goff} = 0.51Ω, V_{GE} = ±15V, T_{vj} = 175°C



HCG600FH120D3E1EA

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

Characteristics Diagrams

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

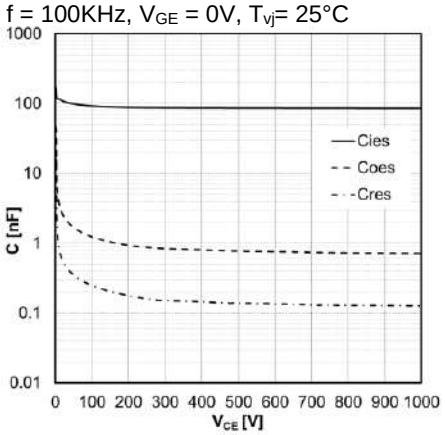


Fig.8 Transient thermal impedance IGBT, Inverter
$Z_{thJC} = f(t)$

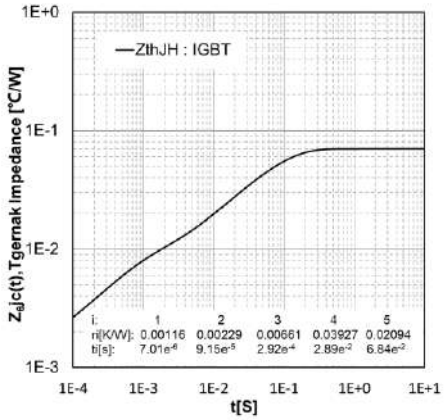


Fig.9 Forward characteristic, Diode, Inverter
$I_F = f(V_F)$ / (terminal)

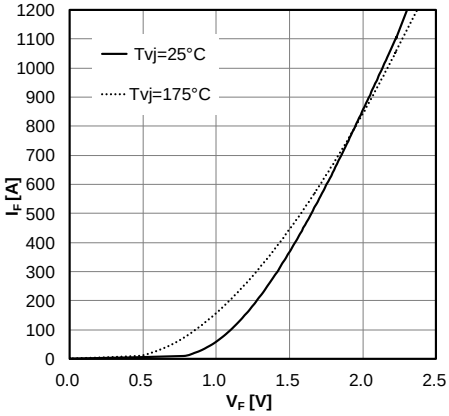


Fig.10 Switching losses, Diode, Inverter
$E_{rec} = f(I_F)$
V_{CE} = 600V, R_{Goff} = 0.51Ω, R_{Gon} = 0.51Ω, V_{GE} = ±15V

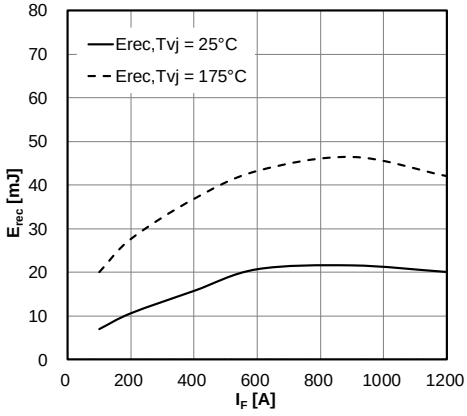


Fig.11 Switching losses, Diode, Inverter
$E_{rec} = f(R_G)$
V_{CE} = 600V, I_F= 600A

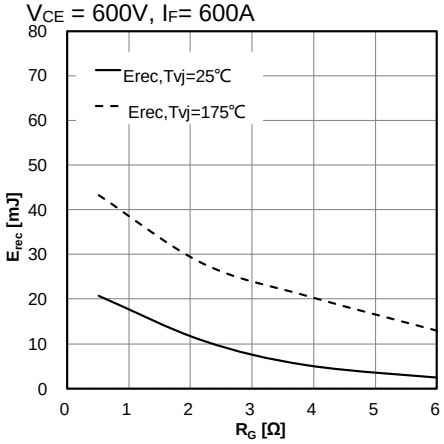
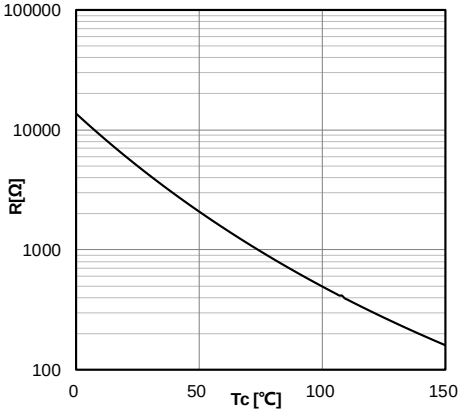


Fig.12 Temperature characteristic, NTC - Thermistor

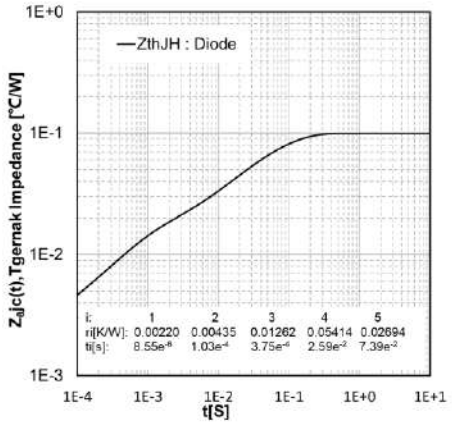


HCG600FH120D3E1EA

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

Characteristics Diagrams

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



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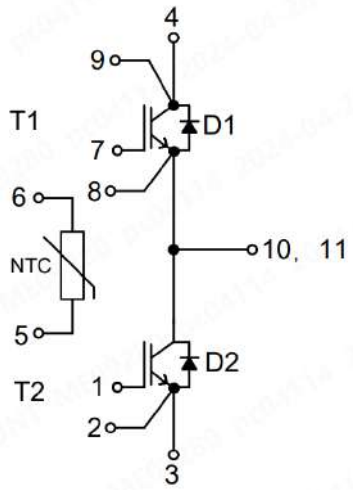
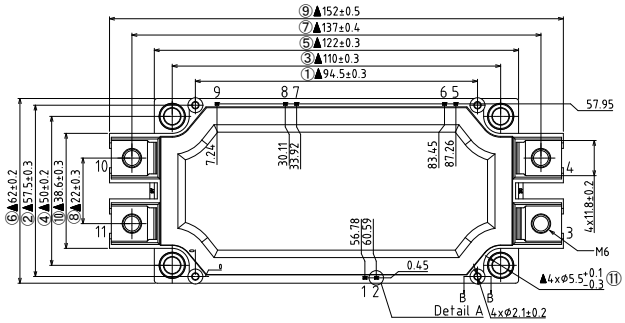
1200V / 600A D3（size similar to Econo Dual with Cu Baseplate）

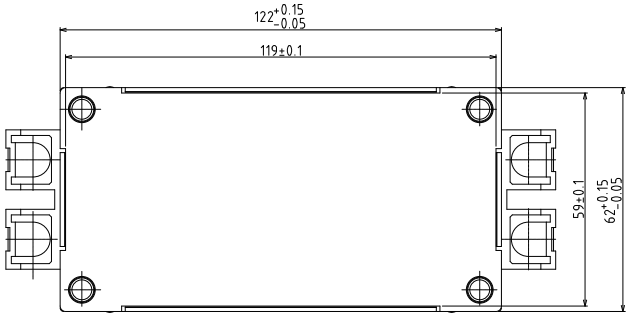
Package Information

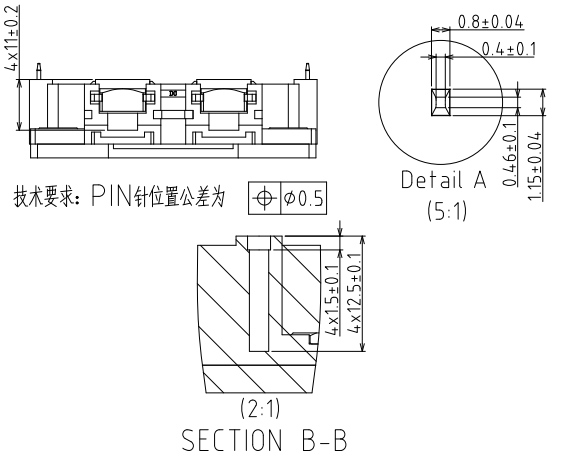
Circuit Diagram



Package Outlines







Revision History

Document Version	Description of Changes
RevX.0.1	Released

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