

HCG450FH120A2E1

1200V / 450A 62 mm with Cu Baseplate

Features

- V_{CEsat} with positive temperature coefficient
- High power density
- High creepage and clearance distances

Applications

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



Table 1 Key Performance and Package Parameters

Type	V_{CES}	I_c ($T_F = 80^\circ\text{C}$)	$V_{CE\ sat}$ ($T_j = 25^\circ\text{C}$, $I_c = 450\text{A}$, $V_{GE} = 15\text{V}$)	T_{vjmax}	Package
IGBT	1200V	450A	1.75V	175°C	62

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

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CES}	1200	V
Gate-emitter peak voltage	V_{GE}	± 20	V
Implemented collector current	I_{CN}	450	A
Continuous DC collector current ($T_F = 80^{\circ}\text{C}$)	I_C	450	A
Repetitive peak collector current	I_{CRM}	900	A
Maximum junction temperature	T_{vjmax}	-40 to +175	$^{\circ}\text{C}$
Temperature under switching conditions	T_{vjop}	-40 to +150	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-40 to +125	$^{\circ}\text{C}$

Table 3 Thermal Resistance

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
IGBT thermal resistance junction - case	R_{thJC}	Per IGBT	-	0.069	-	$^{\circ}\text{C} / \text{W}$
Diode thermal resistance junction - case	R_{thJC}	Per diode	-	0.090	-	$^{\circ}\text{C} / \text{W}$

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Table 4 Characteristics values

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Collector emitter voltage	$V_{(BR)CES}$	$V_{GE} = 0V$	$T_{vj} = 25^{\circ}C$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V,$ $I_C = 450A$	$T_{vj} = 25^{\circ}C$	-	1.75	-	V
		$V_{GE} = 15V,$ $I_C = 450A$	$T_{vj} = 150^{\circ}C$	-	2.20	-	
Diode forward voltage	V_F	$V_{GE} = 0V,$ $I_C = 450A$	$T_{vj} = 25^{\circ}C$	-	1.81	-	V
		$V_{GE} = 0V,$ $I_C = 450A$	$T_{vj} = 150^{\circ}C$	-	1.85	-	
Gate-emitter threshold voltage	$V_{GS(th)}$	$V_{CE} = V_{GE},$ $I_C = 14mA$	$T_{vj} = 25^{\circ}C$	-	5.65	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 1200V,$ $V_{GE} = 0V$	$T_{vj} = 25^{\circ}C$	-	-	100	uA
Gate-emitter leakage current	I_{GES}	$V_{GE} = 20V,$ $V_{CE} = 0V$	$T_{vj} = 25^{\circ}C$	-	-	100	nA
Input capacitance	C_{ies}	$V_{CE} = 25V,$ $V_{GE} = 600V,$ $f = 100\text{ kHz}$	$T_{vj} = 25^{\circ}C$	-	46.39	-	nF
Output capacitance	C_{oss}		$T_{vj} = 25^{\circ}C$	-	0.67	-	
Reverse transfer capacitance	C_{rss}		$T_{vj} = 25^{\circ}C$	-	0.15	-	
Gate input resistance	R_G	$f = 1MHz$	$T_{vj} = 25^{\circ}C$	-	1.70	-	Ω
Gate charge	Q_g	$V_{GE} = \pm 15\text{ V}$ $V_{CE} = 600\text{ V}$	$T_{vj} = 25^{\circ}C$	-	3.21	-	μC
Turn-on delay time (inductive load)	$t_{d\ on}$	$V_{CE} = 600V,$ $I_C = 450A\text{ ,}$ $V_{GE} = \pm 15\text{ V ,}$ $R_{Gon} = 1\Omega,$ $R_{Goff} = 1\Omega$	$T_{vj} = 25^{\circ}C$	-	260	-	ns
Rise time (inductive load)	t_r		$T_{vj} = 150^{\circ}C$	-	300	-	
			$T_{vj} = 25^{\circ}C$	-	47	-	
Turn-off delay time (inductive load)	$t_{d\ off}$		$T_{vj} = 150^{\circ}C$	-	66	-	
			$T_{vj} = 25^{\circ}C$	-	335	-	
Fall time (inductive load)	t_f		$T_{vj} = 150^{\circ}C$	-	380	-	
			$T_{vj} = 25^{\circ}C$	-	163	-	
Turn - on switching loss	E_{on}		$T_{vj} = 150^{\circ}C$	-	230	-	
			$T_{vj} = 25^{\circ}C$	-	28.6	-	
Turn - off switching loss	E_{off}		$T_{vj} = 150^{\circ}C$	-	58.0	-	
			$T_{vj} = 25^{\circ}C$	-	28.4	-	
Total switching energy loss	E_{ts}		$T_{vj} = 150^{\circ}C$	-	39.6	-	
			$T_{vj} = 25^{\circ}C$	-	57.0	-	
				$T_{vj} = 150^{\circ}C$	-	97.6	-
Short circuit current	I_{SC}	$V_{CE} = 800V,$ $V_{GE} \leq 15V\text{ ,}$ $V_{CEmax} =$ $V_{CES} - L_{sCE} * di/dt$	$T_P \leq 6\text{ us,}$ $T_{vj} = 150^{\circ}C$	-	1400	-	A

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Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Reverse recovery time	T _{rr}	V _{CE} = 600V, I _{CE} = 450A , V _{GE} = ±15 , R _{Gon} = 1Ω, R _{Goff} = 1Ω	T _{vj} = 25°C	-	210	-	ns
			T _{vj} = 150°C	-	405	-	
Peak reverse recovery current	I _{RM}		T _{vj} = 25°C	-	243	-	A
			T _{vj} = 150°C	-	210	-	
Reverse recovery charge	Q _{rr}		T _{vj} = 25°C	-	16.6	-	μC
			T _{vj} = 150°C	-	49.7	-	
Reverse recovery energy	E _{rec}		T _{vj} = 25°C	-	4.8	-	mJ
			T _{vi} = 150°C	-	16.9	-	

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Table 5 Module

Parameter	Symbol	Value	Unit	Unit Conditions
Isolation test voltage	V _{ISOL}	4.0	kV	RMS, f = 50 Hz, t = 1min
Material of module baseplate		Cu+Ni		
Internal isolation		Improved Al ₂ O ₃ ceramic		Basic insulation
Mounting torque of screws to heat sink	M _s	3.0-6.0	N·m	M5
Mounting torque of screws to terminals	M _t	2.5-5.0	N·m	M6
Comparative tracking index	CTI	>175		

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Characteristics Diagrams

Fig.1 Typical Output Characteristic, IGBT, Inverter

$$I_C = f(V_{CE})$$

$$V_{GE} = 15V$$

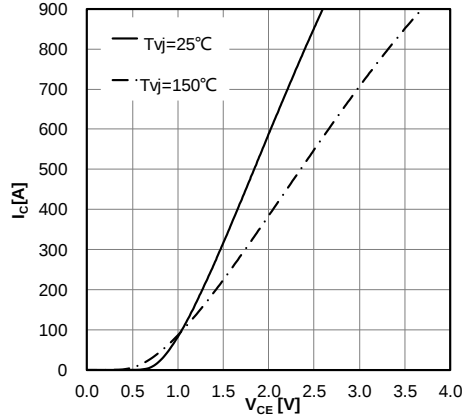


Fig.2 Typical Output Characteristic, IGBT, Inverter

$$I_C = f(V_{CE})$$

$$T_{vj} = 150^{\circ}C$$

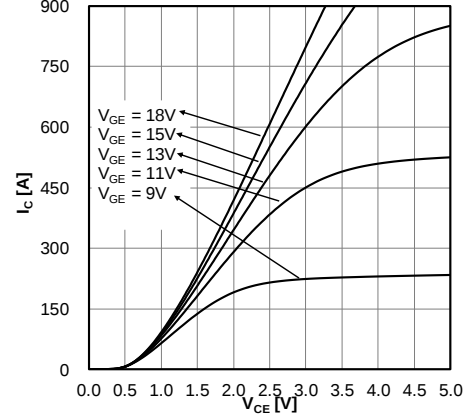


Fig.3 Typical Output Characteristic, IGBT, Inverter

$$I_C = f(V_{GE})$$

$$V_{CE} = 20V$$

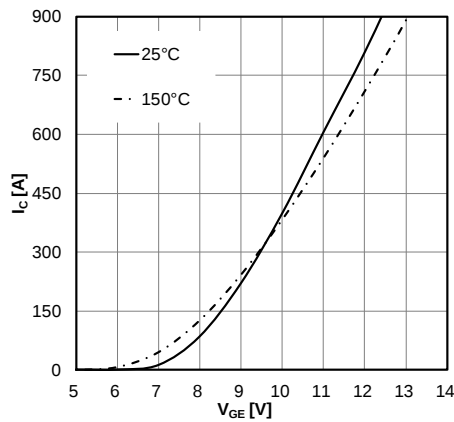


Fig.4 Switching losses, IGBT, Inverter

$$E = f(I_C)$$

$$R_{Goff} = 1.0 \Omega, R_{Gon} = 1.0 \Omega, V_{CE} = 600V, V_{GE} = \pm 15V$$

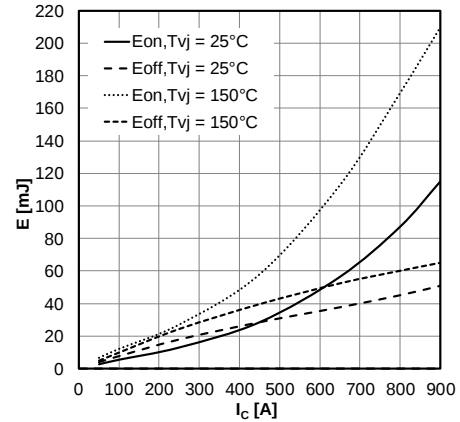


Fig.5 Switching losses, IGBT, Inverter

$$E = f(R_G)$$

$$I_C = 450A, V_{CE} = 600V, V_{GE} = \pm 15V$$

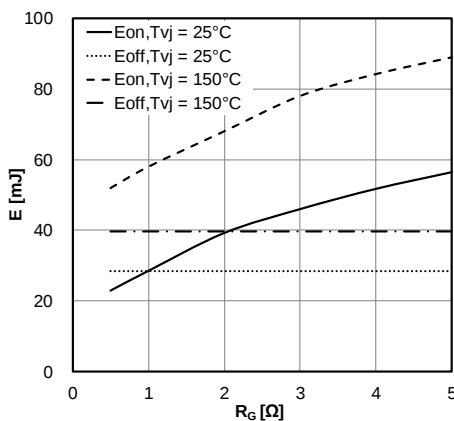
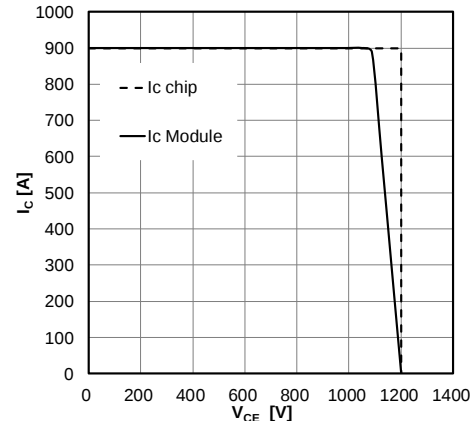


Fig.6 Reverse bias safe operating area(RBOSA), IGBT, Inverter

$$I_C = f(V_{CE})$$

$$R_{Goff} = 1.0 \Omega, V_{GE} = \pm 15V, T_{vj} = 150^{\circ}C$$



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Characteristics diagrams

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

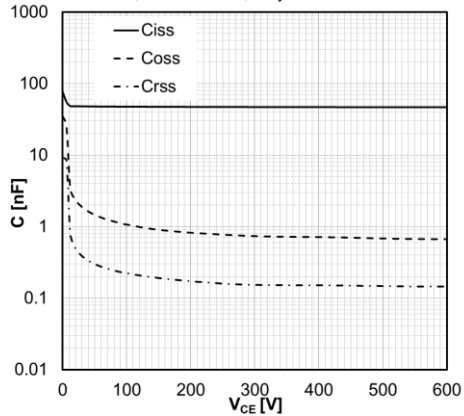


Fig.8 Transient thermal impedance IGBT, Inverter
 $Z_{thJC} = f(t)$

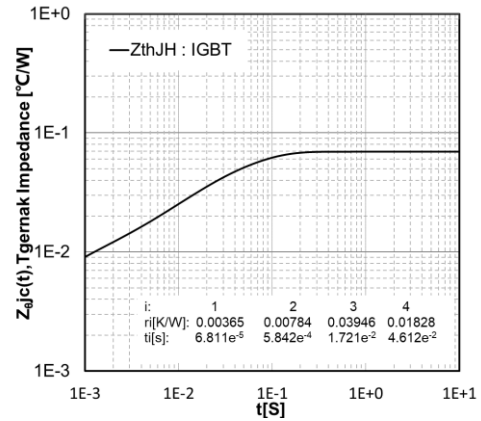


Fig.9 Forward characteristic, Diode, Inverter
 $I_F = f(V_F)$

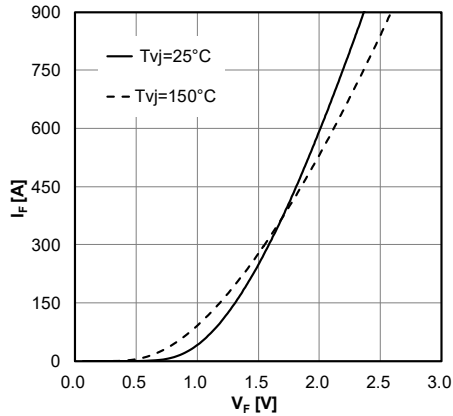


Fig.10 Switching losses, Diode, Inverter
 $E_{rec} = f(I_F)$

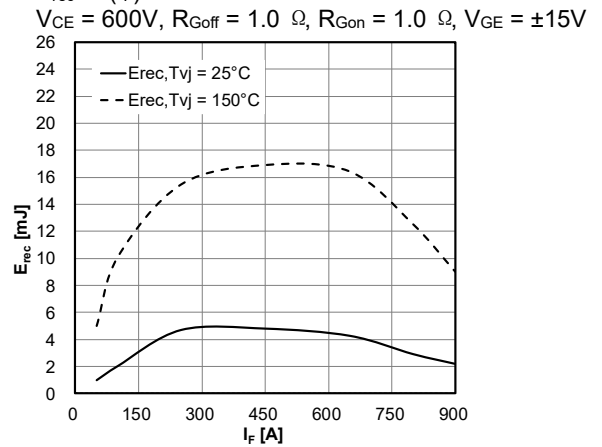


Fig.11 Switching losses, Diode, Inverter
 $E_{rec} = f(R_G)$
 $V_{CE} = 600\text{V}$, $I_F = 450\text{A}$

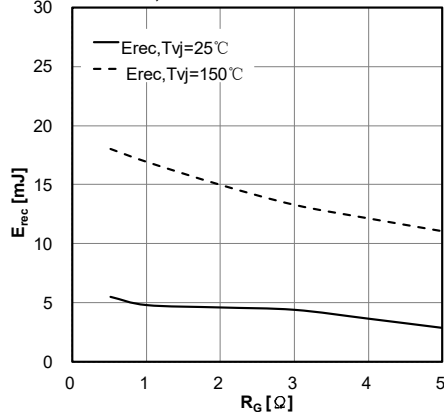
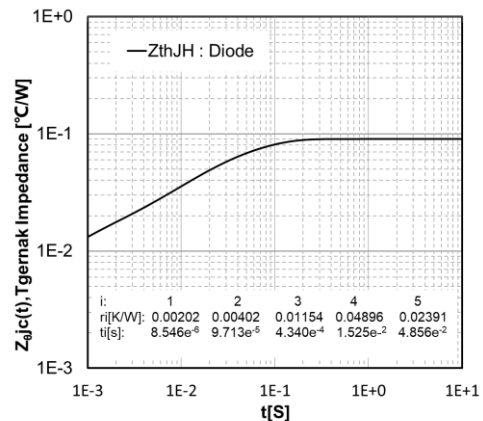


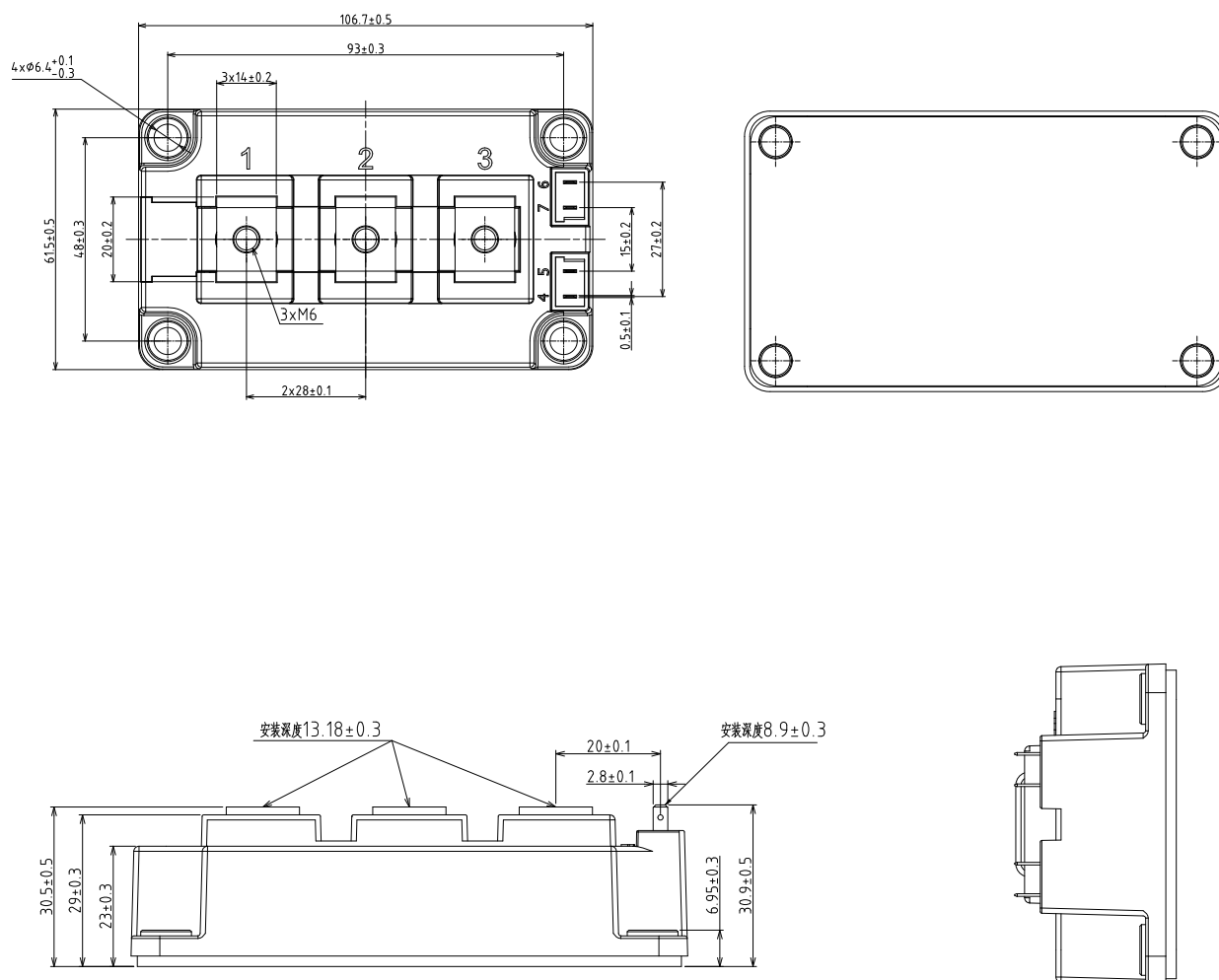
Fig.12 Transient thermal impedance Diode, Inverter
 $Z_{thJC} = f(t)$



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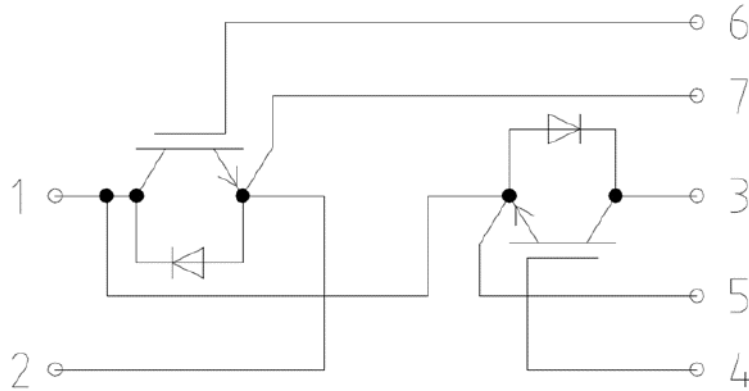
Package Outlines



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Circuit Diagram



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Revision History

Document Version	Description of Changes
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