

## HCG75FP120M3D1

1200V/75A PIM IGBT Module

### Description



### Features

- 1200V 75A,  $V_{CE(sat)}(typ.) = 2.10V$
- Lower losses and higher energy
- Excellent short circuit ruggedness
- PIM module

### Applications

- Inverter
- Power supply
- Motion/servo control

### Circuit diagram

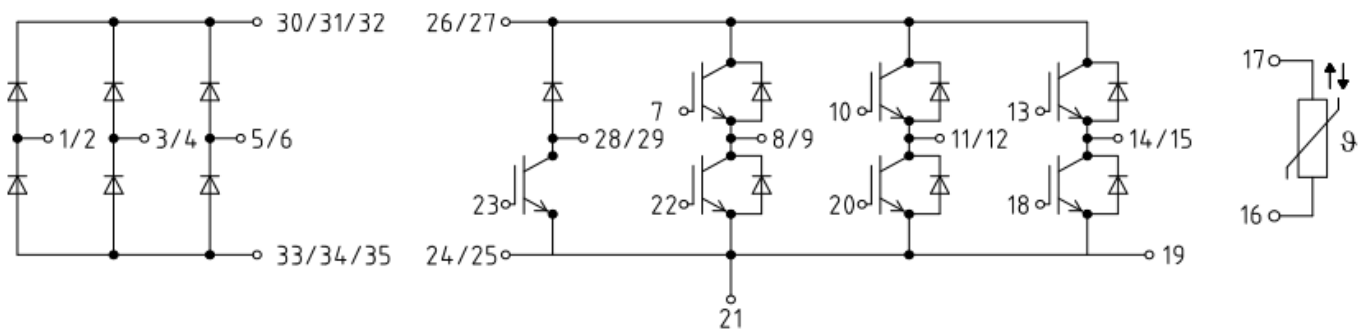


Figure 1. Out drawing & circuit diagram for

# HCG75FP120M3D1

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## Pin Configuration and Marking Information

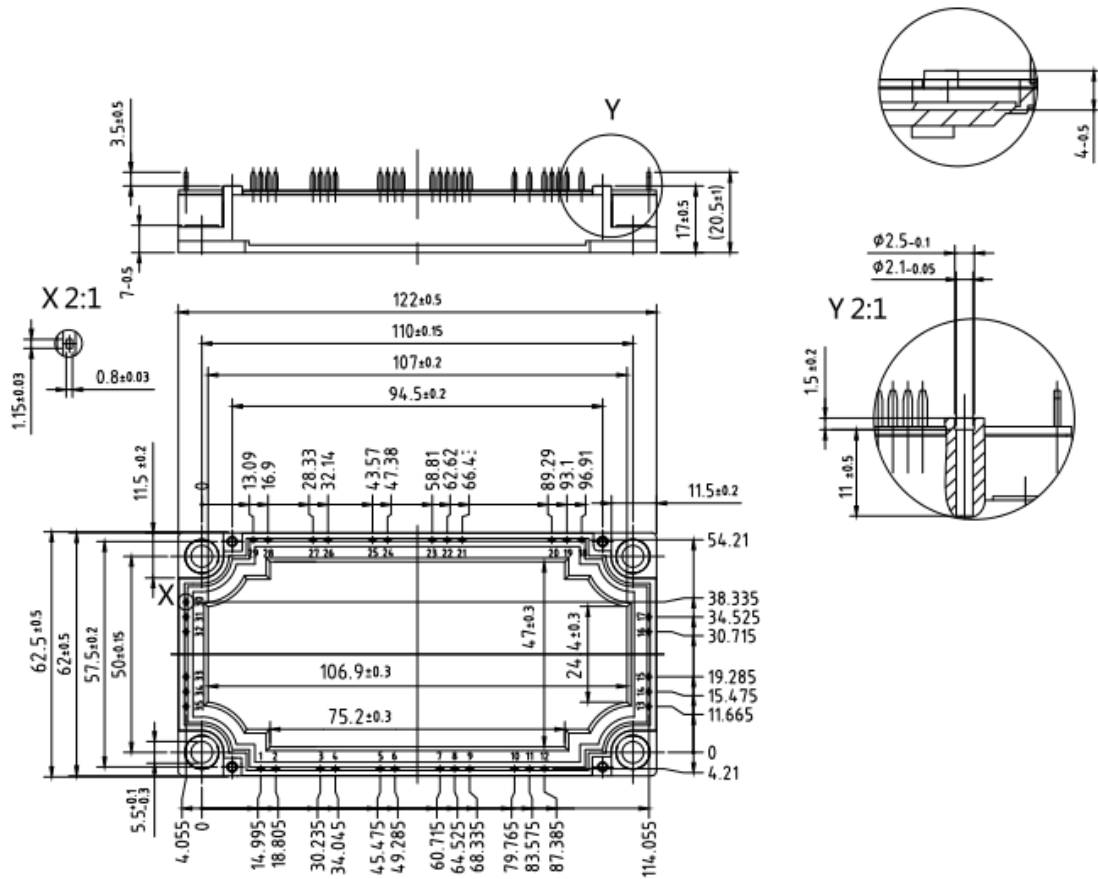


Figure 2. Pin configuration

## Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	2.5	KV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	17 3.81	mm
Clearance	terminal to heatsink terminal to terminal	17 3.81	mm
CTI	-	>200	-
Module lead resistance, terminals – chip	T <sub>c</sub> =25°C	0.8	mΩ
Mounting torque for module mounting	M5	3 to 6	Nm
Weight	-	300	g

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#### Maximum Ratings (IGBT, $T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CES}$	Collector-Emitter Voltage	G-E Short	1200	V
$V_{RRM}$	Peak Repetitive Revers Voltage	-	1200	V
$V_{GES}$	Gate-Emitter Voltage	C-E Short	$\pm 30\text{V}$	V
$I_C$	DC Continuous Collector Current	$T_C=100^{\circ}\text{C}$	75	A
$I_{CM}$	Pulse Collector Current	$t_p=1\text{ms}$ , Note1	150	A
$P_C$	Maximum Power Dissipation		510	W
$T_j$	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

#### Maximum Ratings (Freewheeling diode, $T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{RRM}$	Peak Repetitive Revers Voltage	-	1200	V
$I_F$	Diode forward Current	-	75	A
$I_{FRM}$	Repetitive peak forward Current	$t_p=1\text{ms}$ , Note1	150	A
$T_j$	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

#### Maximum Ratings (IGBT, Brake-chopper, $T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CES}$	Collector-Emitter Voltage	G-E Short	1200	V
$V_{RRM}$	Peak Repetitive Revers Voltage	-	1200	V
$V_{GES}$	Gate-Emitter Voltage	C-E Short	$\pm 30\text{V}$	V
$I_C$	DC Continuous Collector Current	$T_C=100^{\circ}\text{C}$	50	A
$I_{CM}$	Pulse Collector Current	$t_p=1\text{ms}$ , Note1	100	A
$P_C$	Maximum Power Dissipation		365	W
$T_j$	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

#### Maximum Ratings (diode, Brake-chopper, $T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{RRM}$	Peak Repetitive Revers Voltage	-	1200	V
$I_F$	Diode forward Current	-	50	A
$I_{FRM}$	Repetitive peak forward Current	$t_p=1\text{ms}$ , Note1	100	A
$T_j$	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

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#### NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R <sub>25</sub>	Resistance	T <sub>C</sub> =25°C	-	5	-	kΩ
R/R	Deviation of R100	T <sub>C</sub> =100°C, R <sub>100</sub> =493Ω	-5	-	5	%
P <sub>25</sub>	Power dissipation	T <sub>C</sub> =25°C	-	-	50	mW
B <sub>25/50</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/50</sub> (1/T <sub>2</sub> - 1/(298,15 K))]	-	3375	-	K
B <sub>25/80</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/80</sub> (1/T <sub>2</sub> - 1/(298,15 K))]	-	3410	-	K
B <sub>25/100</sub>	B-value	R <sub>2</sub> = R <sub>25</sub> exp [B <sub>25/100</sub> (1/T <sub>2</sub> - 1/(298,15 K))]	-	3433	-	K

#### IGBT Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V <sub>CE(sat)</sub> (Chip)	Collector-Emitter Saturation Voltage	I <sub>C</sub> =75A, T <sub>j</sub> =25°C	-	2.1	2.3	V	
		V <sub>GE</sub> =15V, T <sub>j</sub> =125°C	-	2.5	-	V	
V <sub>GE(th)</sub>	Gate-Emitter threshold Voltage	I <sub>C</sub> =1mA, V <sub>CE</sub> =V <sub>GE</sub>	4.5	-	5.7	V	
Q <sub>G</sub>	Gate charge	V <sub>GE</sub> =-15V to +15V	-	680	-	nC	
R <sub>Gint</sub>	Internal gate resistor	f=1M, V <sub>pp</sub> =1V, T <sub>j</sub> =25°C	-	2.5	-	Ω	
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz, T <sub>j</sub> =25°C	-	5.9	-	nF	
C <sub>oes</sub>	Output Capacitance		-	0.92	-	nF	
C <sub>res</sub>	Reverse transfer Capacitance		-	0.53	-	nF	
I <sub>CES</sub>	Collector- Emitter Cut off Current	V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>j</sub> =25°C	-	-	1	mA	
I <sub>GES</sub>	Gate-Emitter Leakage Current	V <sub>GE</sub> =30V, V <sub>CE</sub> =0V, T <sub>j</sub> =25°C	-	-	200	nA	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =600V, I <sub>C</sub> =75A, V <sub>GE</sub> =+15V/-15V, R <sub>G</sub> =10Ω, Inductive load	T <sub>j</sub> =25°C	-	25	-	ns
			T <sub>j</sub> =125°C	-	30	-	ns
t <sub>r</sub>	Rise time		T <sub>j</sub> =25°C	-	40	-	ns
			T <sub>j</sub> =125°C	-	45	-	ns
t <sub>d(off)</sub>	Turn-off delay time		T <sub>j</sub> =25°C	-	320	-	ns
			T <sub>j</sub> =125°C	-	350	-	ns
t <sub>f</sub>	Fall time		T <sub>j</sub> =25°C	-	160	-	ns
			T <sub>j</sub> =125°C	-	180	-	ns
E <sub>on</sub>	Turn-on power dissipation		T <sub>j</sub> =25°C	-	5.5	-	mJ
			T <sub>j</sub> =125°C	-	7.5	-	mJ
E <sub>off</sub>	Turn-off power dissipation	T <sub>j</sub> =25°C	-	5.1	-	mJ	
		T <sub>j</sub> =125°C	-	8.5	-	mJ	
R <sub>th(j-c)</sub>	Thermal Resistance, Junction to Case (IGBT)		-	-	0.245	°C/W	

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#### Freewheeling Diode Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> =75A, V <sub>GE</sub> =0V	T <sub>j</sub> =25°C	-	1.90	2.2	V
			T <sub>j</sub> =125°C	-	1.9	-	
t <sub>rr</sub>	Reverse recovery time	(Switch side) V <sub>rr</sub> =600V, I <sub>F</sub> =75A di/dt=1200A/μs	T <sub>j</sub> =25°C	-	150	-	ns
			T <sub>j</sub> =125°C	-	270	-	
I <sub>rr</sub>	Peak reverse recovery Current		T <sub>j</sub> =25°C	-	90	-	A
			T <sub>j</sub> =125°C	-	100	-	
Q <sub>rr</sub>	Recovered charge		T <sub>j</sub> =25°C	-	7.00	-	uC
			T <sub>j</sub> =125°C	-	11.50	-	
E <sub>rr</sub>	Reverse recovered energy		T <sub>j</sub> =25°C	-	2.30	-	mJ
			T <sub>j</sub> =125°C	-	4.30	-	
R <sub>th(j-c)</sub>	Thermal Resistance, Junction to Case (Diode)		-	-	0.63	°C/W	

#### IGBT , Brake-chopper Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V <sub>CE(sat)</sub> (Chip)	Collector-Emitter Saturation Voltage	I <sub>C</sub> =50A V <sub>GE</sub> =15V	T <sub>j</sub> =25°C	-	2.1	2.3	V
			T <sub>j</sub> =125°C	-	2.5	-	V
V <sub>GE(th)</sub>	Gate-Emitter threshold Voltage	I <sub>C</sub> =1mA, V <sub>CE</sub> =V <sub>GE</sub>		4.5	-	5.7	V
Q <sub>G</sub>	Gate charge	V <sub>GE</sub> =-15V to +15V		-	430	-	nC
R <sub>Gint</sub>	Internal gate resistor	f=1M, V <sub>pp</sub> =1V	T <sub>j</sub> =25°C	-	2.2	-	Ω
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V f =1MHz	T <sub>j</sub> =25°C	-	3.80	-	nF
C <sub>oes</sub>	Output Capacitance			-	0.51	-	nF
C <sub>res</sub>	Reverse transfer Capacitance			-	0.33	-	nF
I <sub>CES</sub>	Collector- Emitter Cut off Current	V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V	T <sub>j</sub> =25°C	-	-	1	mA
I <sub>GES</sub>	Gate-Emitter Leakage Current	V <sub>GE</sub> =30V, V <sub>CE</sub> =0V	T <sub>j</sub> =25°C	-	-	200	nA
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =600V I <sub>C</sub> = 50A V <sub>GE</sub> =+15V/-15V R <sub>G</sub> =13Ω Inductive load	T <sub>j</sub> =25°C	-	20	-	ns
			T <sub>j</sub> =125°C	-	25	-	
t <sub>r</sub>	Rise time		T <sub>j</sub> =25°C	-	40	-	ns
			T <sub>j</sub> =125°C	-	45	-	
t <sub>d(off)</sub>	Turn-off delay time		T <sub>j</sub> =25°C	-	300	-	ns
			T <sub>j</sub> =125°C	-	330	-	
t <sub>f</sub>	Fall time		T <sub>j</sub> =25°C	-	160	-	ns
			T <sub>j</sub> =125°C	-	180	-	
E <sub>on</sub>	Turn-on power dissipation		T <sub>j</sub> =25°C	-	4.5	-	mJ
			T <sub>j</sub> =125°C	-	6.5	-	
E <sub>off</sub>	Turn-off power dissipation		T <sub>j</sub> =25°C	-	4.2	-	mJ

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			$T_J=125^\circ\text{C}$	-	6.1	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (IGBT)			-		0.343	$^\circ\text{C/W}$

### Diode, Brake-chopper Electrical characteristics ( $T_J=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
$V_F$	Diode Forward Voltage	$I_F=50\text{A}, V_{GE}=0\text{V}$	$T_J=25^\circ\text{C}$	-	1.90	2.2	V
			$T_J=125^\circ\text{C}$	-	1.9	-	
$t_{rr}$	Reverse recovery time		$T_J=25^\circ\text{C}$	-	110	-	ns
			$T_J=125^\circ\text{C}$	-	250	-	
$I_{rr}$	Peak reverse recovery Current	(Switch side) $V_{rr}=600\text{V}, I_F=50\text{A}$	$T_J=25^\circ\text{C}$	-	85	-	A
			$T_J=125^\circ\text{C}$	-	100	-	
$Q_{rr}$	Recovered charge	$di/dt=1500\text{A}/\mu\text{s}$	$T_J=25^\circ\text{C}$	-	5.5	-	uC
			$T_J=125^\circ\text{C}$	-	9.5	-	
$E_{rr}$	Reverse recovered energy		$T_J=25^\circ\text{C}$	-	1.8	-	mJ
			$T_J=125^\circ\text{C}$	-	3.7	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)			-		0.652	$^\circ\text{C/W}$

### Maximum Ratings (Rectifier diode, $T_J=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{RRM}$	Peak Repetitive Revers Voltage	$T_J=25^\circ\text{C}$	1800	V
$I_{FRMSM}$	Maximum RMS forward current per chip	$T_C=80^\circ\text{C}$	75	A
$I_{RMSM}$	Maximum RMS current at rectifier output	$T_C=80^\circ\text{C}$	150	A
$I_{FSM}$	Surge Current @ $t_p=10\text{ms}$	$T_J=25^\circ\text{C}$	840	A
$I^2t$	$I^2t$ - value	$T_J=25^\circ\text{C}$	3528	$\text{A}^2\text{s}$
$T_J$	junction temperature	-	-40 to 150	$^\circ\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^\circ\text{C}$

Note1: Pulse width limited by maximum junction temperature

### Rectifier Diode Electrical characteristics ( $T_J=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit
			Min.	Typ.	Max	
$V_F$	Diode Forward Voltage	$I_F=75\text{A}$	$T_J=25^\circ\text{C}$		1.05	V
			$T_J=125^\circ\text{C}$		0.85	
$I_R$	Reverse current		$T_J=125^\circ\text{C}$		1.0	mA
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Diode)				0.65	$^\circ\text{C/W}$

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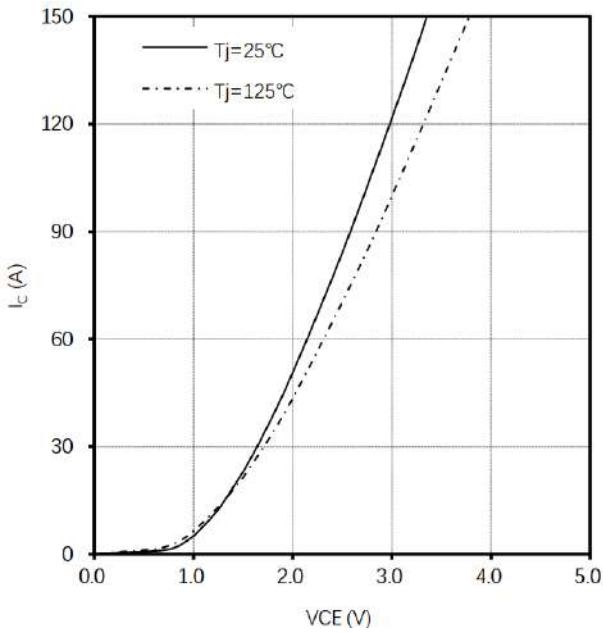


Fig 1. output characteristic IGBT,  
 $I_c=f(V_{ce}), V_{GE}=15V$

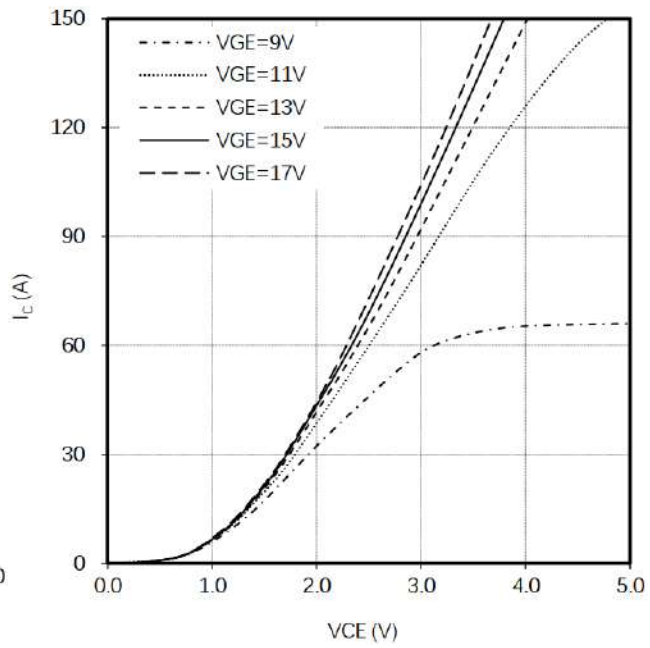


Fig 2. output characteristic IGBT,  
 $I_c=f(V_{ce}), T_j=125^\circ C$

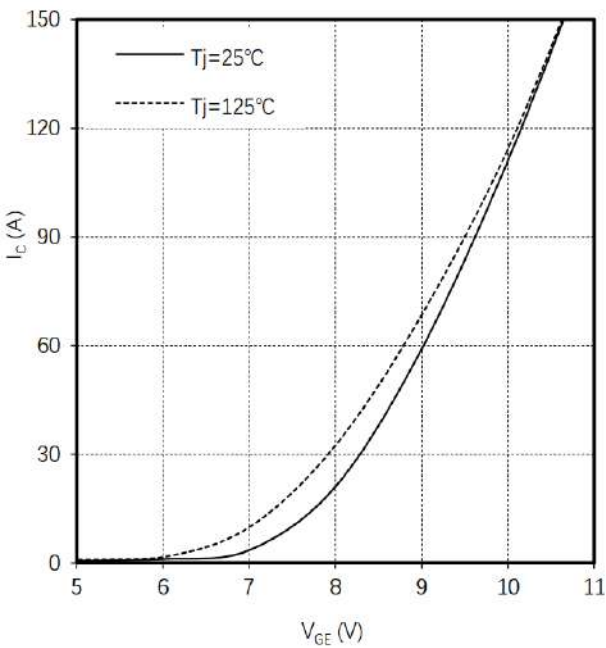


Fig 3. transfer characteristic IGBT,  
 $I_c=f(V_{ge}), V_{ce}=20V$

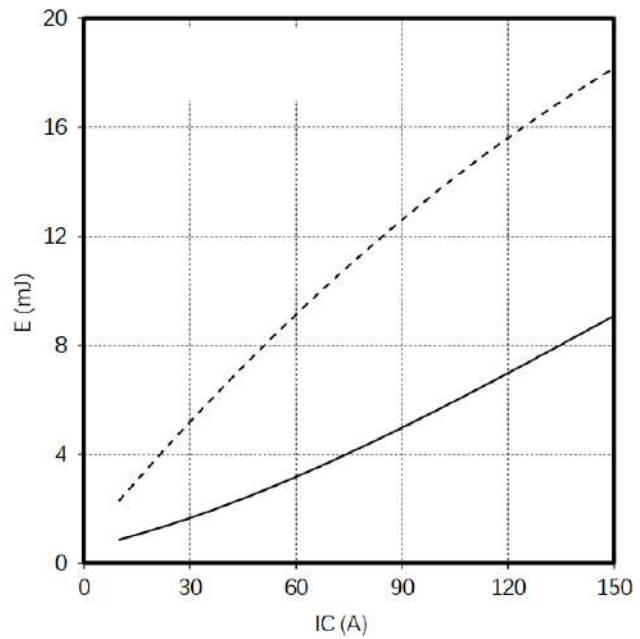


Fig 4. switching losses IGBT,  
 $E_{on}=f(I_c), E_{off}=f(I_c),$   
 $V_{GE}=\pm 15V, R_{Gon}=4.7\Omega, R_{Goff}=4.7\Omega, V_{CE}=600V$

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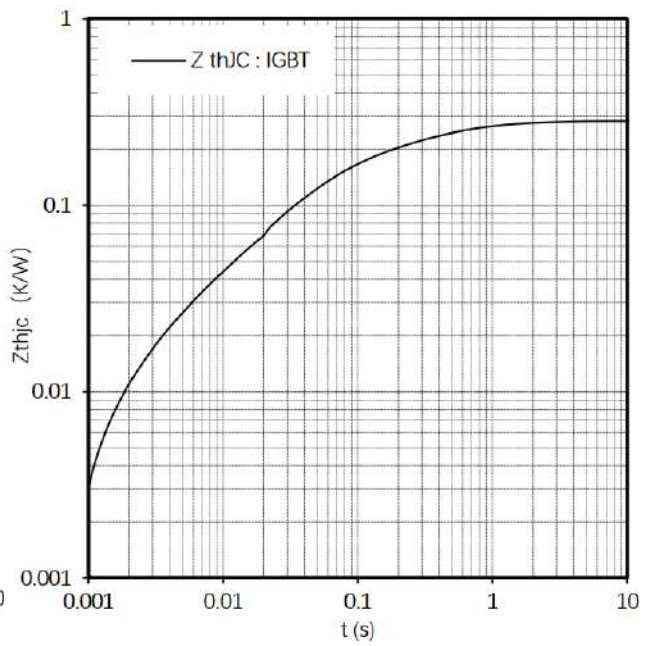
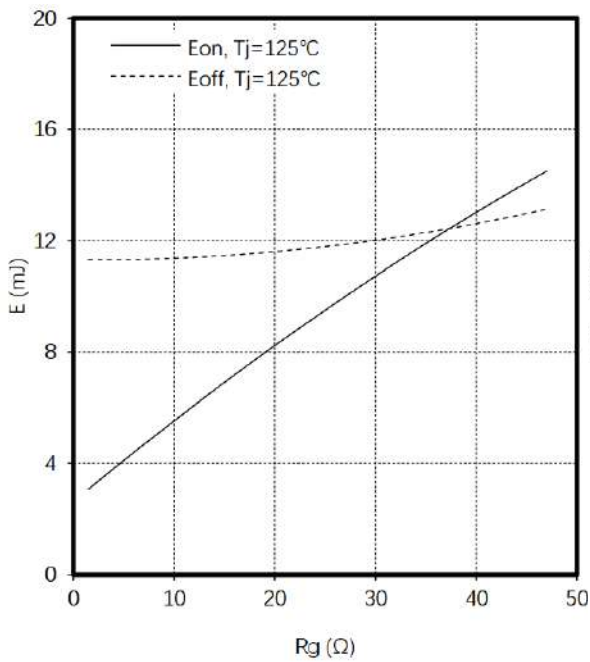


Fig 5. switching losses IGBT,  $E_{on}=f(R_G), E_{off}=f(R_G)$ ,  
 $V_{GE}=\pm 15V, I_C=75A, V_{CE}=600V$

Fig 6. transient thermal impedance IGBT ,  
 $Z_{thjC}=f(t)$

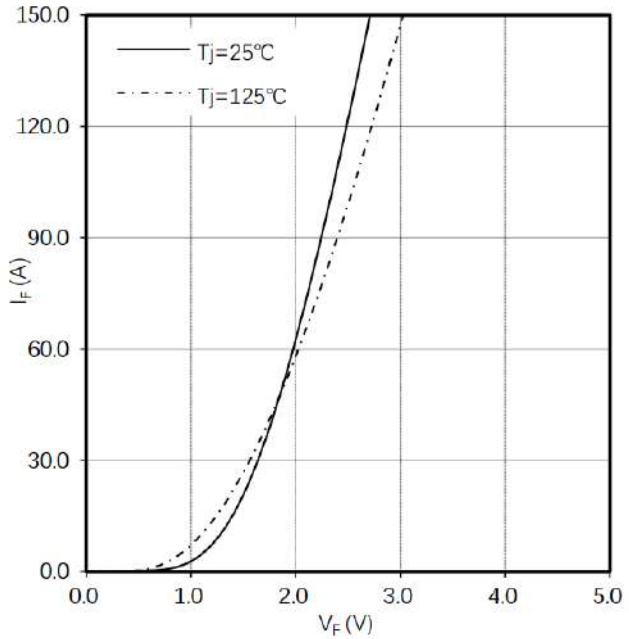
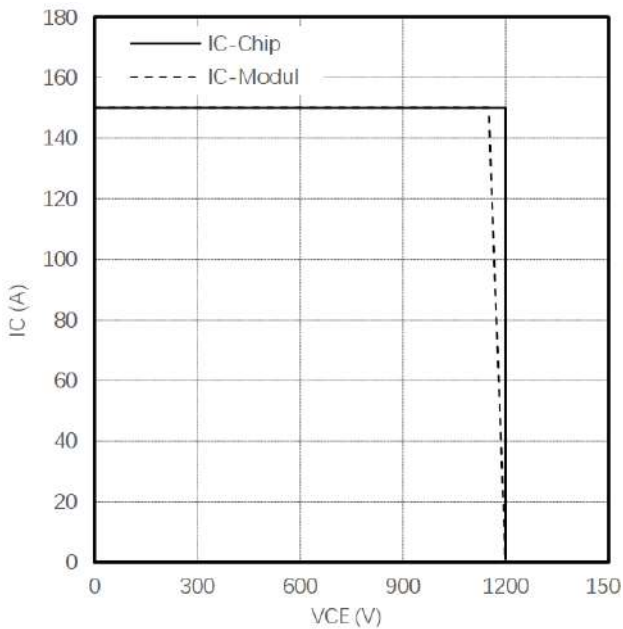


Fig 7. reverse bias safe operating area IGBT,  
 $I_C=f(V_{CE}), V_{GE}=\pm 15V, R_{Goff}=4.7\Omega, T_{vj}=125^\circ C$

Fig 8. forward characteristic of Diode ,  
 $I_F=f(V_F)$



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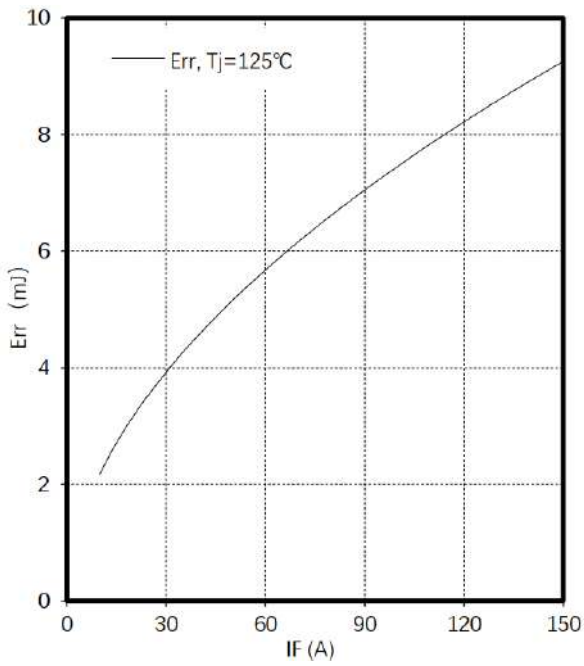


Fig9. switching losses Diode,  
 $E_{rr}=f(I_F), R_{Gon}=4.7\Omega, V_{CE}=600V$

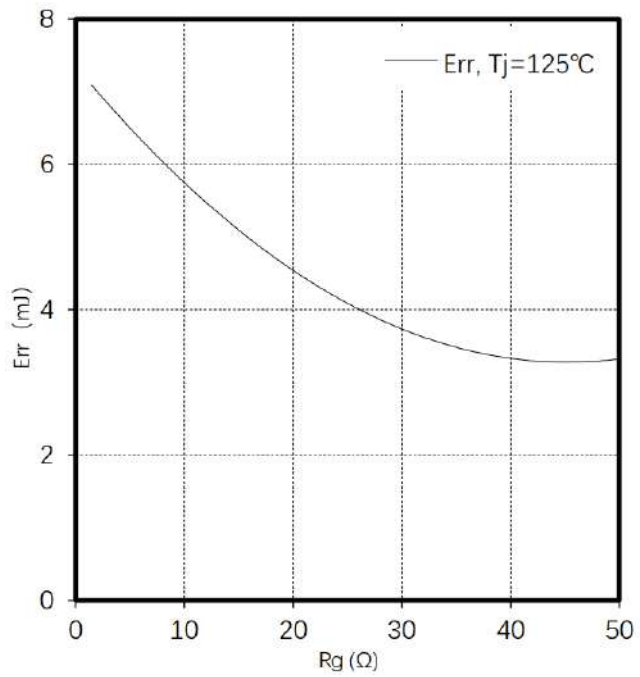


Fig 10. switching losses Diode,  
 $E_{rr}=f(R_G), I_F=75A, V_{CE}=600V$

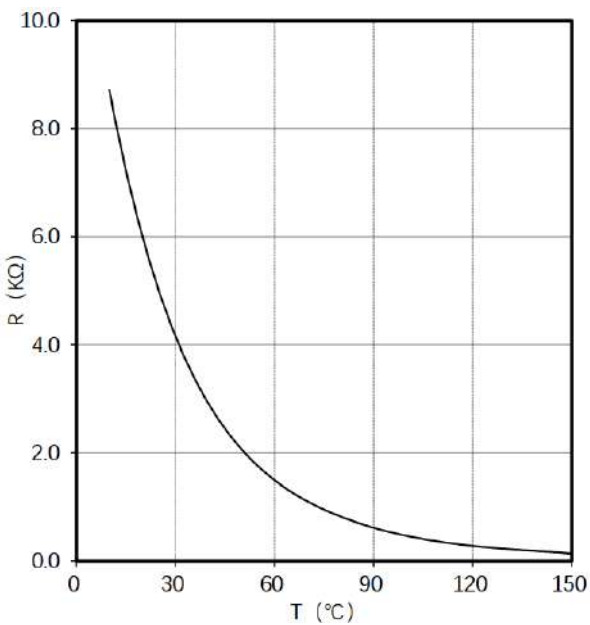


Fig11.NTC-Thermistor-temperature characteristic(typical)

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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 (Email:sales@hiitio.com) for further information on the product, technology, delivery terms, conditions and prices.

### Revision History

Document Version	Description of Changes
RevX.0.1	Released

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