

HCG600FL100E3S2

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

Features

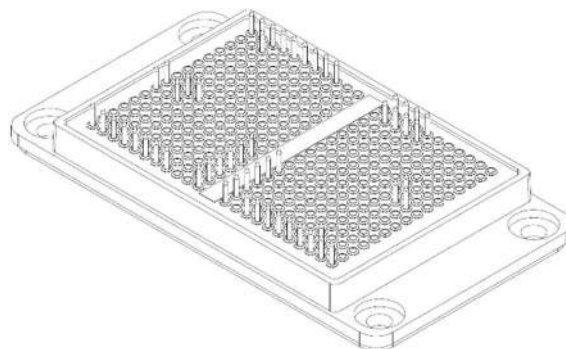
- Neutral Point Clamped Three-Level Inverter Module
- Low Inductive Layout
- Solderable Pins

Benefits

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

Applications

- Solar Inverters
- Uninterruptable Power Supplies Systems



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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 @ T _c = 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 @ T _c = 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 @ T _c = 75°C, T _j = 150°C	I _F	131	A
Repetitive Peak Forward Current @ T _j = 150°C	I _{FRM}	262	A
I ² t-value@ V _R = 0 V, T _p = 10 ms, T _{vj} = 150°C	I ² t	4050	A ² s
Junction Temperature	T _j	-40 to +175	°C
DIODE (D5,D6)			
Peak Repetitive Reverse Voltage	V _{RRM}	1000	V
Continuous Forward Current @ T _c = 75°C, T _j = 150°C	I _F	180	A
Repetitive Peak Forward Current @ T _j = 150°C	I _{FRM}	360	A
I ² t-value@ V _R = 0 V, T _p = 10 ms, T _{vj} = 150°C	I ² t	8450	A ² s
Junction Temperature	T _j	-40 to +175	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz	V _{iso}	4000	V _{RMS}
RECOMMENDED TEMPERATURE			
Storage Temperature	T _{stg}	-40 to +125	°C
Operating Temperature	T _{op}	-40 to +150	°C

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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	-	1.83	-	V	
		V _{GE} = 15 V, I _C = 600 A	T _J = 150°C	-	2.25	-		
Gate–Emitter Threshold Voltage	V _{GE(TH)}	V _{GE} = V _{CE} , I _C = 6.5 mA	T _J = 25°C	-	4.98	-	V	
Total Gate Charge	Q _g	V _{GE} = ±15 V, V _{CE} = 600 V	T _J = 25°C	-	3.24	-	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 = 100 KHz	T _J = 25°C	-	51.1	-	nF	
Output Capacitance	C _{oss}		T _J = 25°C	-	1.41	-		
Reverse Transfer Capacitance	C _{rss}		T _J = 25°C	-	0.22	-		
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	-	89	-	ns	
Rise Time (inductive load)	t _r		T _J = 150°C	-	99	-		
			T _J = 25°C	-	35	-		
			T _J = 150°C	-	38	-		
			T _J = 25°C	-	739	-		
Turn-off Delay Time(inductive load)	t _{d off}		T _J = 150°C	-	806	-		
			T _J = 25°C	-	42	-		
Fall Time (inductive load)	t _f		T _J = 150°C	-	46	-		
			T _J = 25°C	-	11.3	-		
Turn-on Switching Loss	E _{on}			T _J = 150°C	-	21	-	mJ
Turn-off Switching Loss	E _{off}			T _J = 25°C	-	13.7	-	
				T _J = 150°C	-	16.8	-	
Thermal Resistance – Chip-to–Case	R _{thJC}	Thermal grease, λ = 2.8 W/mK		-	0.09	-	°C/W	

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Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
DIODE (D5,D6)							
Diode Forward Voltage	V _F	I _F = 300 A	T _J = 25°C	-	2.01	-	V
		I _F = 300 A	T _J = 150°C	-	2.05	-	
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	-	91	-	ns
			T _J = 150°C	-	218	-	
Reverse Recovery Charge	Q _{RR}		T _J = 25°C	-	19	-	μC
			T _J = 150°C	-	43	-	
Peak Reverse Recovery Current	I _{RRM}		T _J = 25°C	-	341	-	A
			T _J = 150°C	-	491	-	
Reverse Recovery Energy	E _{REC}		T _J = 25°C	-	9.3	-	mJ
			T _J = 150°C	-	22.0	-	
Thermal Resistance – Chip-to-Case	R _{thJC}	Thermal grease ,λ = 2.8 W/mK		-	0.19	-	°C/W
IGBT (Q2, Q3)							
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} = 15 V, I _C = 600 A	T _J = 25°C	-	1.83	-	V
		V _{GE} = 15 V, I _C = 600 A	T _J = 150°C	-	2.25	-	
Gate-Emitter Threshold Voltage	V _{GE(TH)}	V _{GE} = V _{CE} , I _C = 6.5 mA	T _J = 25°C	-	4.98	-	V
Total Gate Charge	Q _g	V _{GE} = ±15 V, V _{CE} = 600 V	T _J = 25°C	-	3.24	-	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	-	51.1	-	nF
Output Capacitance	C _{oss}		T _J = 25°C	-	1.41	-	
Reverse Transfer Capacitance	C _{rss}		T _J = 25°C	-	0.22	-	
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} = 1 Ω, R _{Goff} = 10 Ω	T _J = 25°C	-	82		ns
			T _J = 150°C	-	84		
Rise Time (inductive load)	t _r		T _J = 25°C	-	23.3		
			T _J = 150°C	-	25.5		
Turn-off Delay Time(inductive load)	t _{d off}		T _J = 25°C	-	963		
			T _J = 150°C	-	1120		

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Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Fall Time (inductive load)	t_f	$V_{GE} = -7\text{ V} / +15\text{ V}$, $V_{CE} = 675\text{ V}$, $I_C = 330\text{ A}$, $R_{Gon} = 1\ \Omega$, $R_{Goff} = 10\ \Omega$	$T_j = 25^\circ\text{C}$	-	23.3	ns
			$T_j = 150^\circ\text{C}$	-	25.5	
Turn - on Switching Loss	E_{on}		$T_j = 25^\circ\text{C}$	-	7.0	mJ
			$T_j = 150^\circ\text{C}$	-	11.3	
Turn - off Switching Loss	E_{off}		$T_j = 25^\circ\text{C}$	-	16.4	
			$T_j = 150^\circ\text{C}$	-	19.1	
Thermal Resistance – Chip-to-Case	R_{thJC}	Thermal grease $\lambda = 2.8\text{ W/mK}$	-	0.09	-	$^\circ\text{C/W}$

INVERSE DIODE (D1,D2,D3,D4)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F = 300\text{ A}$	$T_j = 25^\circ\text{C}$	-	2.22	V
		$I_F = 300\text{ A}$	$T_j = 150^\circ\text{C}$	-	2.34	
Reverse Recovery Time	T_{RR}	$V_{GE} = -7\text{ V} / +15\text{ V}$, $V_{CE} = 675\text{ V}$, $I_C = 330\text{ A}$, $R_{Gon} = 1\ \Omega$, $R_{Goff} = 10\ \Omega$	$T_j = 25^\circ\text{C}$	-	168	ns
			$T_j = 150^\circ\text{C}$	-	280	
Reverse Recovery Charge	Q_{RR}		$T_j = 25^\circ\text{C}$	-	16	μC
			$T_j = 150^\circ\text{C}$	-	35	
Peak Reverse Recovery Current	I_{RRM}		$T_j = 25^\circ\text{C}$	-	247	A
			$T_j = 150^\circ\text{C}$	-	323	
Reverse Recovery Energy	E_{REC}		$T_j = 25^\circ\text{C}$	-	9.38	mJ
			$T_j = 150^\circ\text{C}$	-	17.5	
Thermal Resistance – Chip-to-Case	R_{thJC}	Thermal grease $\lambda = 2.8\text{ W/mK}$	-	0.23	-	$^\circ\text{C/W}$

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Table 3 NTC-Thermistor

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Rated Resistance	R_{25}	$T_C = 25^{\circ}\text{C}$	-	5	-	$\text{k}\Omega$
Deviation of R_{100}	$\Delta R/R$	$T_C = 100^{\circ}\text{C}$, $R_{100} = 493 \Omega$	-5	-	5	%
Power Dissipation	P_{25}	$T_{NTC} = 25^{\circ}\text{C}$	-	-	60	mW
B-value	$B_{25/50}$	B (25/50), tolerance $\pm 3\%$	-	3375	-	K
B-value	$B_{25/100}$	B (25/100), tolerance $\pm 3\%$	-	3433	-	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

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Typical Characteristics

Fig.1 Typical output characteristics IGBT
T_{vj} = 25°C (Q1, Q2, Q3, Q4)

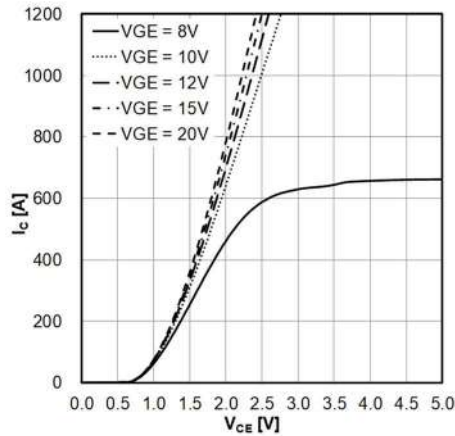


Fig.2 Typical output characteristics IGBT
T_{vj} = 150°C (Q1, Q2, Q3, Q4)

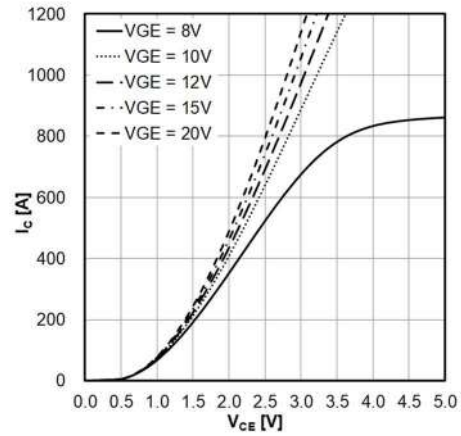


Fig.3 Body diode characteristics (D1, D2, D3, D4)

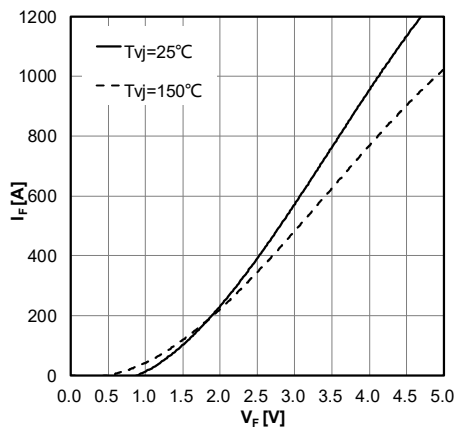


Fig.4 Transient thermal impedance (Q1, Q2, Q3, Q4)

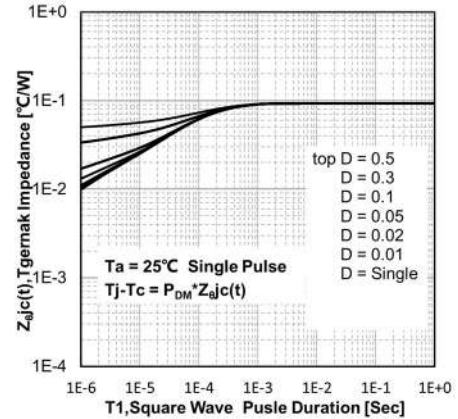


Fig.5 Capacity characteristic
C = f(V_{CE}), V_{GE} = 0 V, T_{vj} = 25°C, f = 100KHz
(Q1, Q2, Q3, Q4)

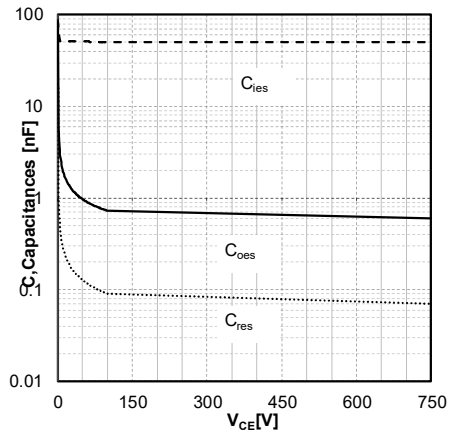
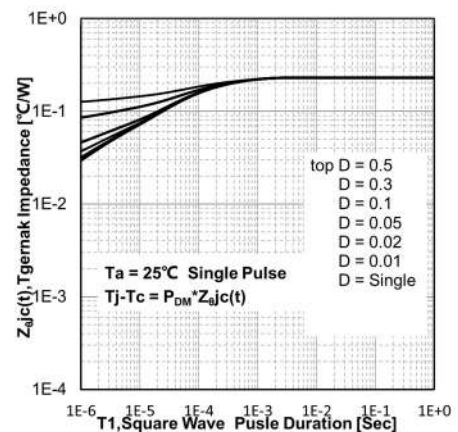


Fig.6 Transient thermal impedance (D1, D2, D3, D4)



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Typical Characteristics

Fig.7 Diode forward characteristics (D5, D6)

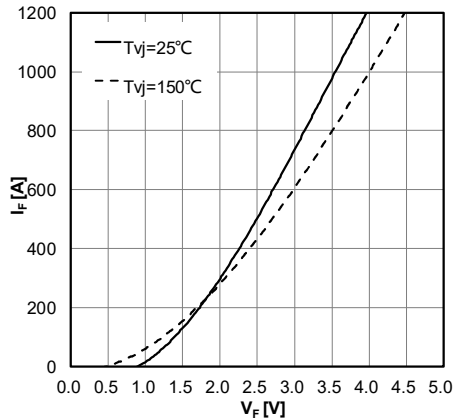
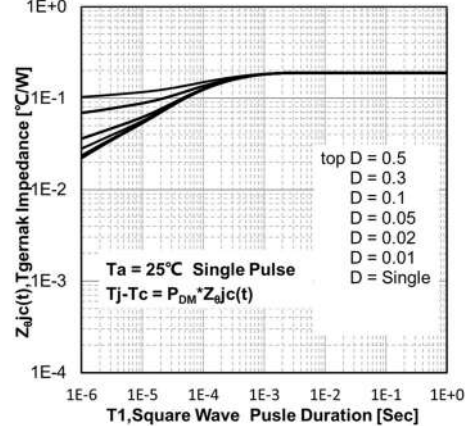


Fig.8 Transient thermal impedance (D5, D6)



Q1 || D5 or Q4 || D6

Fig.9 Switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $R_{Gon} = 0.5\ \Omega$, $R_{Goff} = 5.1\ \Omega$,
 $V_{CE} = 675\text{ V}$

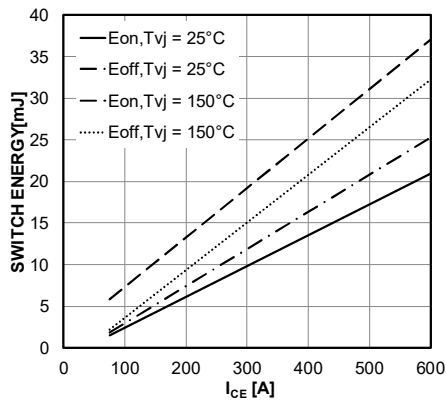


Fig.10 Switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $I_C = 330\text{ A}$, $V_{CE} = 675\text{ V}$

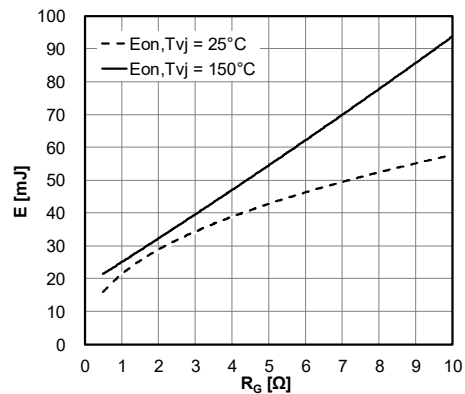


Fig.11 Switching losses IGBT, Inverter (typical)

$E_{off} = f(R_G)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $I_C = 330\text{ A}$, $V_{CE} = 675\text{ V}$

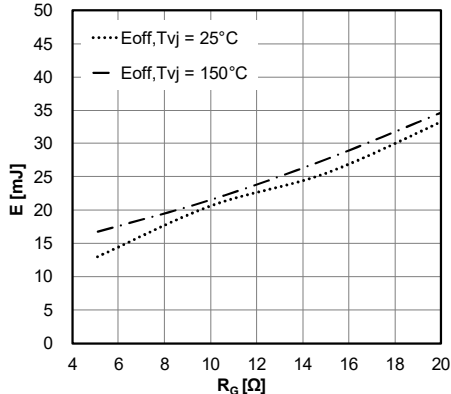
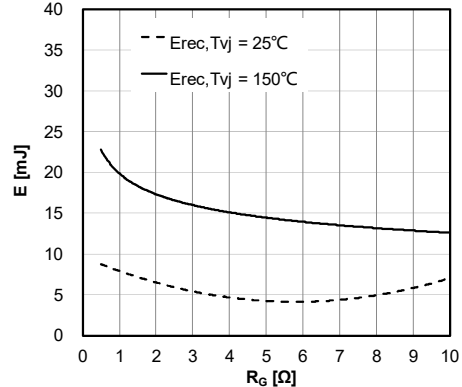


Fig.12 Switching losses IGBT, Inverter (typical)

$E_{REC} = f(R_G)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $I_F = 330\text{ A}$, $V_R = 675\text{ V}$



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Typical Characteristics

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

Fig.13 Switching losses IGBT, Inverter (typical)
 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $R_{Gon} = 1\ \Omega$, $R_{Goff} = 10\ \Omega$,
 $V_{CE} = 675\text{ V}$

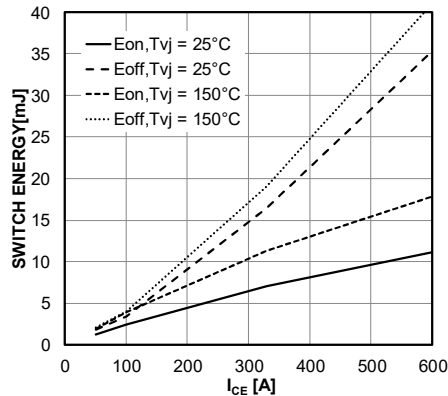


Fig.14 Switching losses IGBT, Inverter (typical)
 $E_{on} = f(R_G)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $I_C = 330\text{ A}$, $V_{CE} = 675\text{ V}$

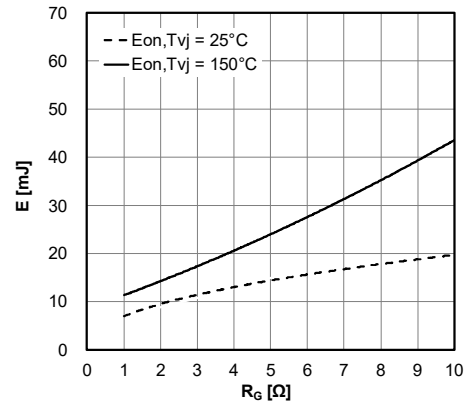


Fig.15 Switching losses IGBT, Inverter (typical)
 $E_{off} = f(R_G)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $I_C = 330\text{ A}$, $V_{CE} = 675\text{ V}$

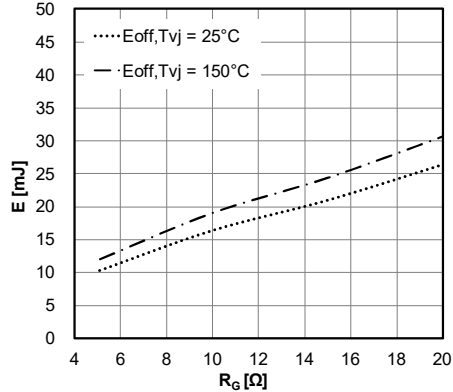


Fig.16 Switching losses IGBT, Inverter (typical)
 $E_{rec} = f(R_G)$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $I_F = 330\text{ A}$, $V_R = 675\text{ V}$

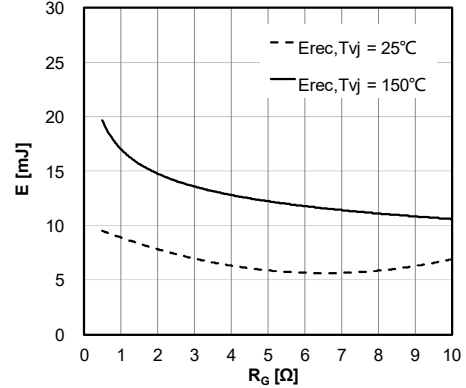


Fig.17 NTC-Thermistor-temperature characteristic (typical)

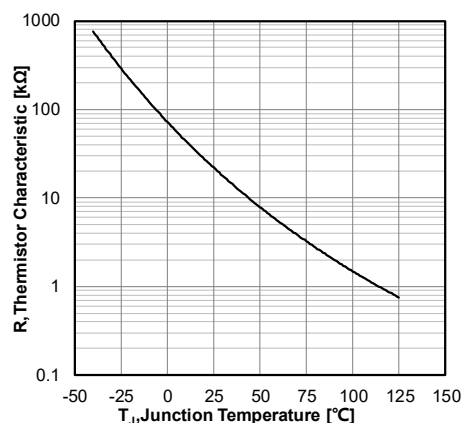
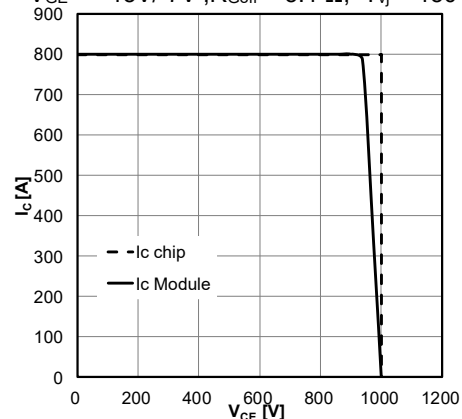


Fig.18 Reverse bias safe operating area IGBT, Inverter(RBSOA)

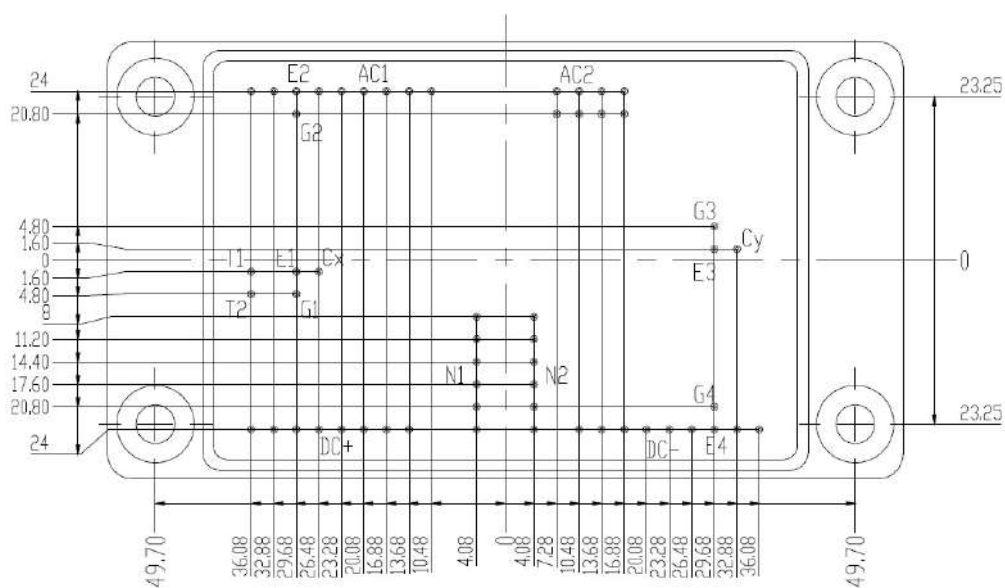
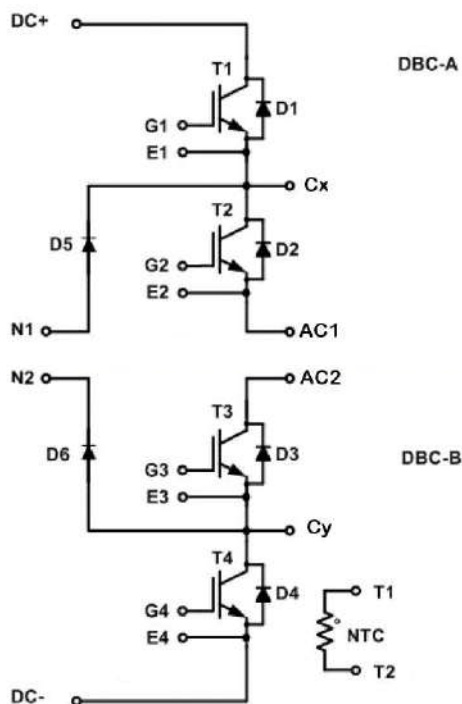
$I_C = f(V_{CE})$,
 $V_{GE} = +15\text{ V} / -7\text{ V}$, $R_{Goff} = 5.1\ \Omega$, $T_{vj} = 150^\circ\text{C}$



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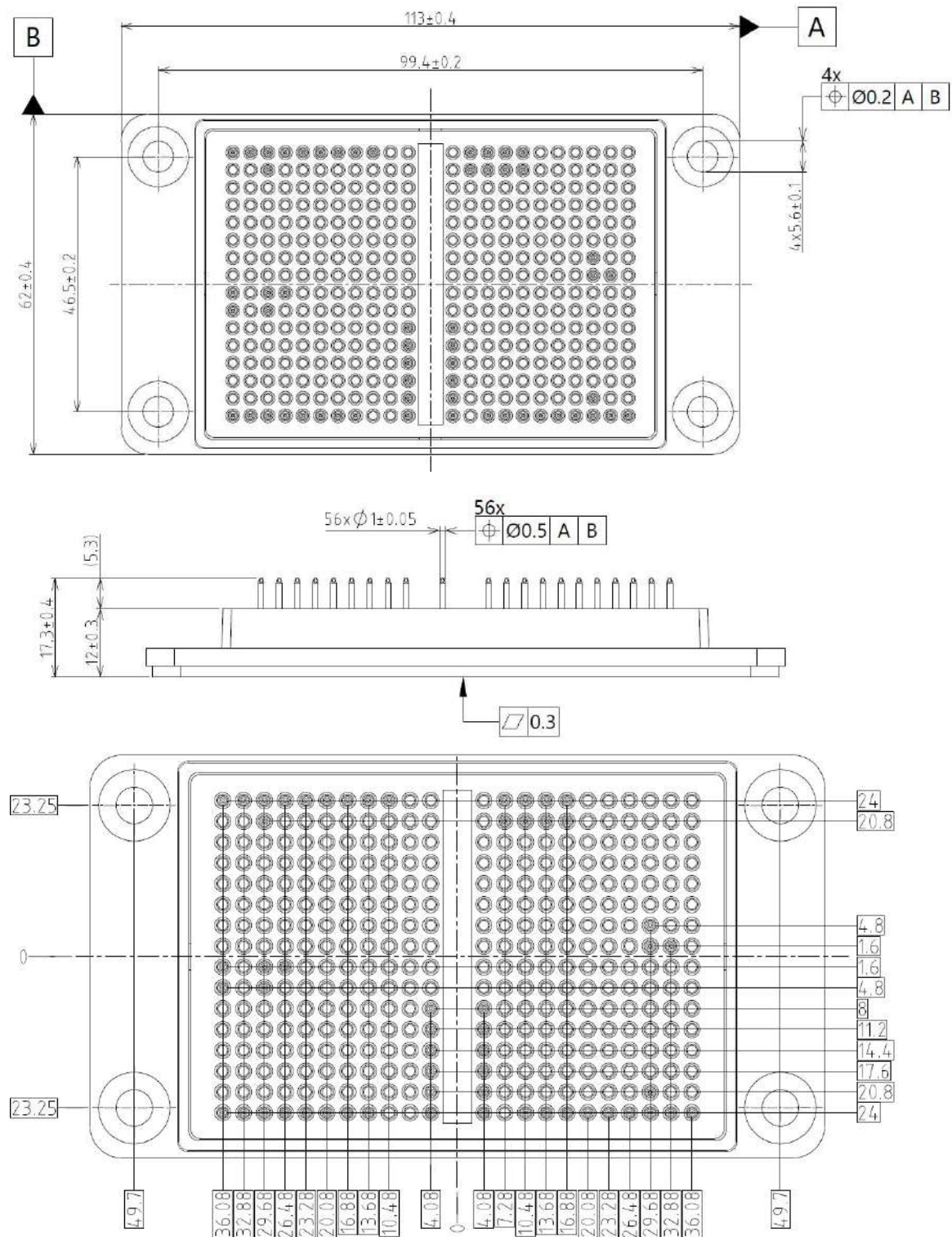
Circuit Diagram



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Package Outlines



Revision History

Document Version	Description of Changes
RevX.0.1	Released

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TEL :400-667-9977



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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.