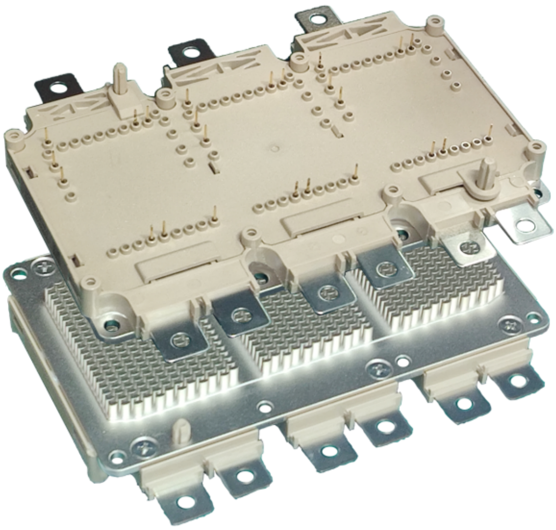
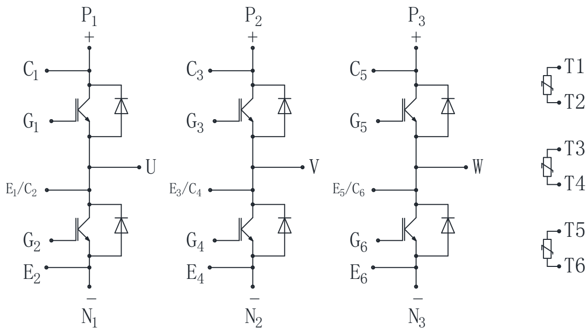
* General Description

BYD IGBT Power Module BGW950F08B34L6-D provides low conduction and switching loss as well as short circuit ruggedness. which introduce the advanced Micro-Pattern Trench & field stop IGBT chip and ultra fast & soft recovery anti-parallel FRD to improved connection, it is able to take on a perfect performance in various applications with switching frequencies in the range of 10KHz.



* Key Features

- Full bridge module
- Compact & High power density design
- 750V Micro-Pattern Trench&field stop technology
- Ultra low conduction and switching loss
- Short circuit ruggedness
- Including ultra fast & soft recovery anti-parallel FRD
- Low Inductive Design
- The direct cooled oval PinFin Base Plate
- $T_{vj\ op}$=150℃
- Short-time extended Operation Temperature $T_{vj\ op}$=175℃
- RoHS compliant



* Applications

- ❒ Automotive application
- ❒ Hybrid and electric vehicle
- ❒ Inverters for motor drive

- **IGBT**

❐ Maximum Rated Values

Symbol	Parameter	Conditions	Value	Unit
V_{CES}	Collector-emitter voltage	T_{vj}=25℃	750	V
V_{GES}	Gate-emitter voltage	T_{vj}=25℃	±20	V
I_{CN}	Implemented Collector current		950	A
$I_{C\ nom}$	Continuous DC Collector current	T_F=95℃, $T_{vj\ max}$=175℃	450	A
I_{CRM}	Repetitive peak collector current	Pulse, t_P=1ms, T_{vj}=25℃	1900	A
P_{tot}	Total power dissipation	T_F=65℃， $T_{vj\ max}$=175℃	1149	W

❐ Characteristics Values

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{CE\ sat}$	Collector-Emitter Saturation Voltage	I_C=450A, V_{GE}=15V, T_{vj}=25℃		1.20		V
		I_C=450A, V_{GE}=15V, T_{vj}=150℃		1.30		
		I_C=450A, V_{GE}=15V, T_{vj}=175℃		1.30		
		I_C=950A, V_{GE}=15V, T_{vj}=25℃		1.57		
		I_C=950A, V_{GE}=15V, T_{vj}=175℃		1.90		
V_{GEth}	Gate threshold voltage	V_{CE}=V_{GE},I_C=9.6mA,T_{vj}=25℃	4.9	5.8	6.5	V
Q_G	Gate charge	V_{GE}=-8V…+15V, V_{CE}=400V		1.84		μC
R_{Gint}	Internal gate Resistance	T_{vj}=25℃		0.8		Ω
C_{ies}	Input capacitance	T_{vj}=25℃,f=100KHz, V_{CE}=50V, V_{GE}=0V		39.6		nF
C_{oes}	Output capacitance			1.45		nF
C_{res}	Reverse capacitance			0.19		nF
I_{CES}	Collector-emitter cut-off current	V_{CE}=750V, V_{GE}=0V, T_{vj}=25℃			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃			400	nA

t_{don}	Turn-on delay time	I_C = 450 A V_{CE} = 450 V V_{GE}=-8V…+15 V R_{Gon} = 2.5Ω R_{Goff}=13.5Ω L_S=30nH	T_{vj}=25℃		255		ns
			T_{vj}=150℃		265		ns
			T_{vj}=175℃		266		ns
t_r	Rise time		T_{vj}=25℃		77		ns
			T_{vj}=150℃		83		ns
			T_{vj}=175℃		97		ns
$t_{d\ off}$	Turn-off delay time,		T_{vj}=25℃		1035		ns
			T_{vj}=150℃		1127		ns
			T_{vj}=175℃		1153		ns
t_f	Fall time		T_{vj}=25℃		56		ns
			T_{vj}=150℃		83		ns
			T_{vj}=175℃		96		ns
E_{on}	Turn-on energy loss		T_{vj}=25℃		19.0		mJ
			T_{vj}=150℃		31.5		mJ
			T_{vj}=175℃		33.5		mJ
E_{off}	Turn-off energy loss		T_{vj}=25℃		24.0		mJ
			T_{vj}=150℃		31.0		mJ
			T_{vj}=175℃		31.5		mJ
I_{SC}	SC data	V_{GE}≤15V,V_{CC}=450V V_{CEmax}=V_{CES}-L_{sCE}*di/dt	tp≤6us,Tvj=25℃		3600		A
			tp≤3us,Tvj=175℃		2800		

● Diode

❐ Maximum Rated Values

Symbol	Parameter	Conditions	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25℃	750	V
I_{FN}	Implemented forward current		950	A
I_F	Continuous DC forward current		450	A
I_{FRM}	Repetitive peak forward current	Pulse, t_P=1ms, T_{vj}=25℃	1900	A
I^2t	I^2t-value	V_R=0V, t_p=10ms, T_{vj}=150℃ V_R=0V, t_p=10ms, T_{vj}=175℃	27000 25000	A^2s A^2s

Characteristics Values

Symbol	Parameter	Conditions		Value			Unit
				Min.	Typ.	Max.	
V_F	Forward voltage	I_F=450A, V_{GE}=0V, T_{vj}=25℃			1.40		V
		I_F=450A, V_{GE}=0V, T_{vj}=150℃			1.30		
		I_F=450A, V_{GE}=0V, T_{vj}=175℃			1.25		
		I_F=950A, V_{GE}=0V, T_{vj}=25℃			1.68		
		I_F=950A, V_{GE}=0V, T_{vj}=175℃			1.60		
I_{RM}	Peak reverse recovery current	I_F=450A V_R=450V V_{GE}=-8V	T_{vj}=25℃		247		A
			T_{vj}=150℃		327		
			T_{vj}=175℃		336		
Q_r	Recovered charge		T_{vj}=25℃		20		μC
			T_{vj}=150℃		43		μC
			T_{vj}=175℃		51		μC
E_{rec}	Reverse recovery energy		T_{vj}=25℃		6		mJ
			T_{vj}=150℃		13		mJ
			T_{vj}=175℃		16		mJ

NTC-Thermistor

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Rated resistance	T_C=25℃		5.0		KΩ
△R/R	Deviation of R100	T_C=100℃，R_{100}=493	-5		5	%
P_{25}	Power dissipation	T_C=25℃			20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Module

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
$T_{vj\ max}$	Maximum junction temperature				175	℃
T_{vjop}	Temperature under switching conditions	T_{op} continuous	-40		150	℃
		For 10s within a period of 30s,occurrence maximum 3000 times over lifetime	150		175	
T_{stg}	Storage temperature	Storage Temperature Range	-40		125	℃
V_{ISOL}	Isolation test voltage	RMS, f=50Hz, t=30s	3800			V
△p	Press drop in cooling circuit	△V/△t=10.0 dm³/min; T_F=65℃		77		mbar
p	Maximum drop in cooling circuit (relative)	$T_{baseplate}$＜40℃ $T_{baseplate}$＞40℃			2.5 2.0	bar
L_{sCE}	Stray inductance module			8		nH
$R_{CC'+EE'}$	Module lead resistance terminal to chip	Tvj=25℃, per switch		0.75		mΩ
$R_{thjF\ IGBT}$	thermal resistance, junction to cooling fluid	per IGBT, △V/△t=10.0 dm³/min; T_F=65℃		0.0957		K/W
$R_{thjF\ Diode}$	thermal resistance, junction to cooing fluid	per diode, △V/△t=10.0 dm³/min; T_F=65℃		0.142		K/W
M_1	Mounting torque for module mounting	Screw M4 baseplate to heatsink Screw EJOT Delta PT WN5451 30x10 PCB to frame	1.8 0.45	2.00 0.50	2.20 0.55	N.m
M_2	Terminal connection torque	Screw M5	3		6	N.m
m	Weight			710		g

	Material of module baseplate		Cu+Ni	
	Internal isolation	ceramics	Si_3N_4	
d_{Creep}	Creepage distance	Terminal to heatsink	9.0	mm
		Terminal to terminal	9.0	
d_{Clear}	Clearance	Terminal to heatsink	4.5	mm
		Terminal to terminal	4.5	
L×W×H	Dimension		154.5×126.5×32	mm

□ Characteristics Diagrams

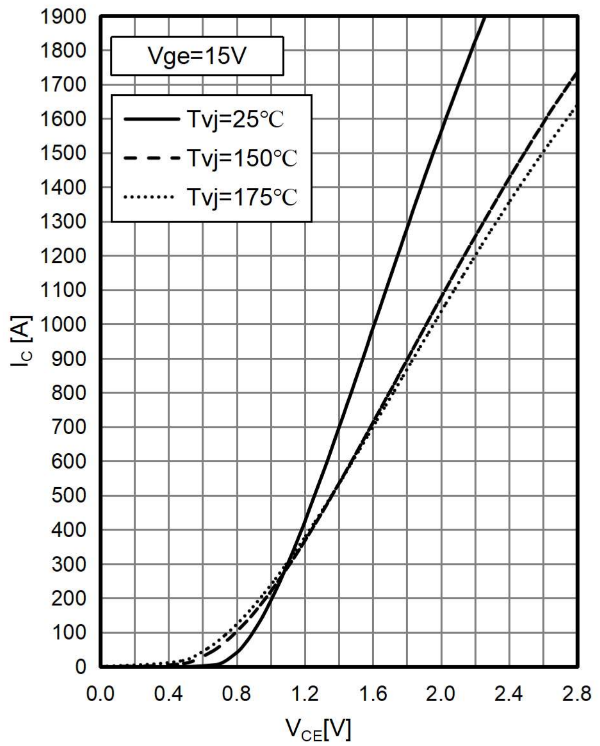


Fig.1:IGBT Output Characteristics

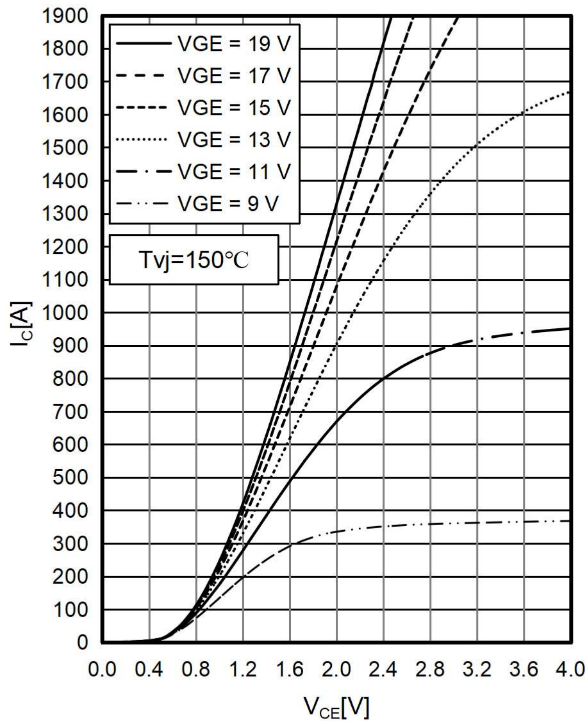


Fig.2:IGBT Output characteristics

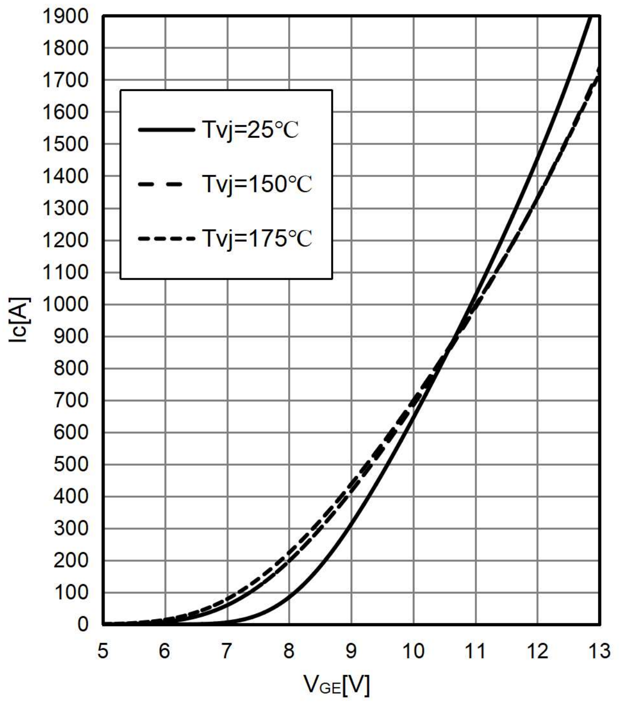


Fig.3: IGBT Transfer Characteristics

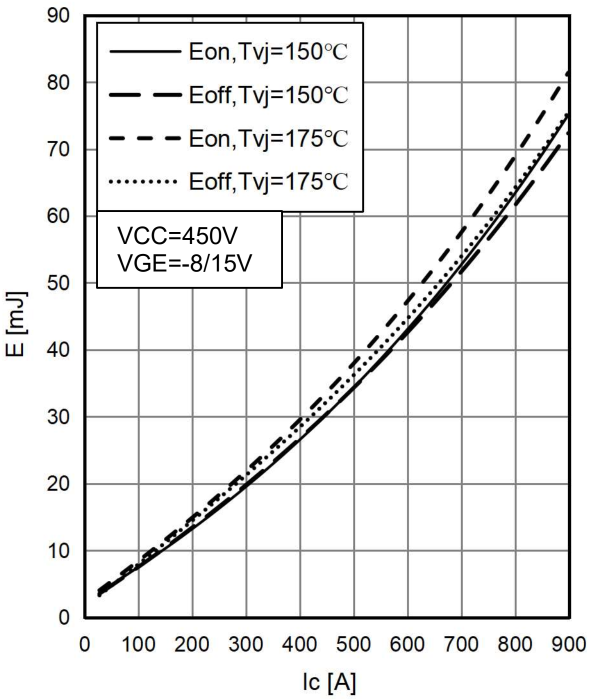
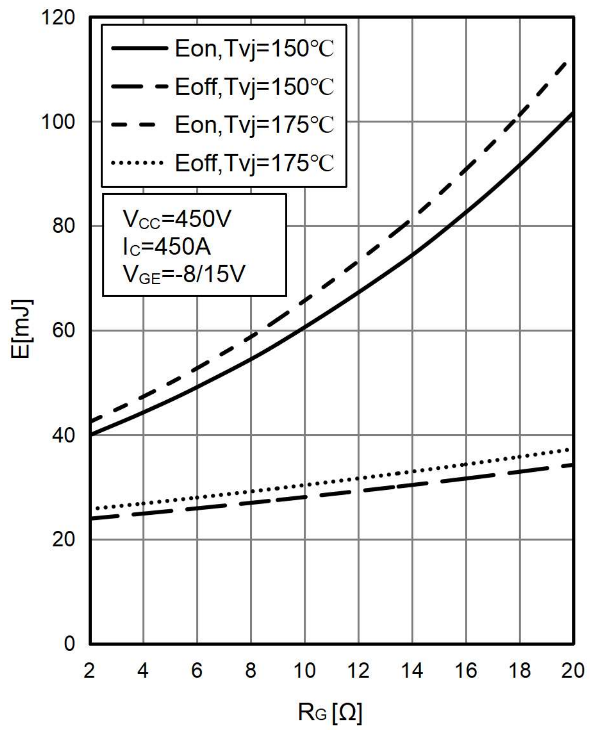


Fig.4: IGBT Switching Loss vs. I_C



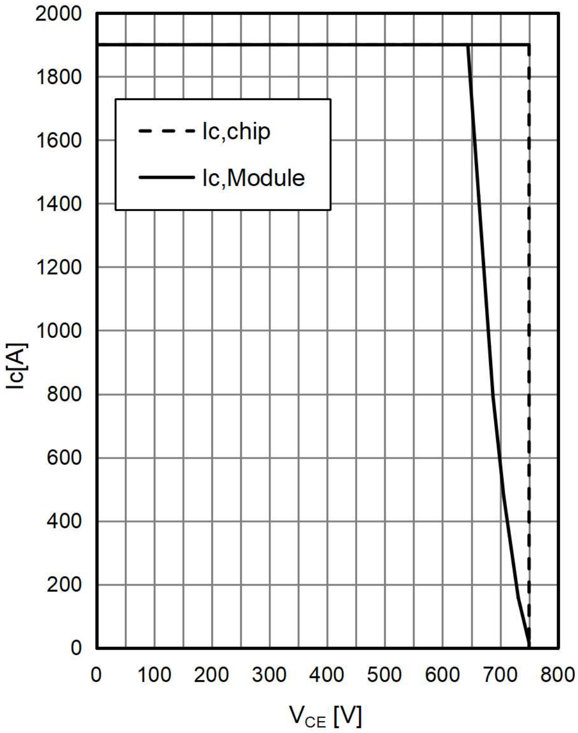
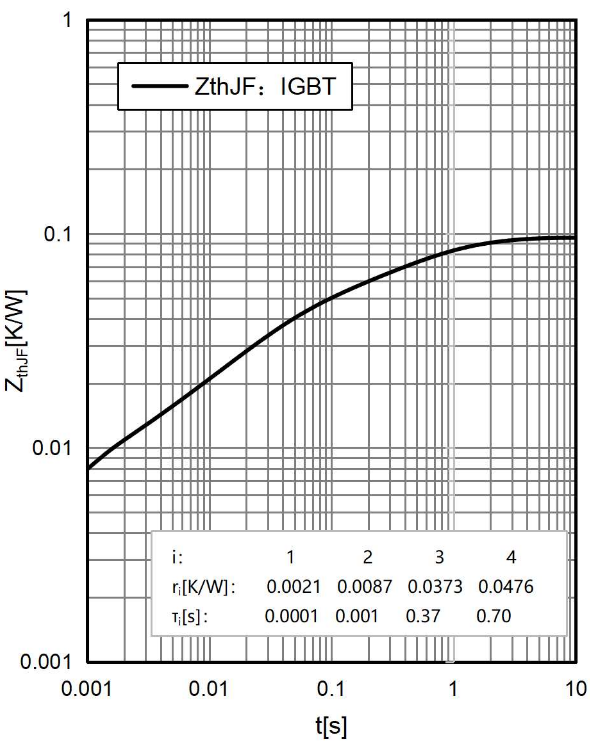


Fig.5: IGBT Switching Loss vs.R_G	Fig.6: Reverse Bias Safe Operating Area



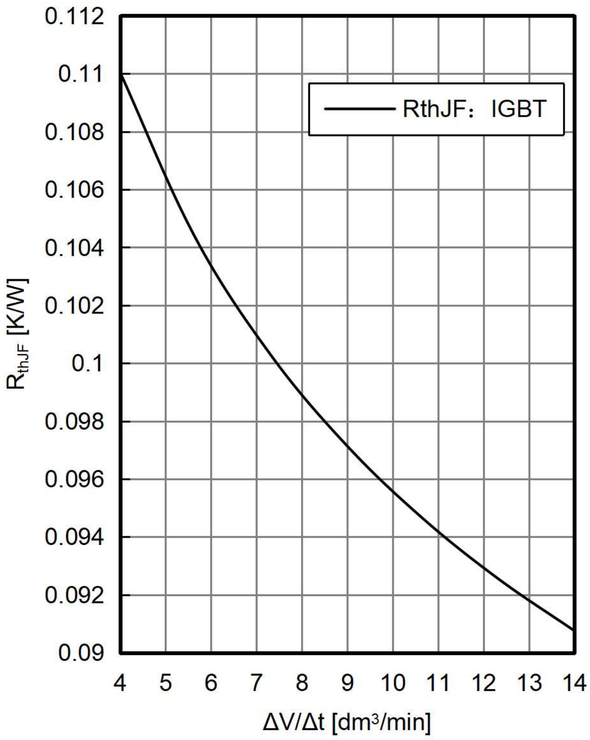


Fig.7: IGBT transient thermal impedance	Fig.8: IGBT thermal impedance

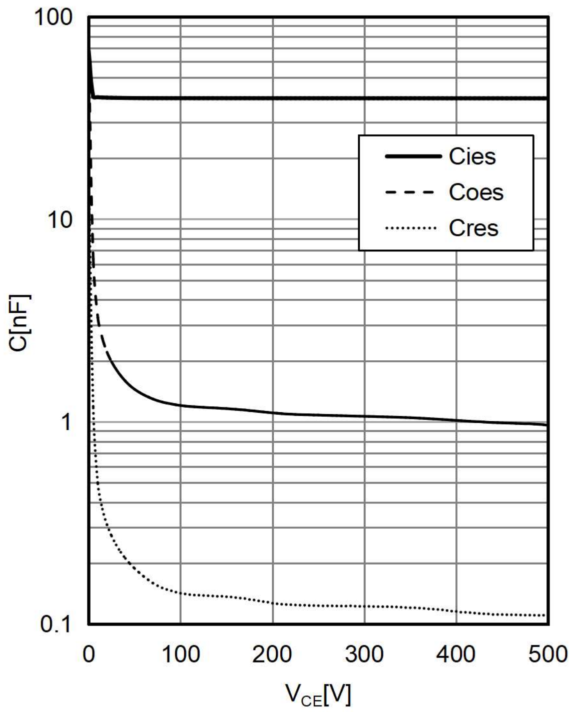
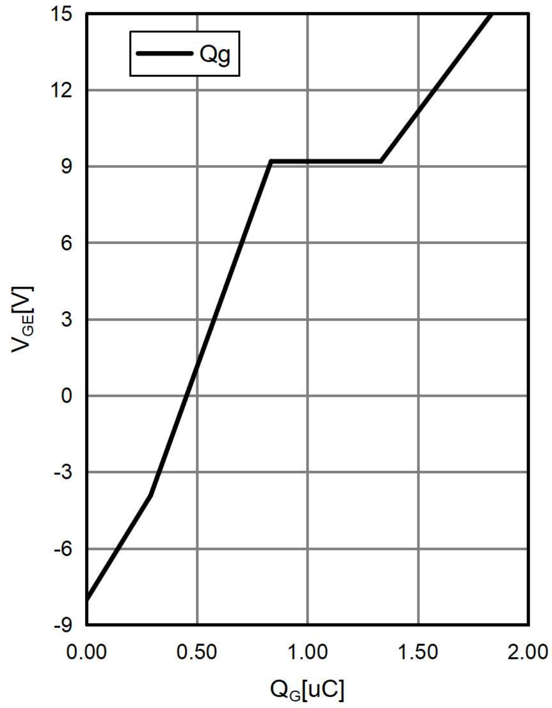
	

Fig.9: IGBT Capacity characteristic	Fig.10: IGBT Gate charge characteristic

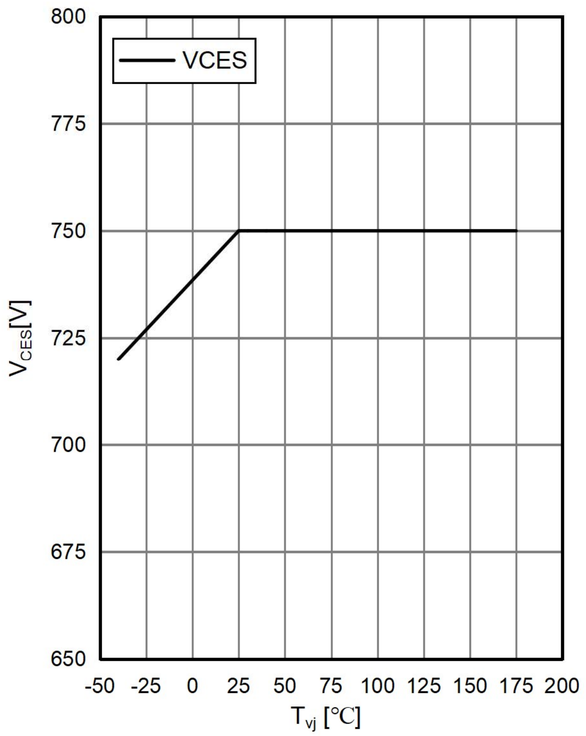
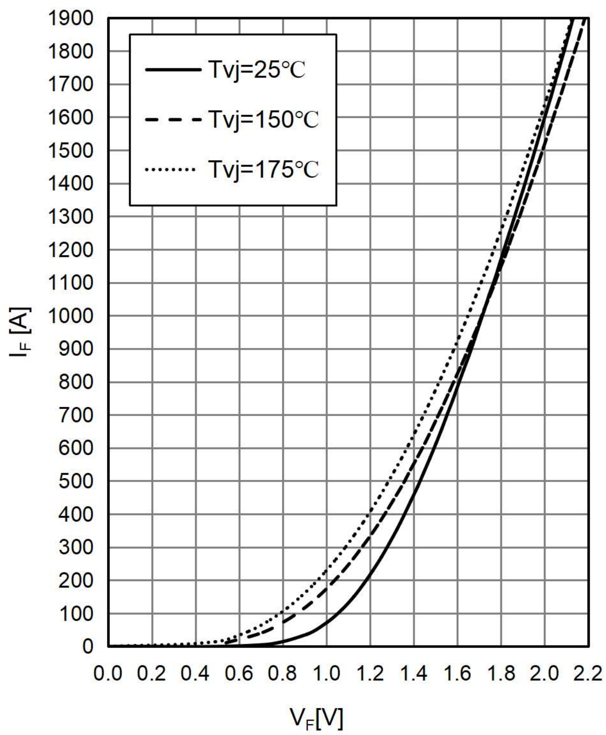
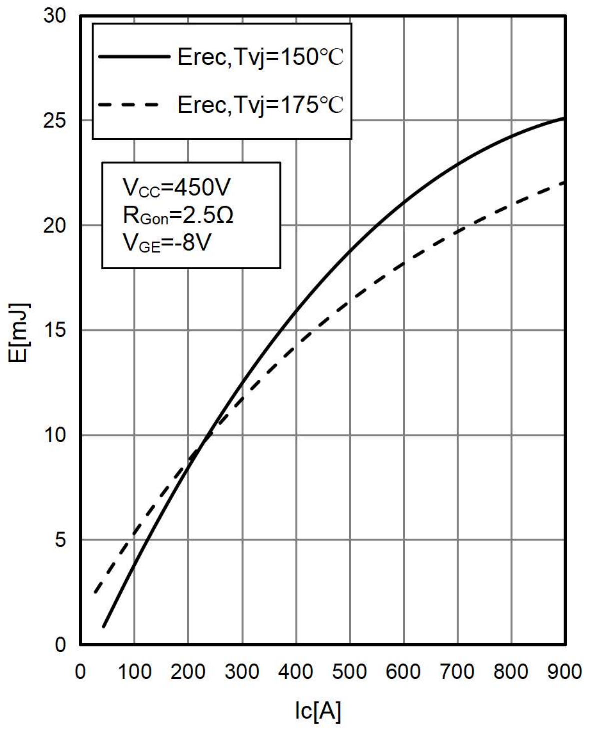

	

Fig.11: Maximum allowed collector-emitter voltage	Fig.12: Diode forward characteristic



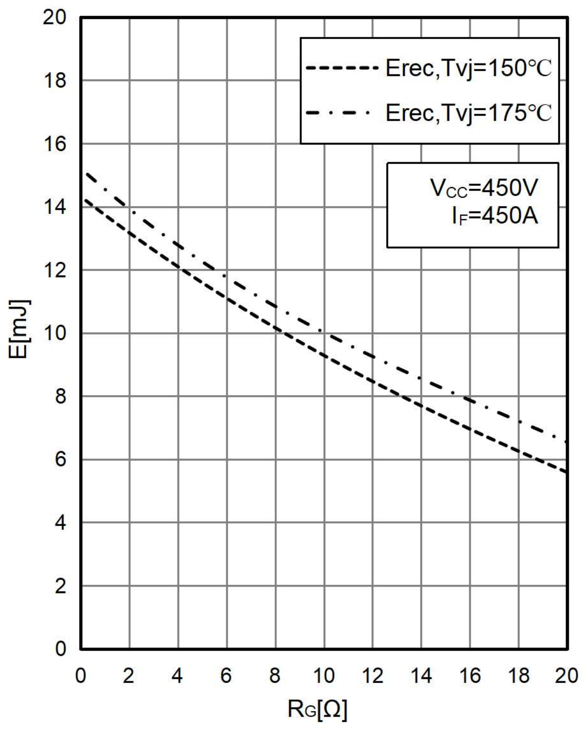
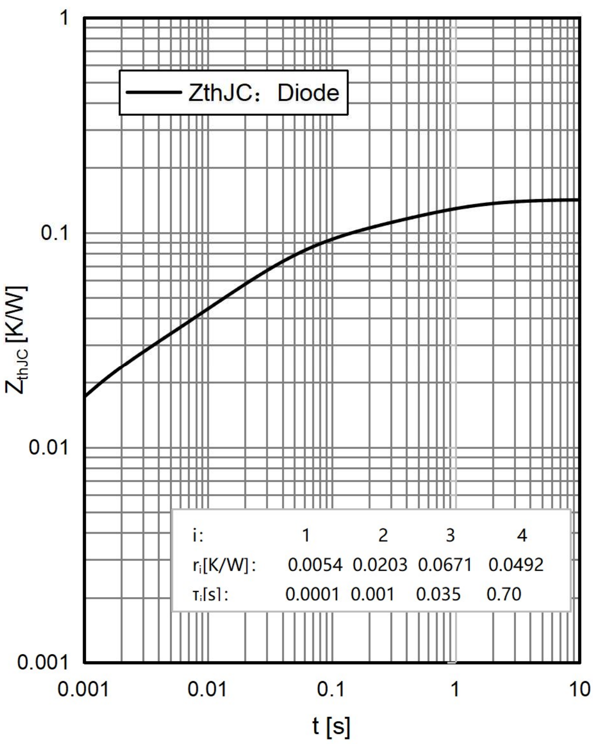


Fig.13: Diode Switching Loss vs. I_F	Fig.14: Diode Switching Loss vs.R_G



i:	1	2	3	4
r_i[K/W]:	0.0054	0.0203	0.0671	0.0492
τ_i[s]:	0.0001	0.001	0.035	0.70

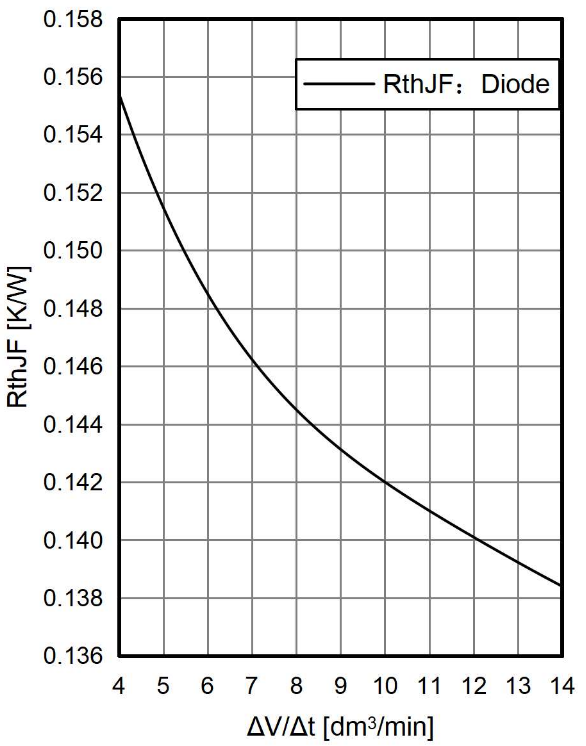


Fig.15: Diode transient thermal impedance	Fig.16: Diode thermal impedance

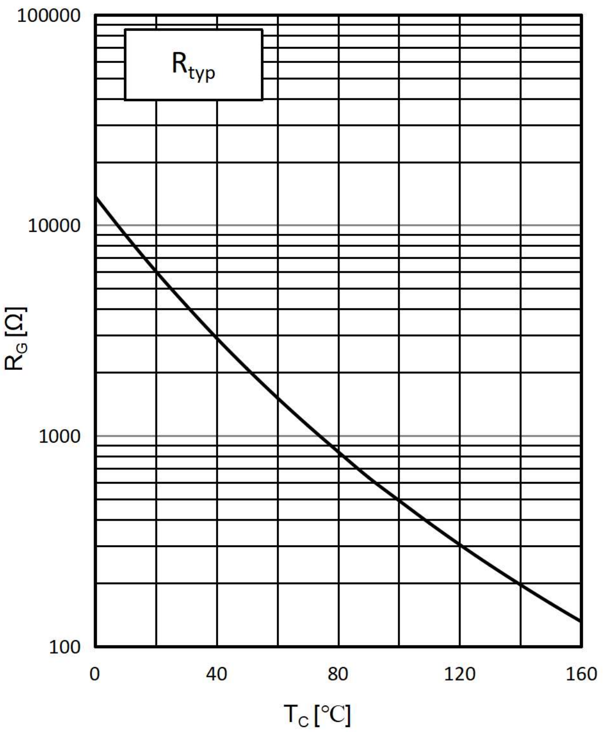


Fig.17: NTC temperature characteristic (typical)

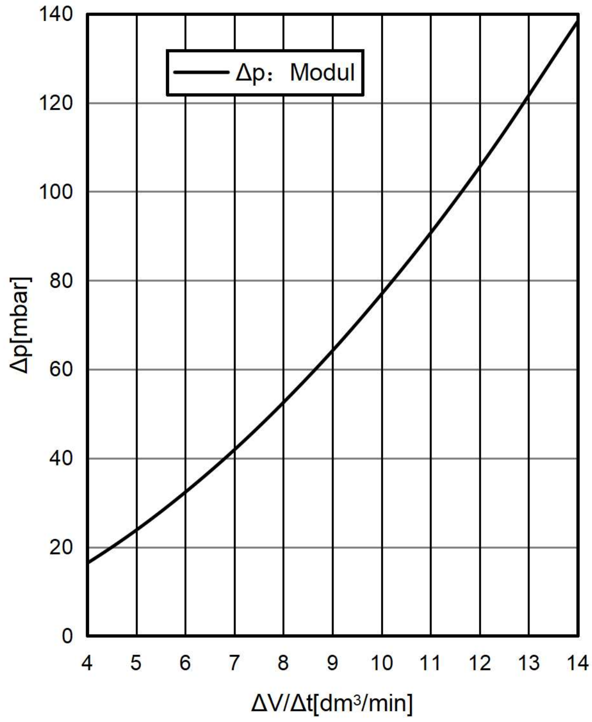
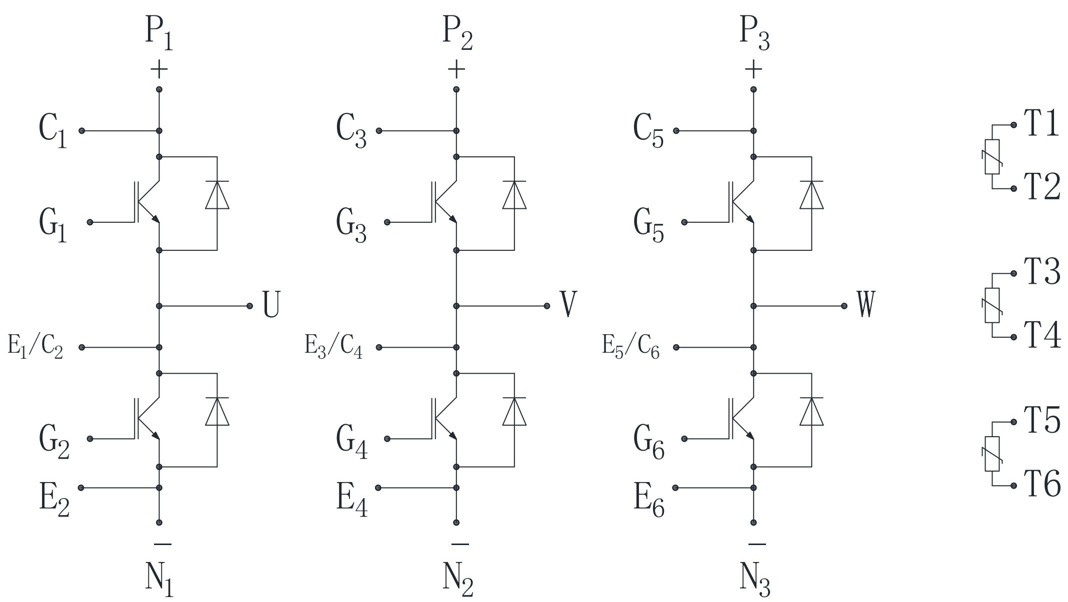
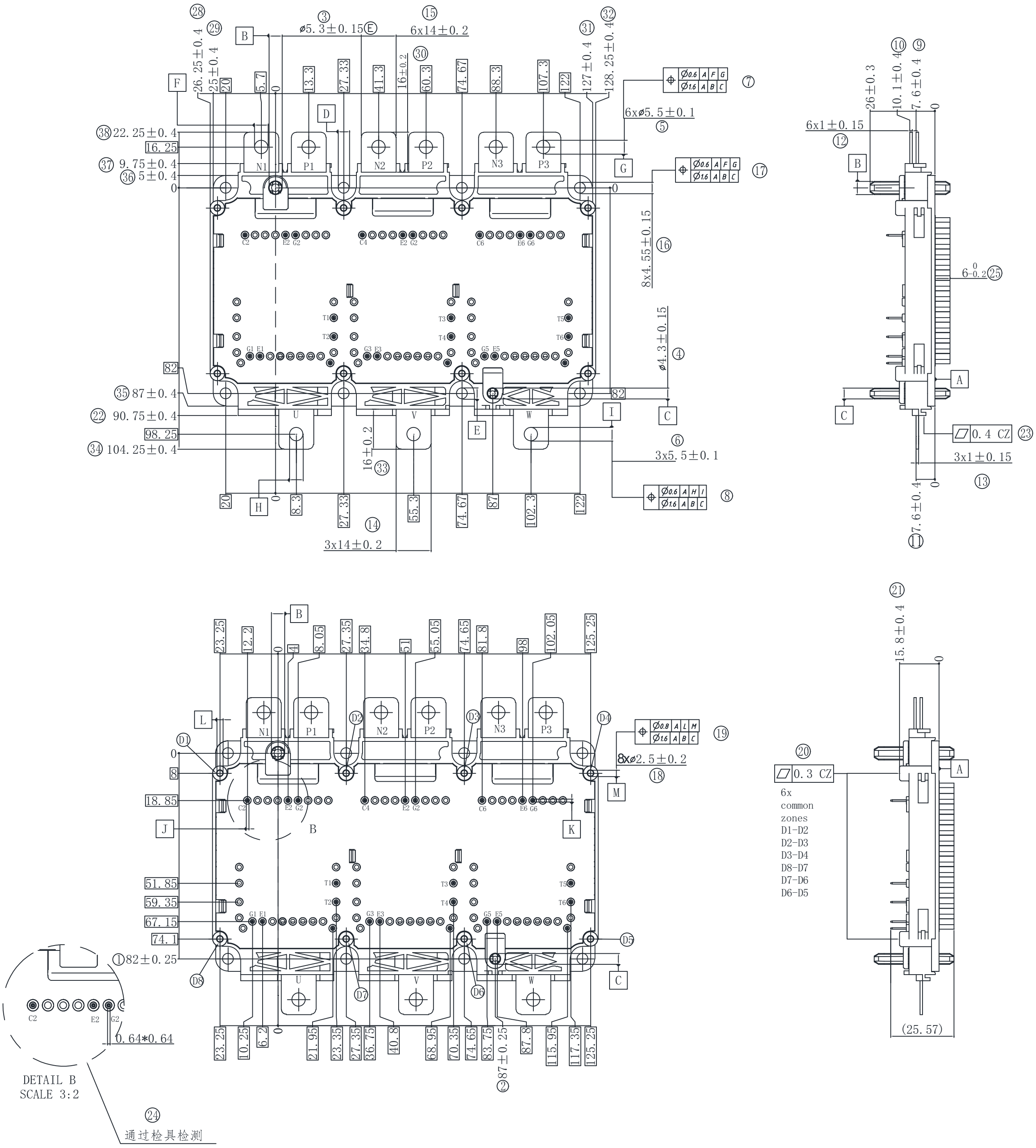


Fig.18: Pressure drop in cooling circuit

☐ Circuit Diagram



- **Package outlines**



Attention

Correct and Safety Use of Power Module

Unsuitable operation (such as electrical, mechanical stress and so on) may lead to damage of power modules.

Please pay attention to the following descriptions and use BYD's IGBT modules according to the guidance.

During Transit:

• Tossing or dropping of a carton may damage devices inside.

• If a device gets wet with water, malfunctioning and failure may result. Special care should be taken during rain or snow to prevent the devices from getting wet.

Storage:

• The temperature and humidity of the storage place should be 15~25°C and 30~60% respectively. The performance and reliability of devices may be jeopardized if devices are stored in an environment far above or below the range indicated above.

Prolonged Storage:

• When storing devices more than one year, dehumidifying measures should be provided for the storage place. When using devices after a long period of storage, make sure to check the exterior of the devices is free from scratches, dirt, rust, and so on.

Operating Environment:

• Devices should not be exposed to water, organic solvents, corrosive gases, explosive gases, fine particles, or corrosive agents, since any of those can lead to a serious accident.

Anti-electrostatic Measures:

• Following precautions should be taken for gated devices to prevent static buildup which could damage the devices.

(1) Precautions against the device rupture caused by static electricity

Static electricity of human bodies and cartons and/or excessive voltage applied across the gate to emitter may damage and rupture devices. Sense-emitter and temperature-sensor are also vulnerable to excessive voltage. The basis of anti-electrostatic is suppression of build-up and quick dissipation of the charged electricity.

❐ Containers that are susceptible to static electricity should not be used for transit or for storage.

❐ Signal terminals to emitter should be always shorted with a carbon cloth or the like until right before a module is used. Never touch the signal terminals with bare hands.

❐ Always ground the equipment and your body during installation (after removing a carbon cloth or the like. It is advisable to cover the workstation and its surrounding floor with conductive mats and ground them.

❐ Use soldering irons with grounded tips.

BYD Semiconductor Co., Ltd. exerts the greatest possible effort to ensure high quality and reliability. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing BYD products, to comply with the standards of safety in making a safe design for the entire system, including redundancy, fire-prevention measures, and malfunction prevention, to prevent any accidents, fires, or community damage that may ensue. In developing your designs, please ensure that BYD products are used within specified operating ranges as set forth in the most recent BYD products specifications.