

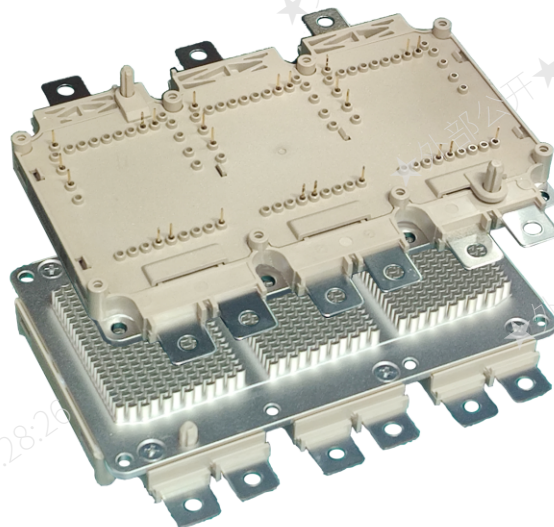


BGW820F08B14L6-D

IGBT Power Module

* General Description

BYD IGBT Power Module BGW820F08B14L6-D provides low conduction and switching loss as well as short circuit ruggedness. which introduce the advanced Fine 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.

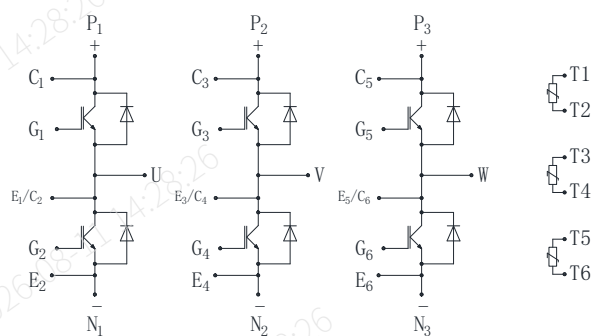


* Key Features

- Full bridge module
- Compact & High power density design
- 750V Fine 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
- $T_{vj\ op}=150^{\circ}\text{C}$
- Short-time extended Operation Temperature $T_{vj\ op}=175^{\circ}\text{C}$
- RoHS compliant

* Applications

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



**BGW820F08B14L6-D**

● IGBT

□ Maximum Rated Values

Symbol	Parameter	Conditions	Value	Unit
V_{CES}	Collector-emitter voltage	$T_{vj}=25^{\circ}\text{C}$	750	V
V_{GES}	Gate-emitter voltage	$T_{vj}=25^{\circ}\text{C}$	± 20	V
I_{CN}	Implemented Collector current		820	A
$I_{C\text{ nom}}$	Continuous DC Collector current	$T_F=80^{\circ}\text{C}$, $T_{vj\text{ max}}=175^{\circ}\text{C}$	450	A
I_{CRM}	Repetitive peak collector current	Pulse, $t_P=1\text{ms}$, $T_{vj}=25^{\circ}\text{C}$	1640	A
P_{tot}	Total power dissipation	$T_F=65^{\circ}\text{C}$, $T_{vj\text{ max}}=175^{\circ}\text{C}$	982	W

□ Characteristics Values

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{CE\text{ sat}}$	Collector-Emitter Saturation Voltage	$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=25^{\circ}\text{C}$		1.20		V
		$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=150^{\circ}\text{C}$		1.30		
		$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=175^{\circ}\text{C}$		1.30		
		$I_C=820\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=25^{\circ}\text{C}$		1.45		
		$I_C=820\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=175^{\circ}\text{C}$		1.70		
V_{GEth}	Gate threshold voltage	$V_{CE}=V_{GE}$, $I_C=9.6\text{mA}$, $T_{vj}=25^{\circ}\text{C}$	4.9	5.8	6.5	V
Q_G	Gate charge	$V_{GE}=-8\text{V}\dots+15\text{V}$, $V_{CE}=400\text{V}$		1.84		μC
R_{Gint}	Internal gate Resistance	$T_{vj}=25^{\circ}\text{C}$		0.8		Ω
C_{ies}	Input capacitance	$T_{vj}=25^{\circ}\text{C}$, $f=100\text{KHz}$, $V_{CE}=50\text{V}$, $V_{GE}=0\text{V}$		39.6		nF
C_{oes}	Output capacitance			1.45		nF
C_{res}	Reverse capacitance			0.19		nF
I_{CES}	Collector-emitter cut-off current	$V_{CE}=750\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$			1	mA
I_{GES}	Gate-emitter leakage current	$V_{CE}=0\text{V}$, $V_{GE}=20\text{V}$, $T_{vj}=25^{\circ}\text{C}$			400	nA

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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	$T_{vj} = 25^\circ\text{C}$	750	V
I_{FN}	Implemented forward current		820	A
I_F	Continuous DC forward current		450	A
I_{FRM}	Repetitive peak forward current	Pulse, $t_p = 1\text{ ms}$, $T_{vj} = 25^\circ\text{C}$	1640	A
I^2t	I^2t -value	$V_R = 0\text{ V}$, $t_p = 10\text{ ms}$, $T_{vj} = 150^\circ\text{C}$ $V_R = 0\text{ V}$, $t_p = 10\text{ ms}$, $T_{vj} = 175^\circ\text{C}$	27000 25000	A ² s A ² s

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□ 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 =820A, V _{GE} =0V, T _{vj} =25℃		1.65			
		I _F =820A, V _{GE} =0V, T _{vj} =175℃		1.55			
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	$T_C=25^{\circ}C$		5.0		K Ω
$\Delta R/R$	Deviation of R100	$T_C=100^{\circ}C, R_{100}=493$	-5		5	%
P_{25}	Power dissipation	$T_C=25^{\circ}C$			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	T _{vj} =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℃		0.112	0.132	K/W
R _{thjF Diode}	thermal resistance, junction to cooing fluid	per diode, △V/△t=10.0 dm³/min; T _F =65℃		0.1823	0.200	K/W
M ₁	Mounting torque for module mounting	Screw M4 baseplate to heatsink Screw EJOT Delta PT WN5451	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
D _{pin}	Pin Hole Diameter		1.5		1.7	mm
D	Pin Diameter	Designer Pin Diameter		0.84		mm
δ	Baseplate Warpage	Warpage along the length Warpage along the width	-0.25 -0.20		0.25 0.15	mm
	Material of module baseplate		Cu+Ni			
	Internal isolation	ceramics	Al ₂ O ₃			
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

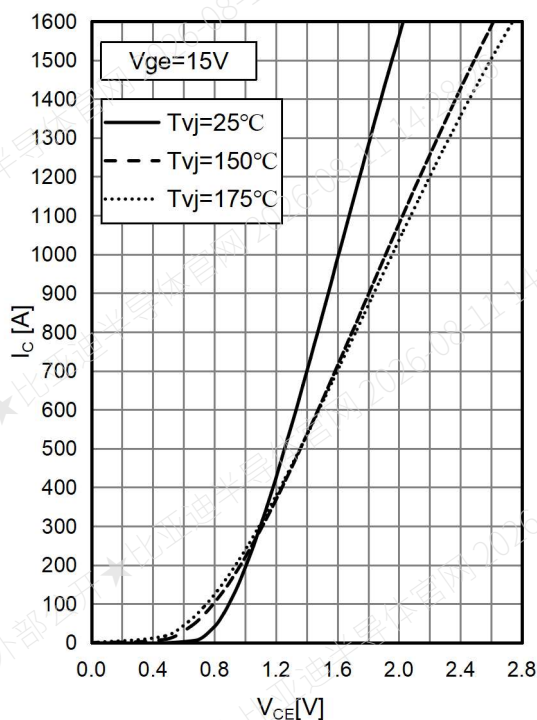


Fig.1: IGBT Output Characteristics

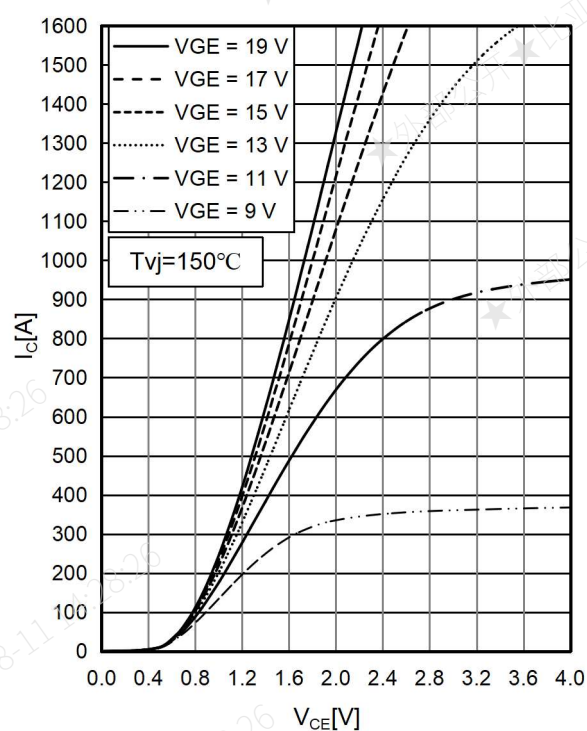


Fig.2: IGBT Output characteristics

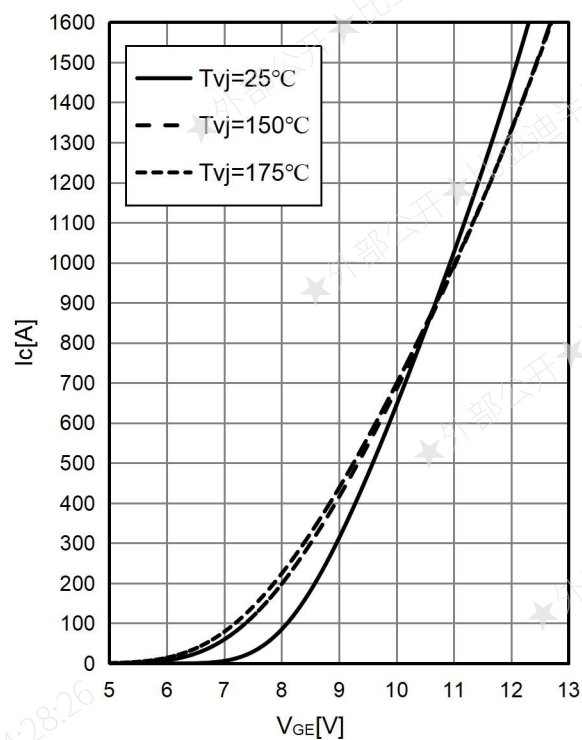
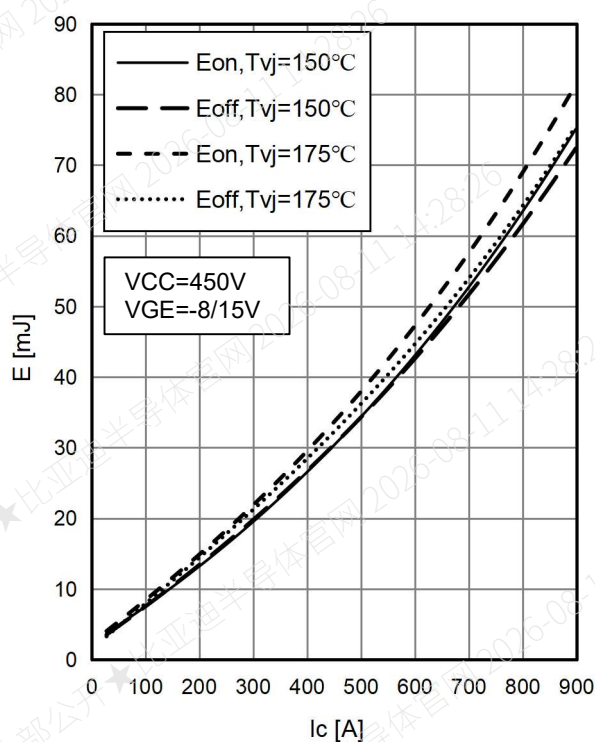
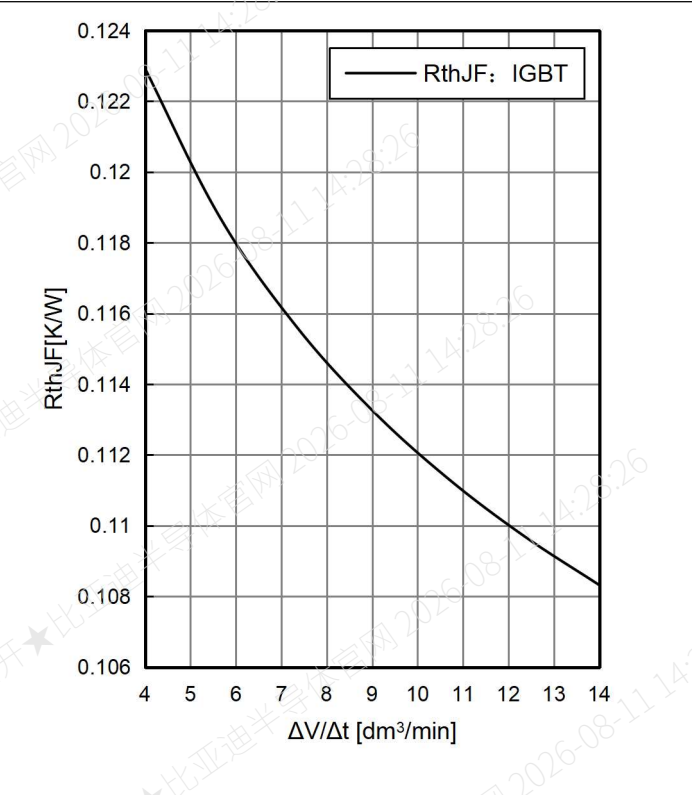
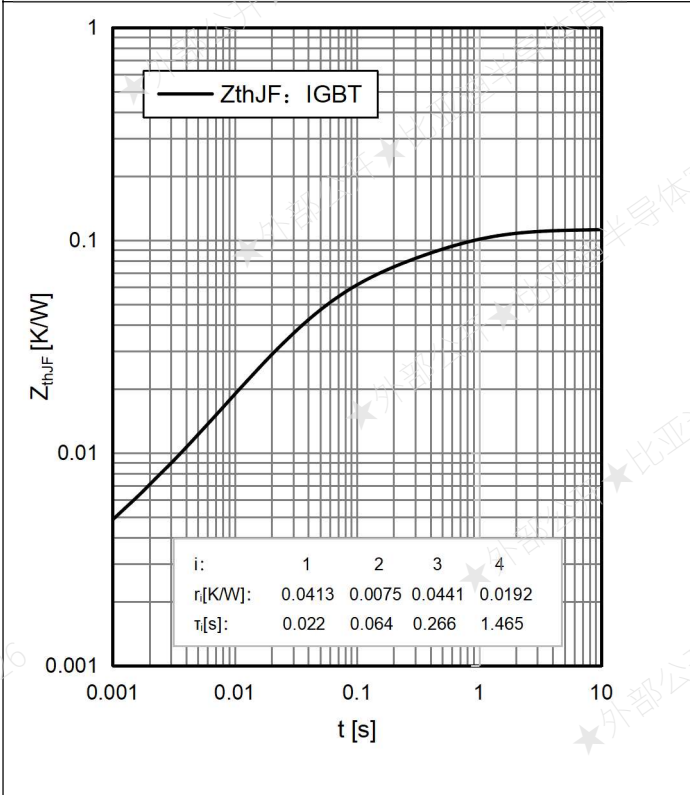
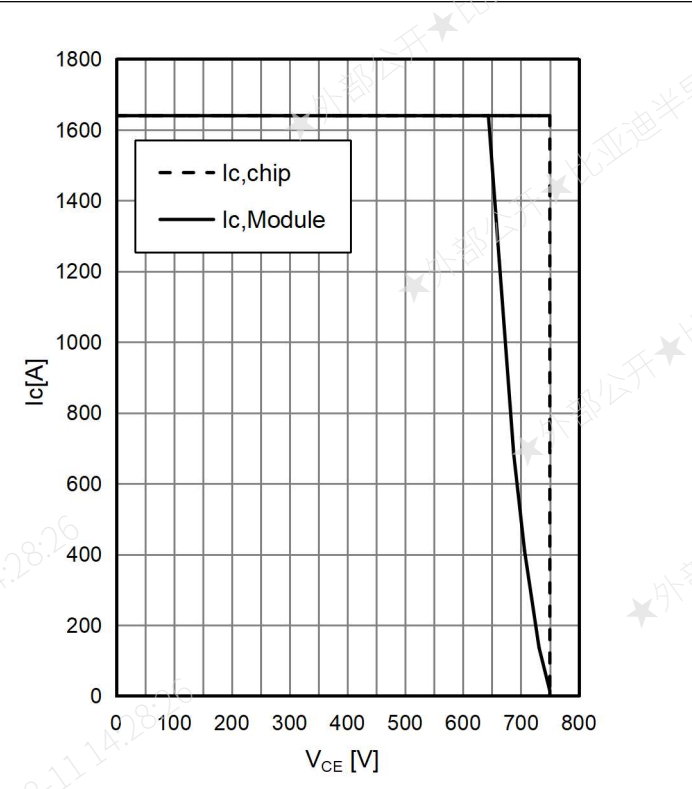
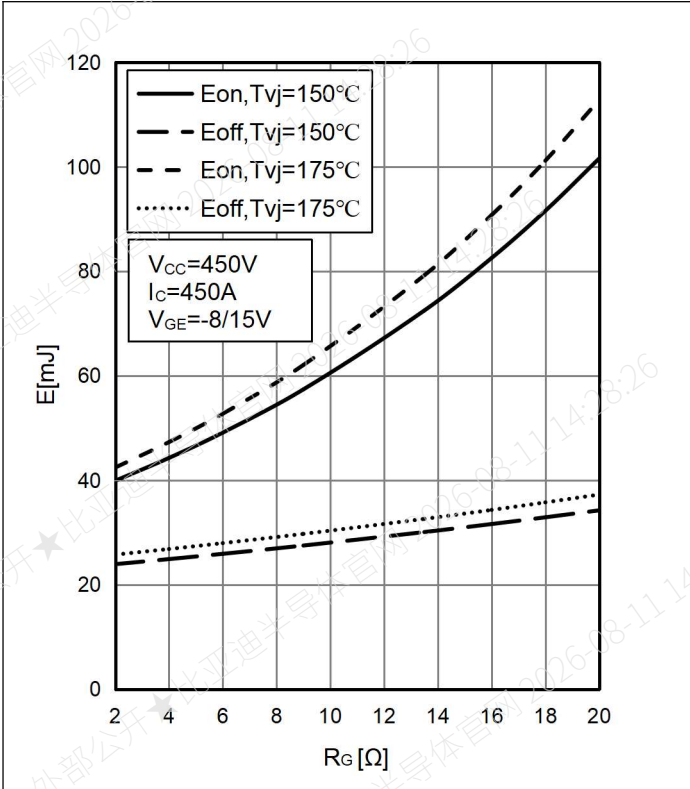


Fig.3: IGBT Transfer Characteristics

Fig.4: IGBT Switching Loss vs. I_c



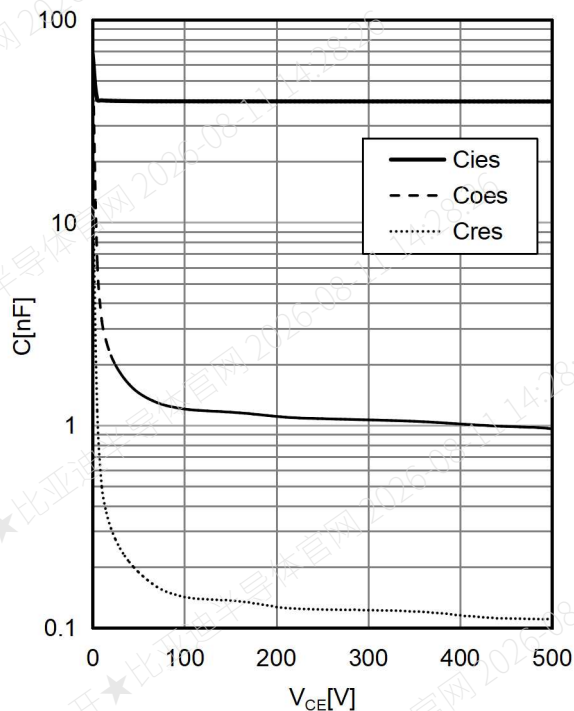


Fig.9: IGBT Capacity characteristic

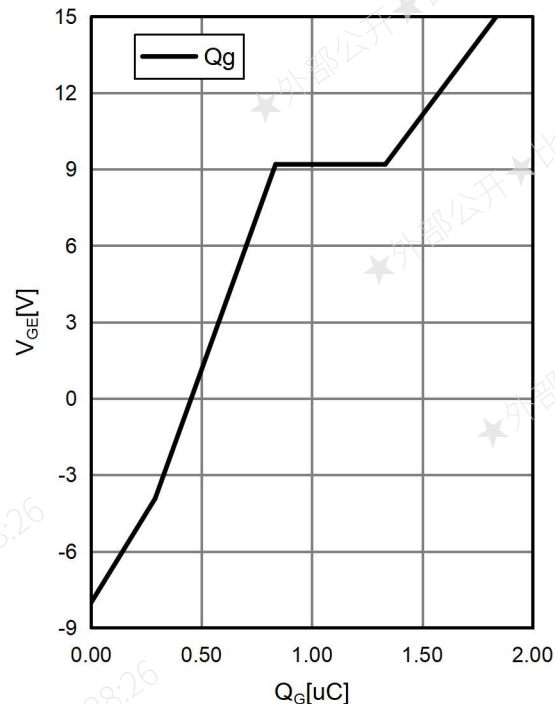


Fig.10: IGBT Gate charge characteristic

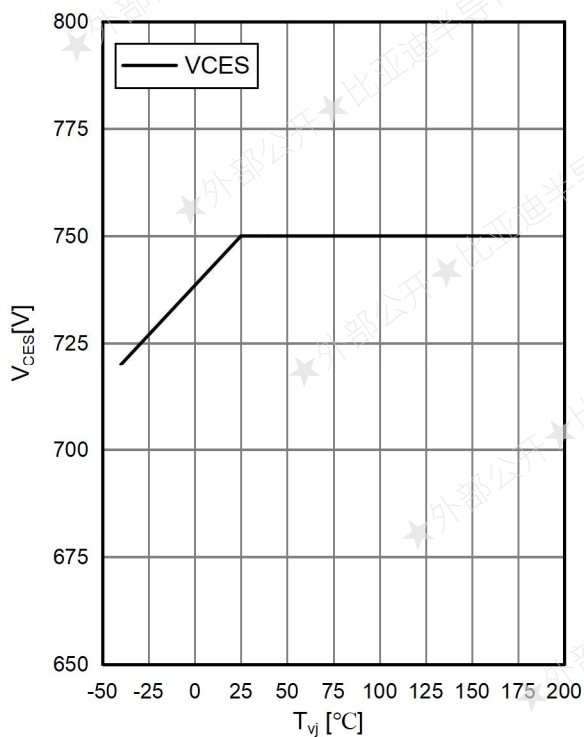


Fig.11: Maximum allowed collector-emitter voltage

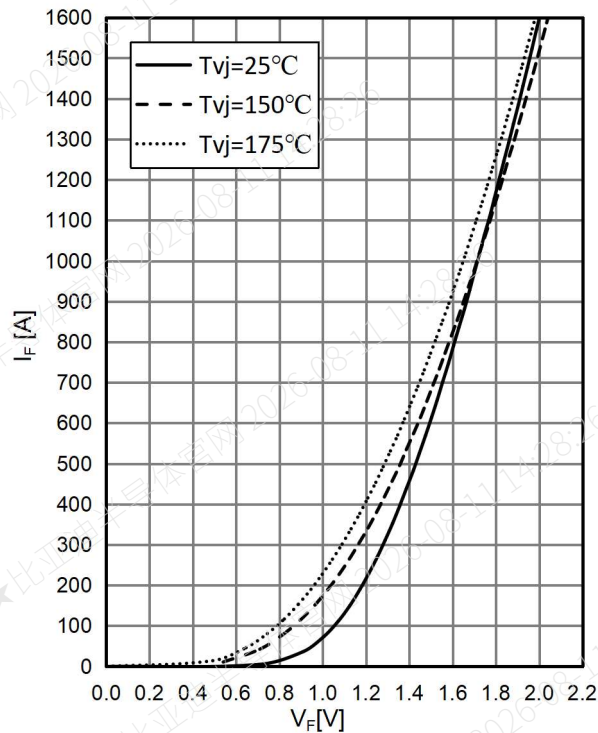


Fig.12: Diode forward characteristic

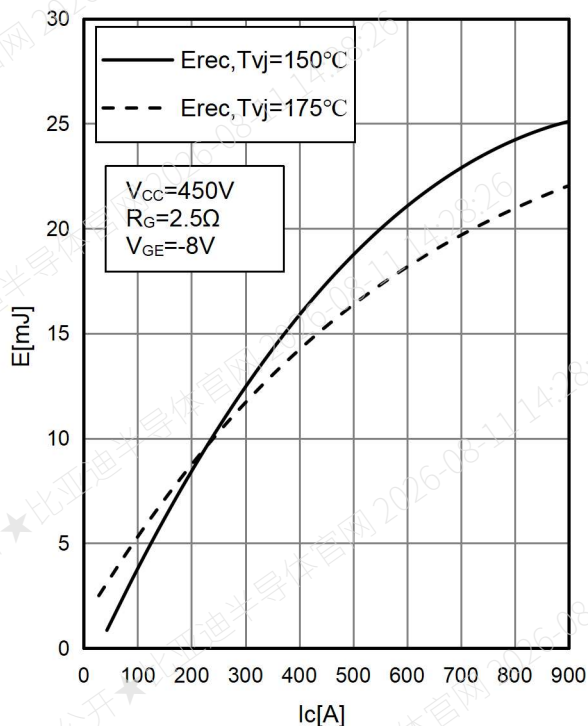
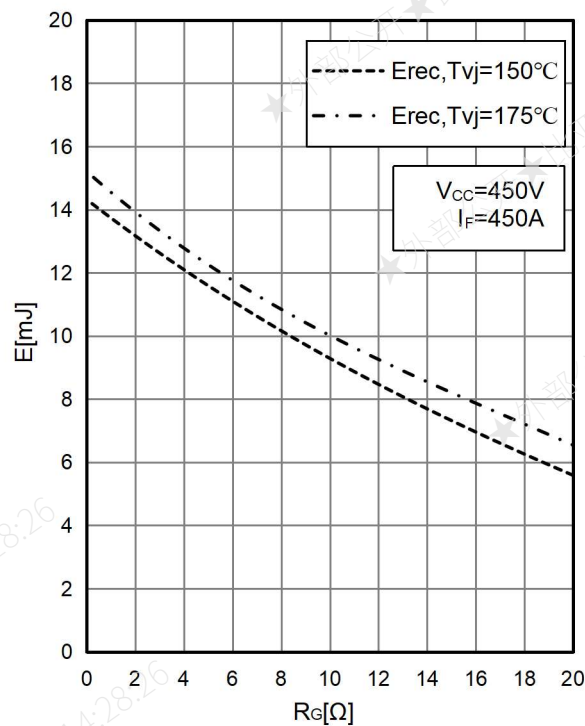
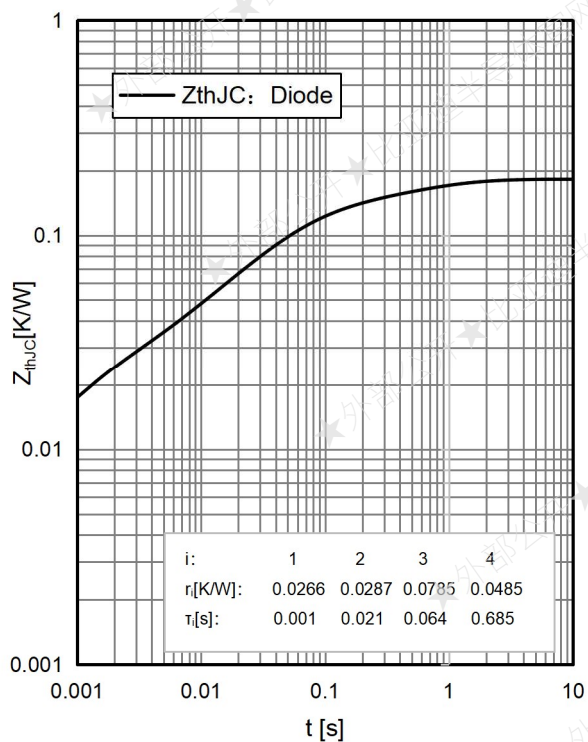
Fig.13: Diode Switching Loss vs. I_F Fig.14: Diode Switching Loss vs. R_G 

Fig.15: Diode transient thermal impedance

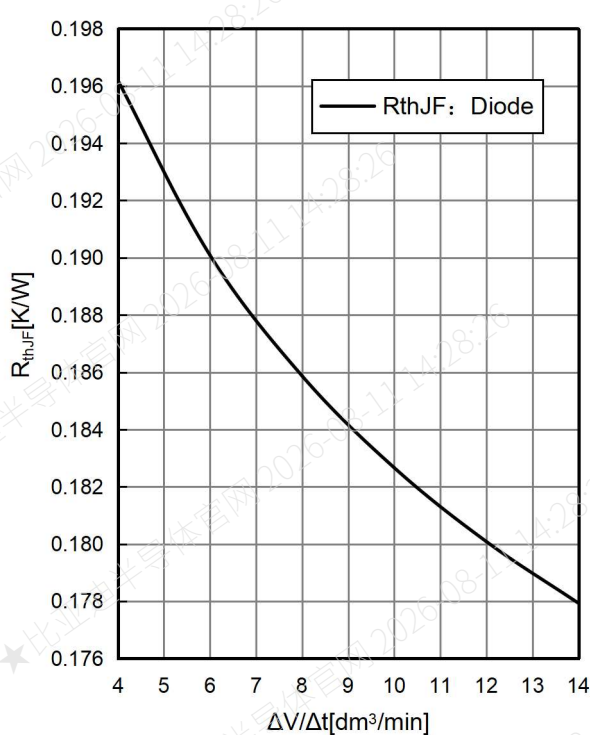


Fig.16: Diode thermal impedance



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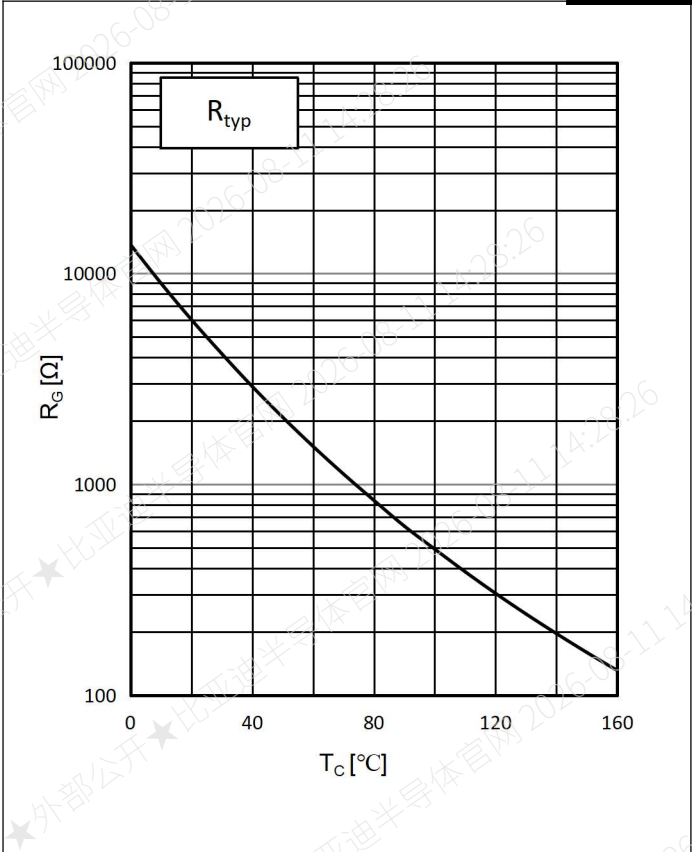


Fig.17: NTC temperature characteristic (typical)

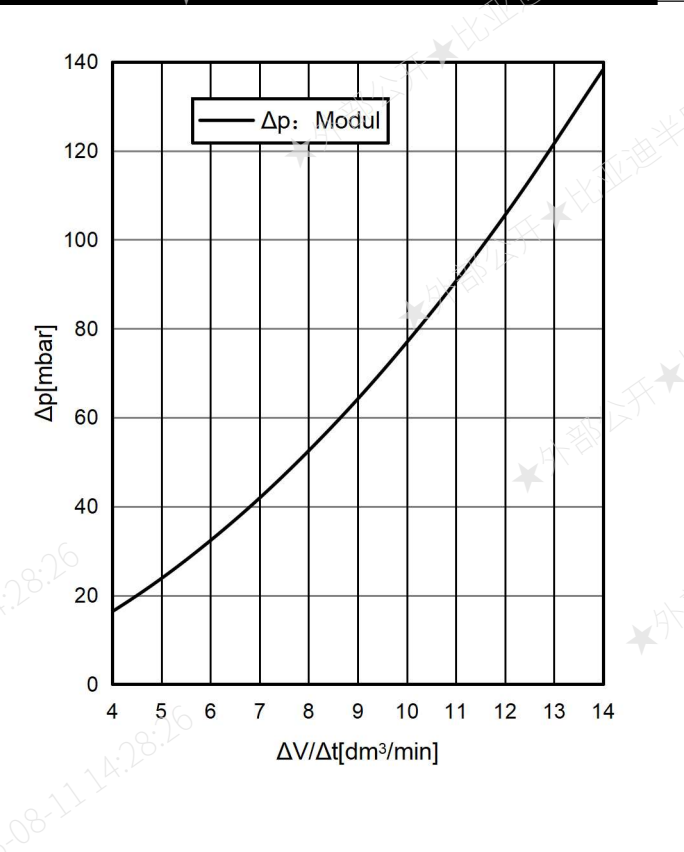
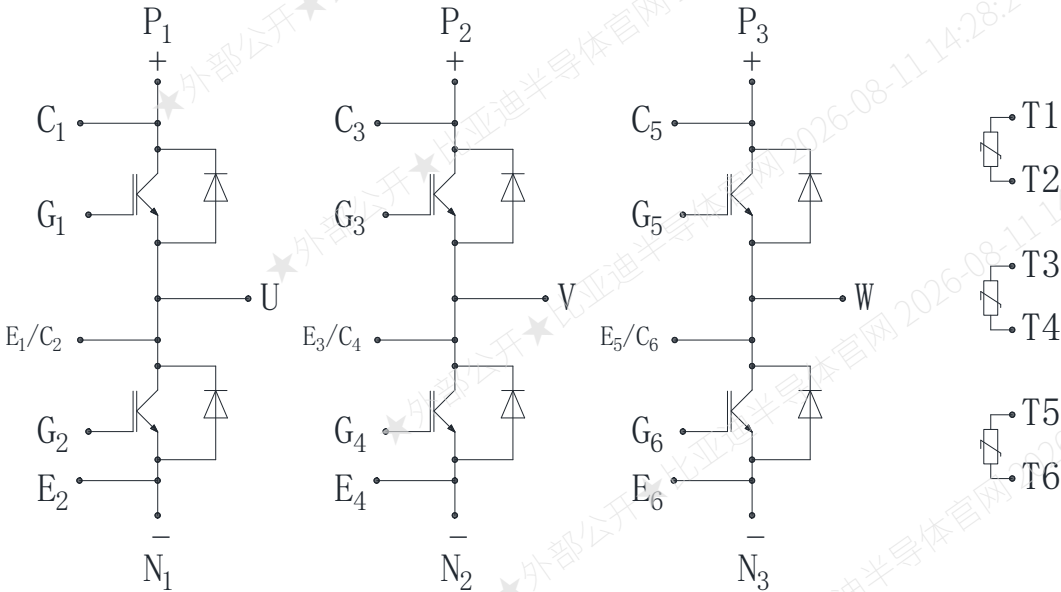
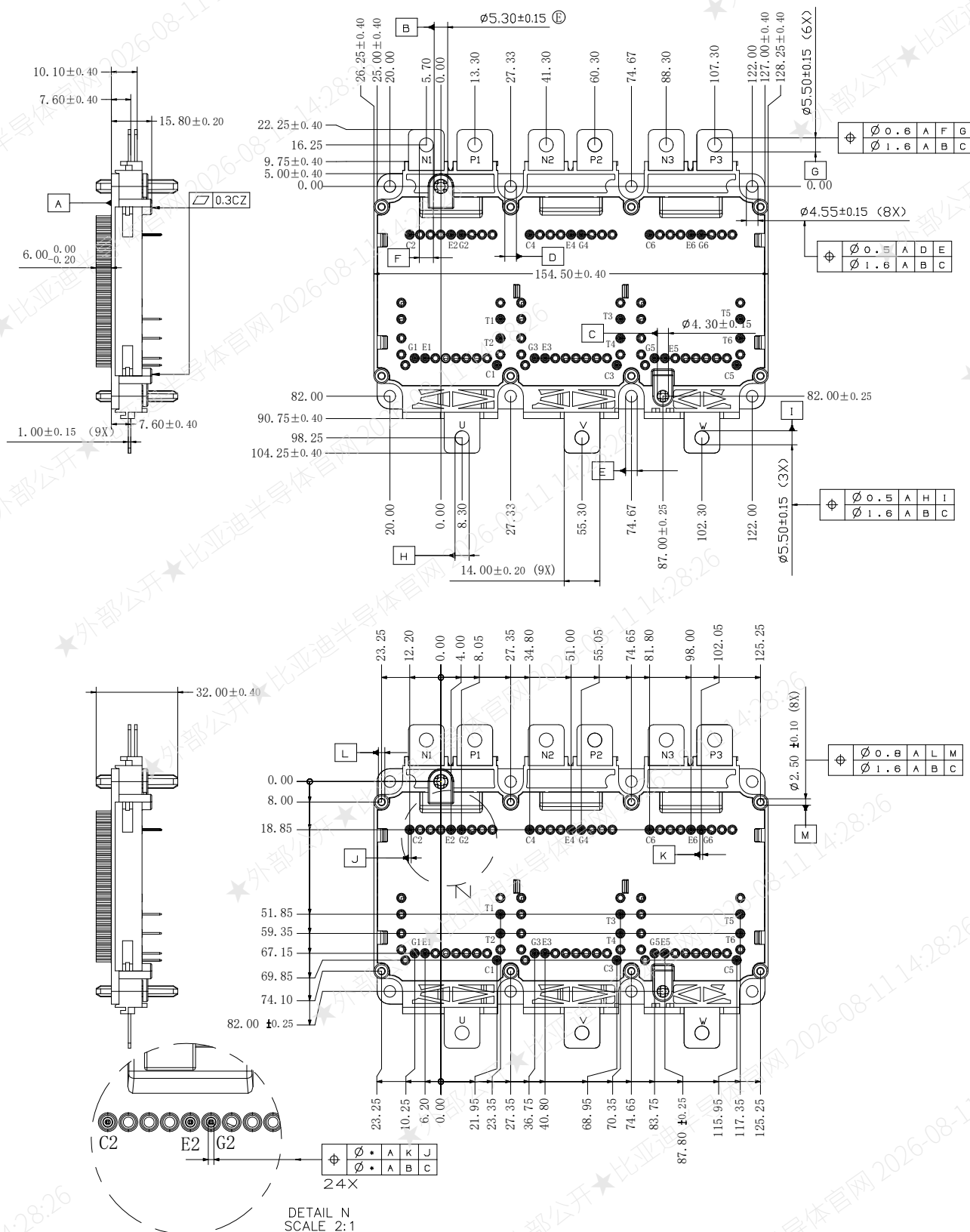


Fig.18: Pressure drop in cooling circuit

□ Circuit Diagram



- **Package outlines**





DISCLAIMER

- **Application:** This product is suitable for general vehicle-grade electrical applications.
- **Warranty Period:** Unless otherwise agreed in the COOPERATION AGREEMENT or other WRITTEN DOCUMENTS, the Warranty Period for the product described in this specification is 12 months from the date of shipment.
- **Special Notes Related to the Product :**
 - **Transit:**
 - 1) The tossing or dropping of a carton may lead to damage of the devices contained within.
 - 2) If device comes into contact with water, it may result in malfunction or failure. Special precautions should be taken during rainy or snowy conditions to prevent the devices from becoming wet.
 - **Storage:**

The storage environment for the devices should maintain a temperature range of 5~35° C and a humidity level of 30~75%RH. Storing the devices in an environment that falls outside of these specified ranges may jeopardize their performance and reliability.
 - **Usage:**
 - 1) Please install IGBT modules which potting with silicone properly with the pins up. Unsuitable operation (such as electrical, mechanical stress and so on) may lead to damage of power modules.
 - 2) 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.
 - 3) Anti-static Measures: To prevent static electricity accumulation that could damage the gate devices, the following precautions should be taken: The signal terminals should always be shorted to the emitter with conductive foam or other materials until the module is about to be used, at which point they should be removed. Never touch the signal terminals with bare hands. During installation (after removing the conductive foam or other materials), ensure that the equipment and your body are grounded. It is recommended to cover the workbench and the surrounding floor with conductive pads and ground them. Use a grounded soldering iron tip.
- Our company is committed to enhancing product quality and stability. This specification serves solely to delineate technical product details.
- **Notwithstanding the Company's reasonable efforts and due diligence, the sensitive nature of the products and variations in testing environments and systems may result in a certain failure rate, including potential malfunctions or failures under specific conditions. Consequently, the Company does not warrant the accuracy of the information contained in the specifications, nor the fitness for a particular purpose or merchantability of the products. The information in the specifications shall not be construed as a guarantee or commitment regarding product functionality, condition, or quality.**
- The content contained in this specification shall not be construed as any express, implied, or otherwise grant and/or license to patents, trademarks, copyrights, or other intellectual property rights owned by the Company or third parties. The Company's commitments regarding product intellectual property are strictly limited to the terms expressly stated in SEPARATE WRITTEN AGREEMENTS with Customers. Reverse-engineering, disassembly, or any form of analysis of the product is strictly prohibited without the Company's prior written consent.

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- The Company shall not be held liable for any product damage or consequential incidents resulting from usage beyond the recommended storage conditions, operating parameters, or absolute maximum ratings (or other explicitly stated limits) specified in this specification. Customers must strictly adhere to the operational procedures and conditions outlined in the latest version of the specification when utilizing or testing the product. Customers are responsible for complying with safety standards, including but not limited to redundant design, fire prevention measures, and fault prevention, to design and maintain a safe and stable system environment. Customers must verify all functionalities described in the specifications before or during actual application to ensure product suitability, safety (preventing potential accidents, fires, or public harm etc.), and reliability. It is recommended that Customers consult our company prior to testing to confirm whether the product information adequately covers the application requirements.
- This product shall not be used in any equipment requiring higher reliability or quality standards where failure could result in personal injury, death, or catastrophic events, including but not limited to nuclear control systems, aircraft/aviation components, maritime/rail transport equipment, traffic signaling devices, combustion control systems, medical equipment, or other safety-critical applications. Customers must procure genuine products exclusively through the Company or authorized channels, and utilize them strictly within legally permitted boundaries and under conditions expressly defined in this specification. The Company disclaims all liability for losses, damages, or injuries arising from non-compliance with these requirements.
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