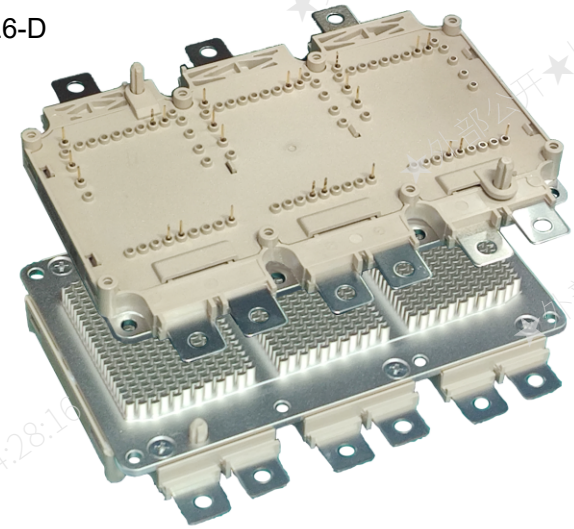
Semiconductor

BGW600F08B14L6-D

IGBT Power Module

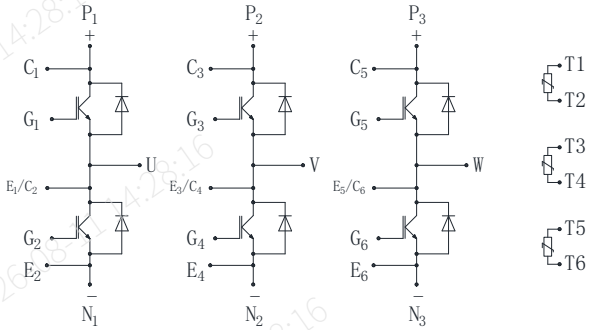
General Description

BYD IGBT Power Module BGW600F08B14L6-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℃
- 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		600	A
$I_{C\ nom}$	Continuous DC Collector current	T_F=65℃, $T_{vj\ max}$=175℃	450	A
I_{CRM}	Repetitive peak collector current	Pulse, t_P=1ms, T_{vj}=25℃	1200	A
P_{tot}	Total power dissipation	T_F=65℃， $T_{vj\ max}$=175℃	688	W

❒ Characteristic 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℃		1.38		V
		I_C=450A, V_{GE}=15V, T_{vj}=150℃		1.55		
		I_C=450A, V_{GE}=15V, T_{vj}=175℃		1.57		
		I_C=600A, V_{GE}=15V, T_{vj}=25℃		1.54		
		I_C=600A, V_{GE}=15V, T_{vj}=175℃		1.80		
V_{GEth}	Gate threshold voltage	V_{CE}=V_{GE}, I_C=6.4mA, T_{vj}=25℃	4.9	5.8	6.5	V
Q_G	Gate charge	V_{GE}=-8V…+15V, V_{CE}=400V		1.24		μC
R_{Gint}	Internal gate Resistance	T_{vj}=25℃		1.2		Ω
C_{ies}	Input capacitance	T_{vj}=25℃, f=100KHz, V_{CE}=50V, V_{GE}=0V		26.28		nF
C_{oes}	Output capacitance			1.03		nF
C_{res}	Reverse capacitance			0.13		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}=16.5Ω L_S=30nH	T_{vj}=25℃		212		ns
			T_{vj}=150℃		228		ns
			T_{vj}=175℃		230		ns
t_r	Rise time		T_{vj}=25℃		83		ns
			T_{vj}=150℃		106		ns
			T_{vj}=175℃		110		ns
$t_{d\ off}$	Turn-off delay time,		T_{vj}=25℃		827		ns
			T_{vj}=150℃		896		ns
			T_{vj}=175℃		917		ns
t_f	Fall time		T_{vj}=25℃		56		ns
			T_{vj}=150℃		77		ns
			T_{vj}=175℃		84		ns
E_{on}	Turn-on energy loss		T_{vj}=25℃		20.3		mJ
			T_{vj}=150℃		33.7		mJ
			T_{vj}=175℃		37.6		mJ
E_{off}	Turn-off energy loss		T_{vj}=25℃		22.2		mJ
			T_{vj}=150℃		29.1		mJ
			T_{vj}=175℃		31.0		mJ
I_{SC}	SC data	V_{GE}≤15V,V_{CC}=450V V_{CEmax}=V_{CES}-L_{sCE}*di/dt	tp≤6us,Tvj=25℃		2300		A
			tp≤3us,Tvj=175℃		1770		

● 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		600	A
I_F	Continuous DC forward current		450	A
I_{FRM}	Repetitive peak forward current	Pulse, t_P=1ms, T_{vj}=25℃	1200	A
I^2t	I^2t-value	V_R=0V, t_p=10ms, T_{vj}=150℃ V_R=0V, t_p=10ms, T_{vj}=175℃	18000 16000	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℃			1.54		V
		I_F=450A, V_{GE}=0V, T_{vj}=150℃			1.49		
		I_F=450A, V_{GE}=0V, T_{vj}=175℃			1.42		
		I_F=600A, V_{GE}=0V, T_{vj}=25℃			1.66		
		I_F=600A, V_{GE}=0V, T_{vj}=175℃			1.58		
I_{RM}	Peak reverse recovery current	I_F=450A V_R=450V V_{GE}=-8V	T_{vj}=25℃		210		A
			T_{vj}=150℃		245		
			T_{vj}=175℃		255		
Q_r	Recovered charge		T_{vj}=25℃		19		μC
			T_{vj}=150℃		36		μC
			T_{vj}=175℃		41		μC
E_{rec}	Reverse recovery energy		T_{vj}=25℃		6		mJ
			T_{vj}=150℃		10		mJ
			T_{vj}=175℃		11		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 dm^3/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			8.5		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 dm^3/min; T_F=65℃		0.1603		K/W
$R_{thjF\ Diode}$	thermal resistance, junction to cooing fluid	per diode, △V/△t=10.0 dm^3/min; T_F=65℃		0.2526		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
Dpin	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_2O_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

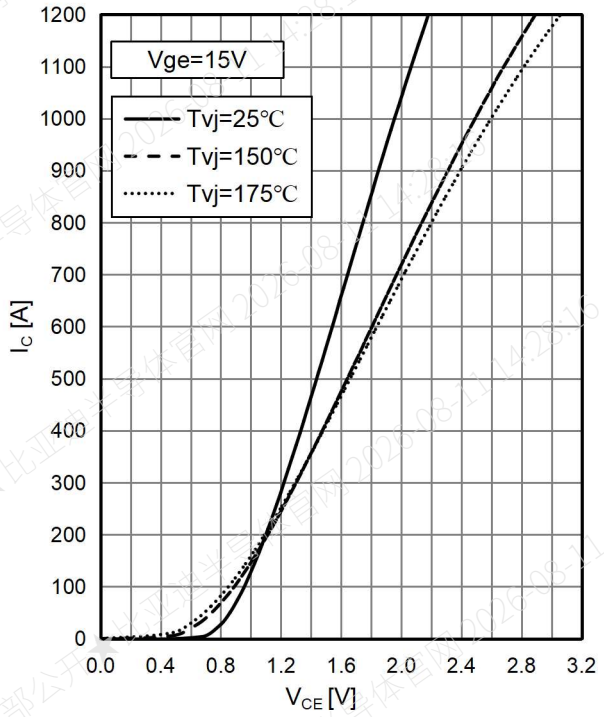


Fig.1: IGBT Output Characteristics

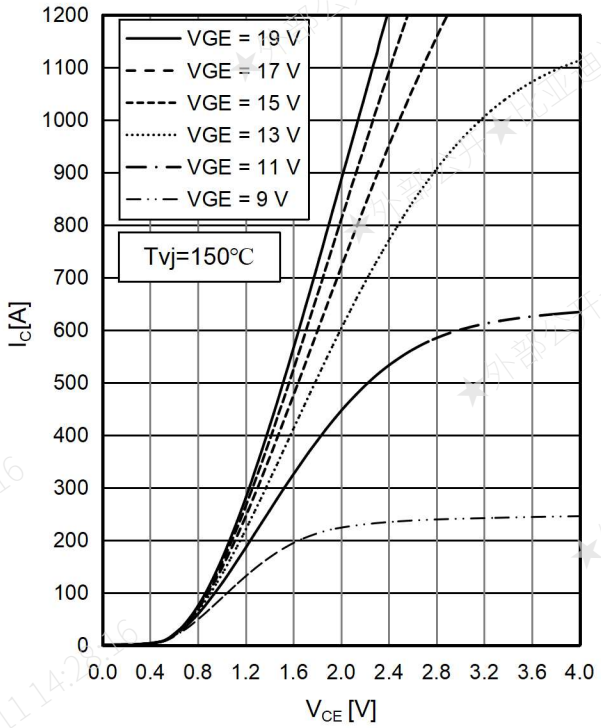


Fig.2: IGBT Output characteristics

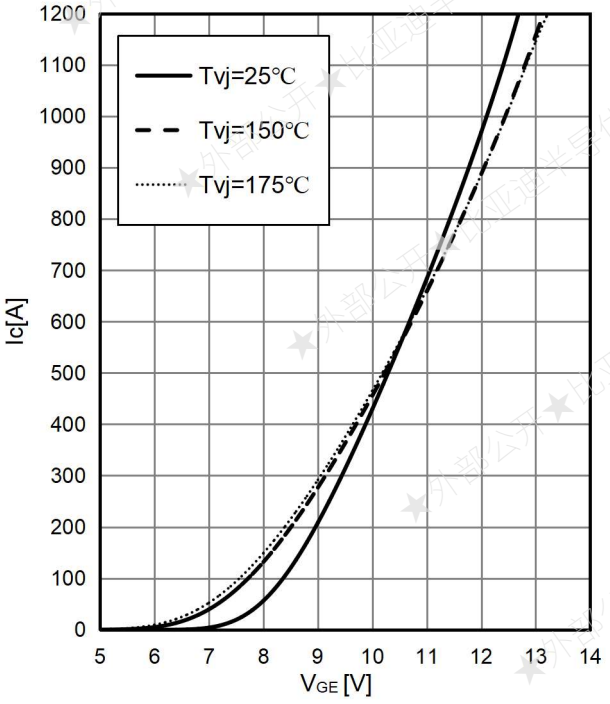


Fig.3: IGBT Transfer Characteristics

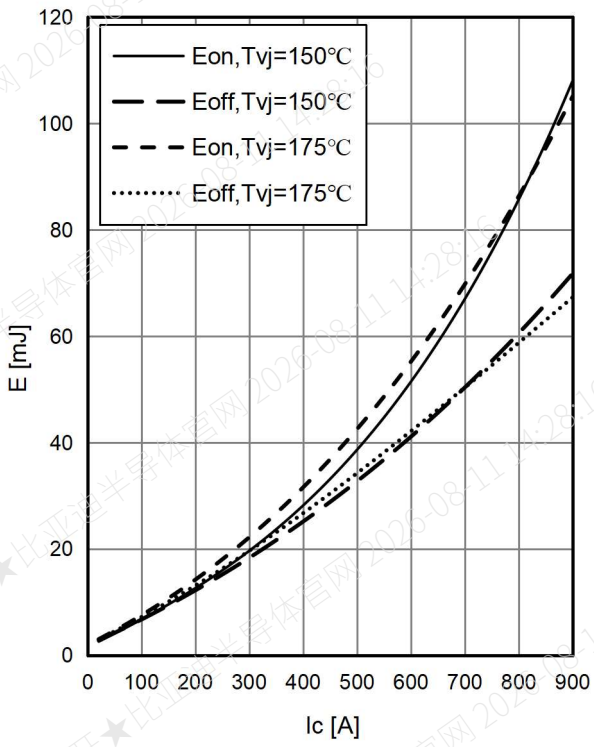


Fig.4: IGBT Switching Loss vs. I_C

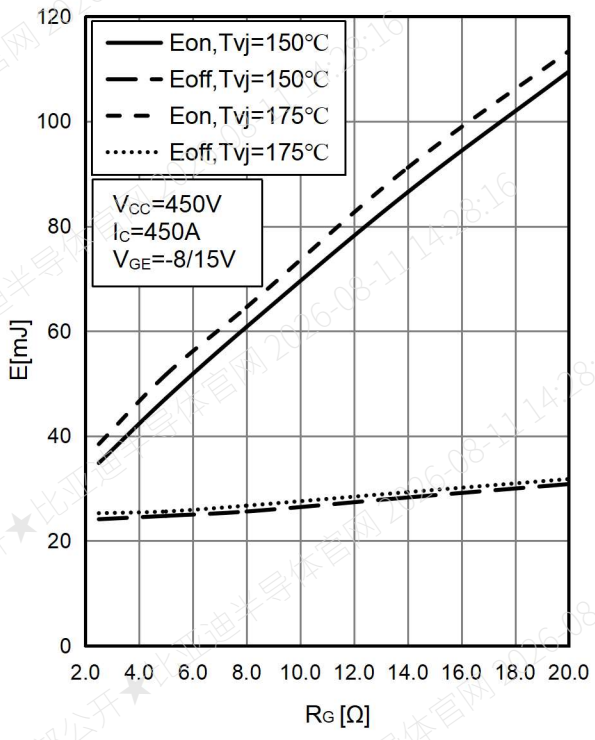


Fig.5: IGBT Switching Loss vs.R_G

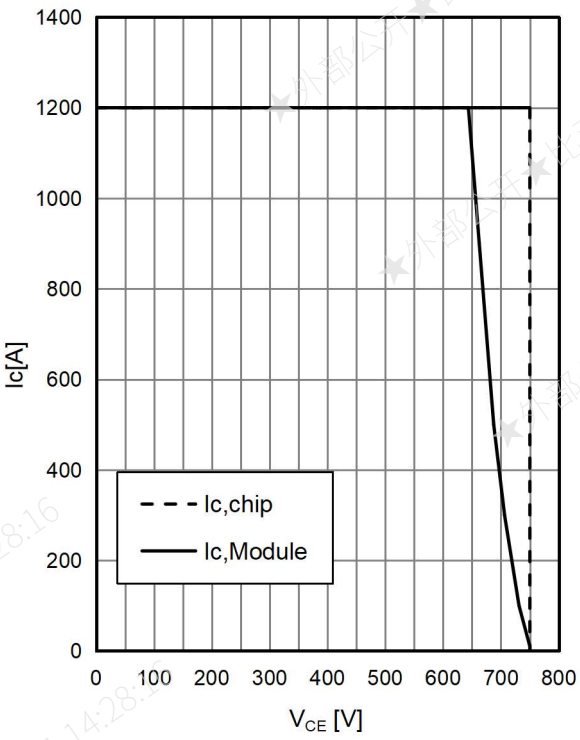


Fig.6: Reverse Bias Safe Operating Area

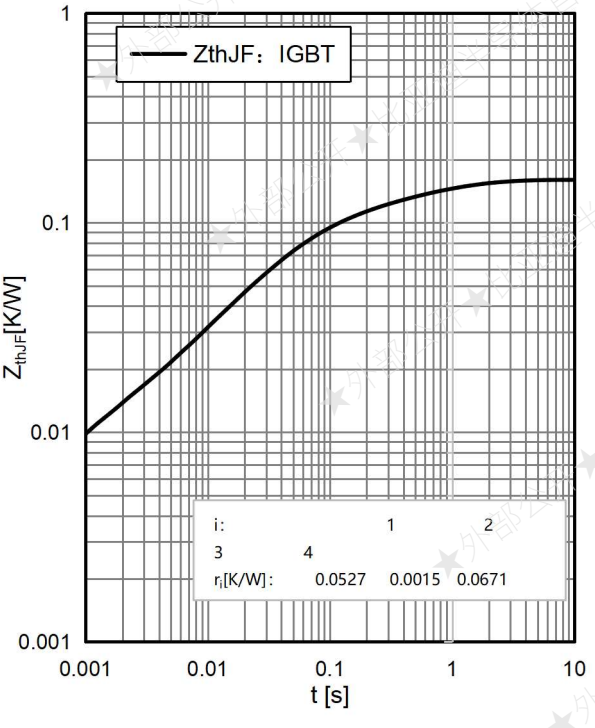


Fig.7: IGBT transient thermal impedance

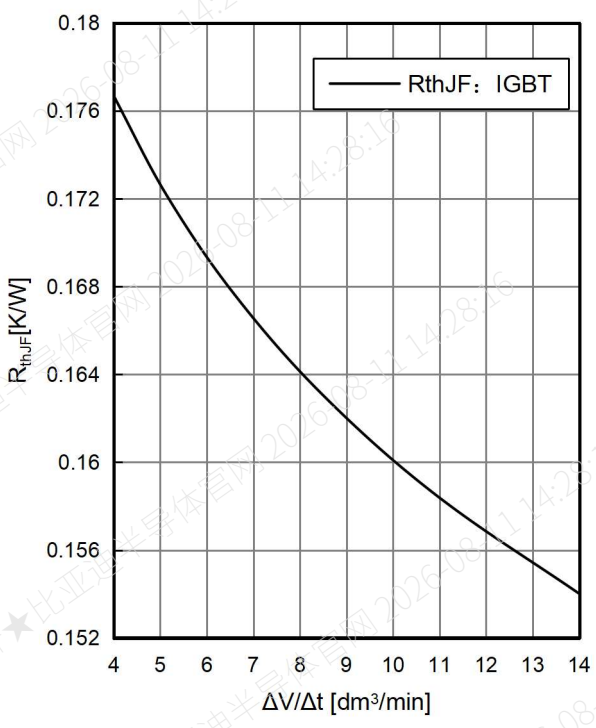


Fig.8: IGBT thermal impedance

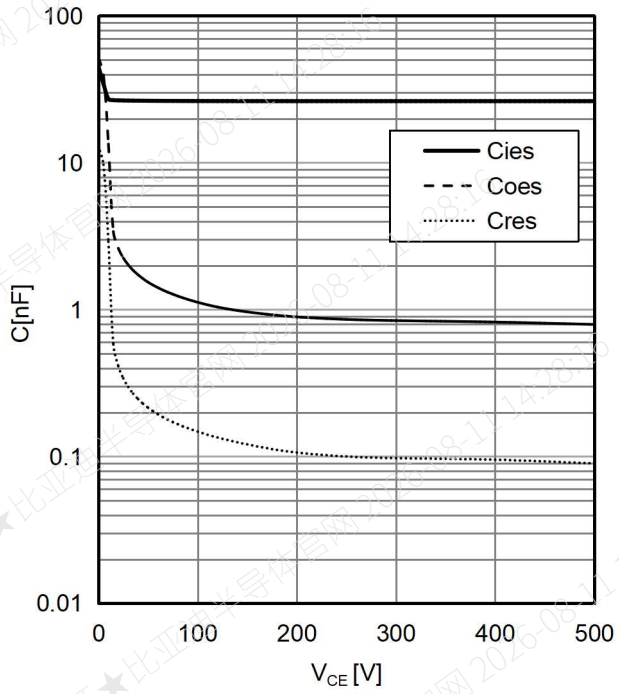


Fig.9: IGBT Capacity characteristic

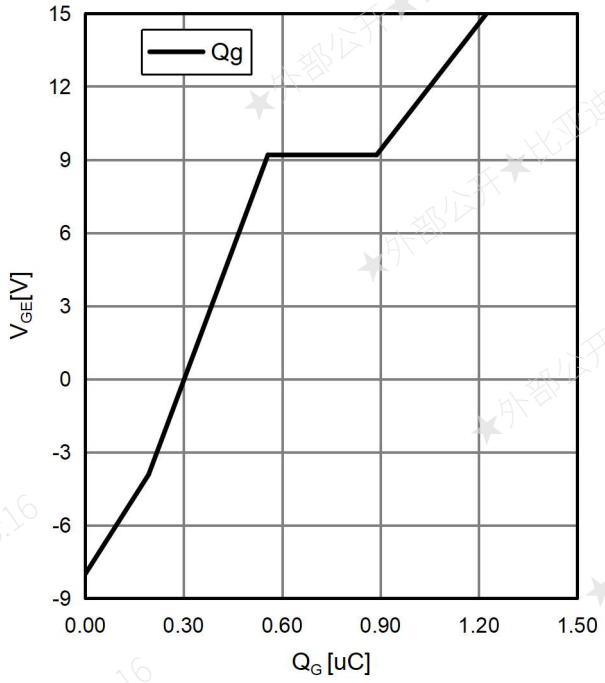


Fig.10: IGBT Gate charge characteristic

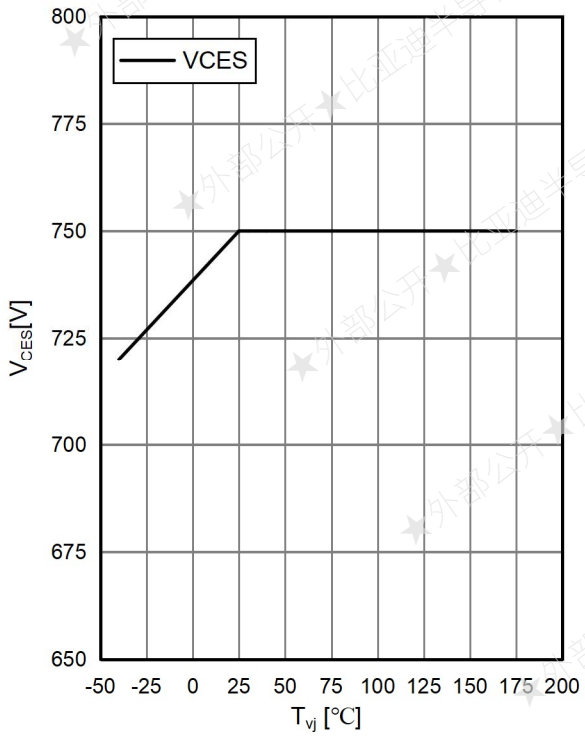


Fig.11: Maximum allowed collector-emitter voltage

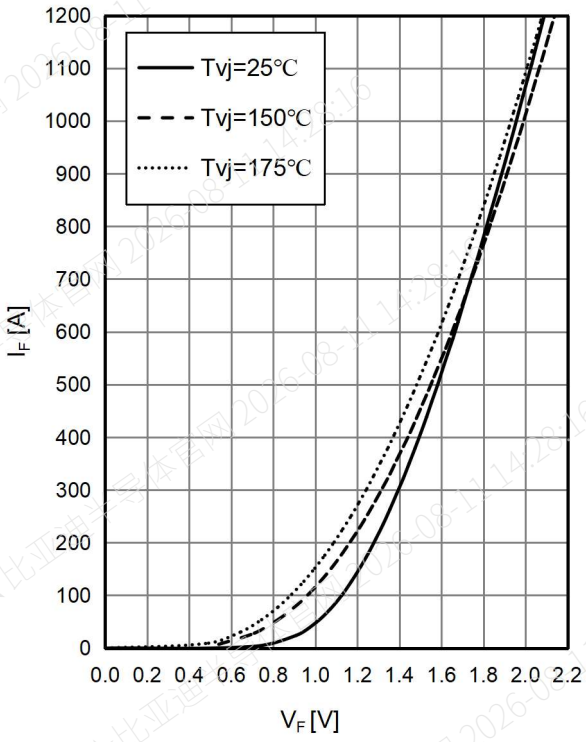


Fig.12: Diode forward characteristic

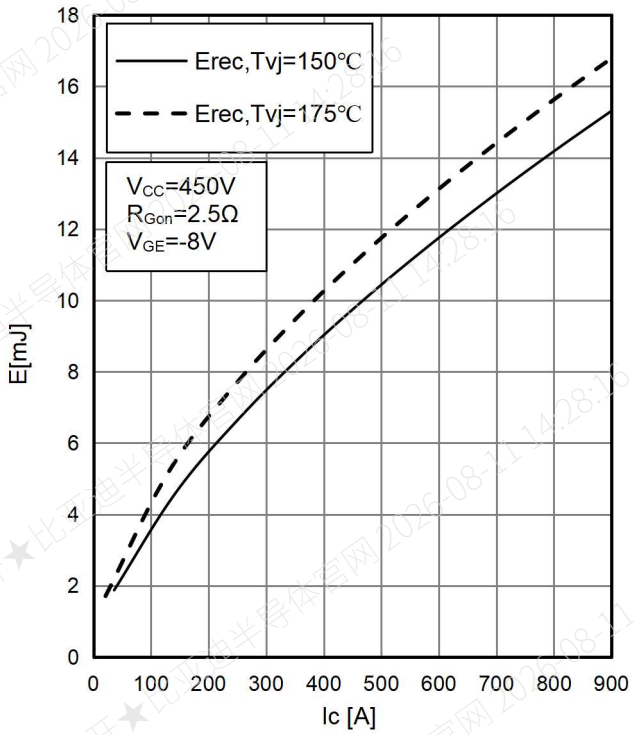


Fig.13: Diode Switching Loss vs. I_F

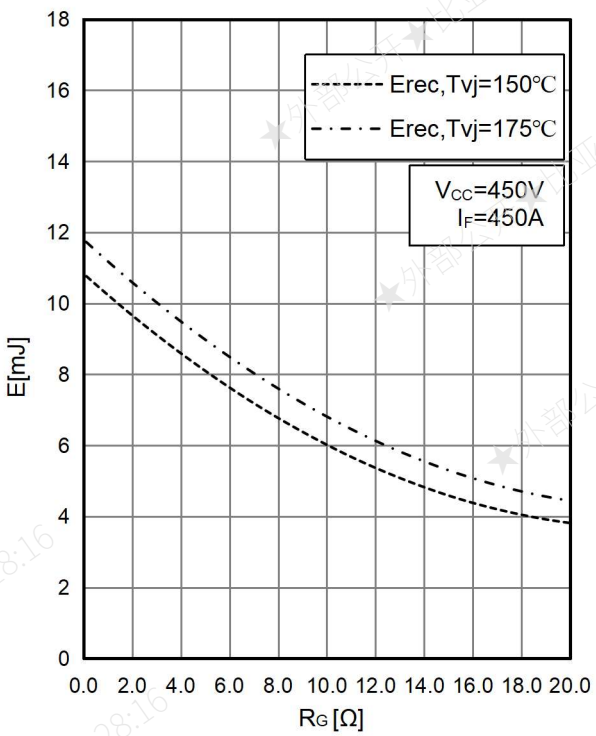


Fig.14: Diode Switching Loss vs.R_G

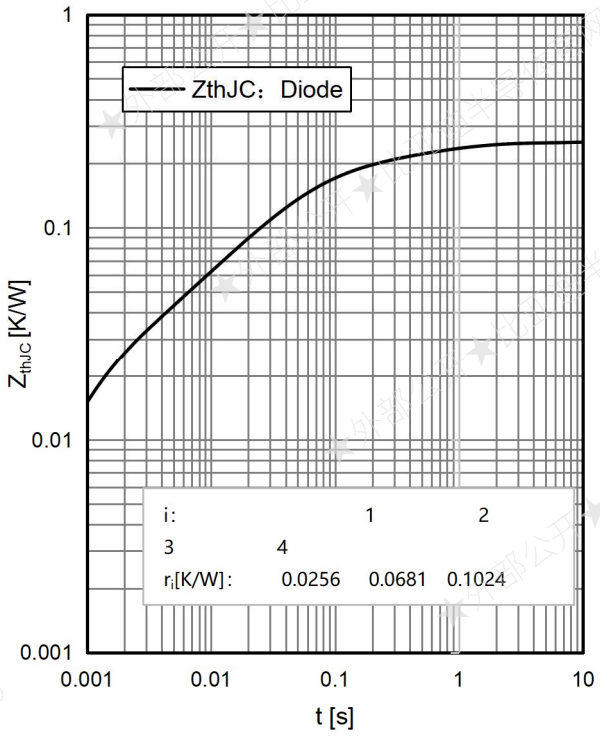


Fig.15: Diode transient thermal impedance

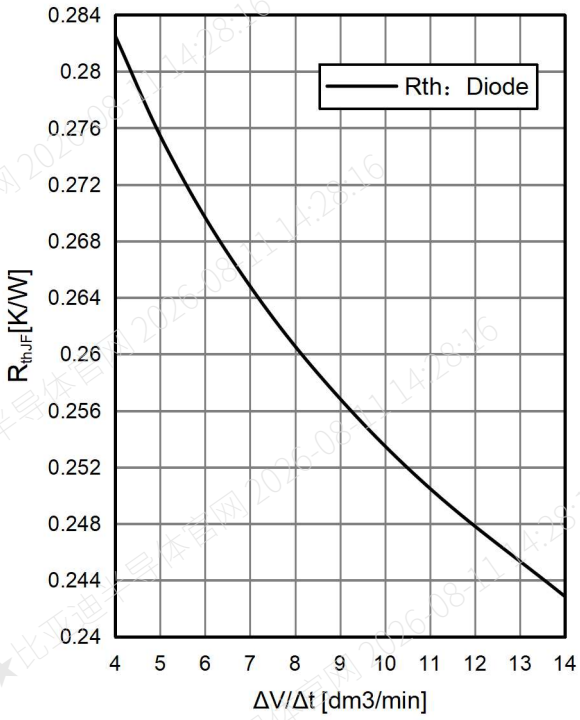


Fig.16: Diode thermal impedance

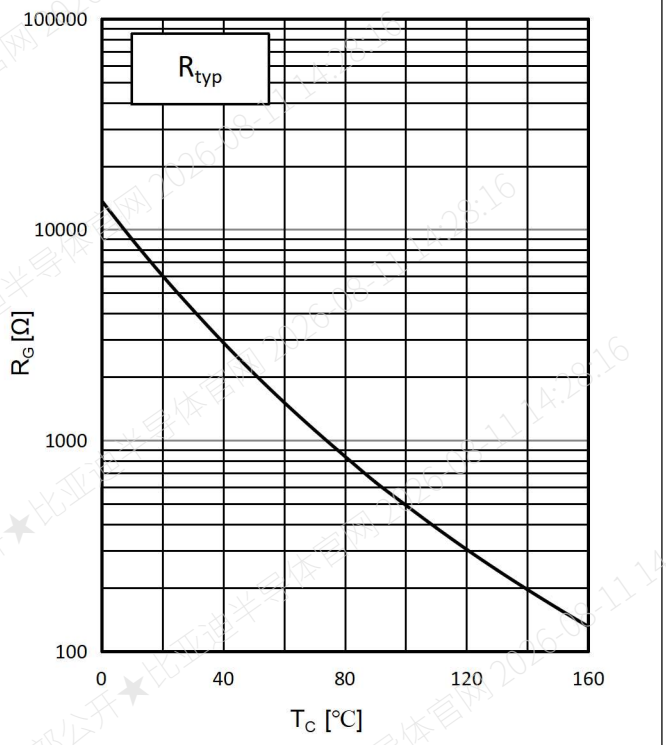


Fig.17: NTC temperature characteristic (typical)

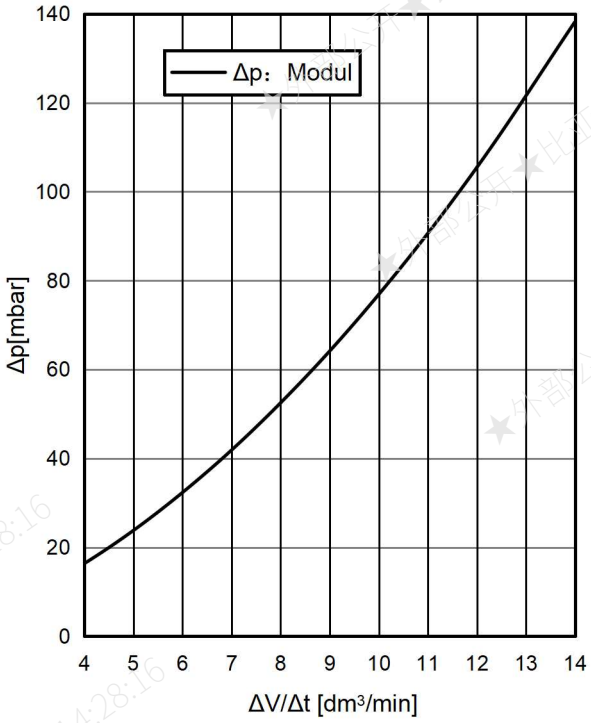
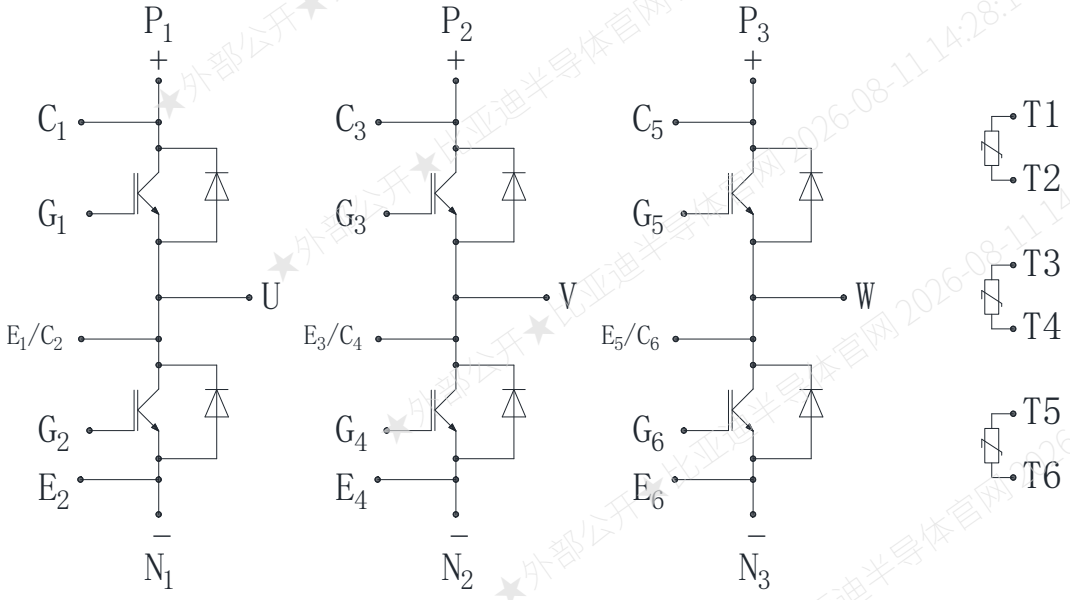
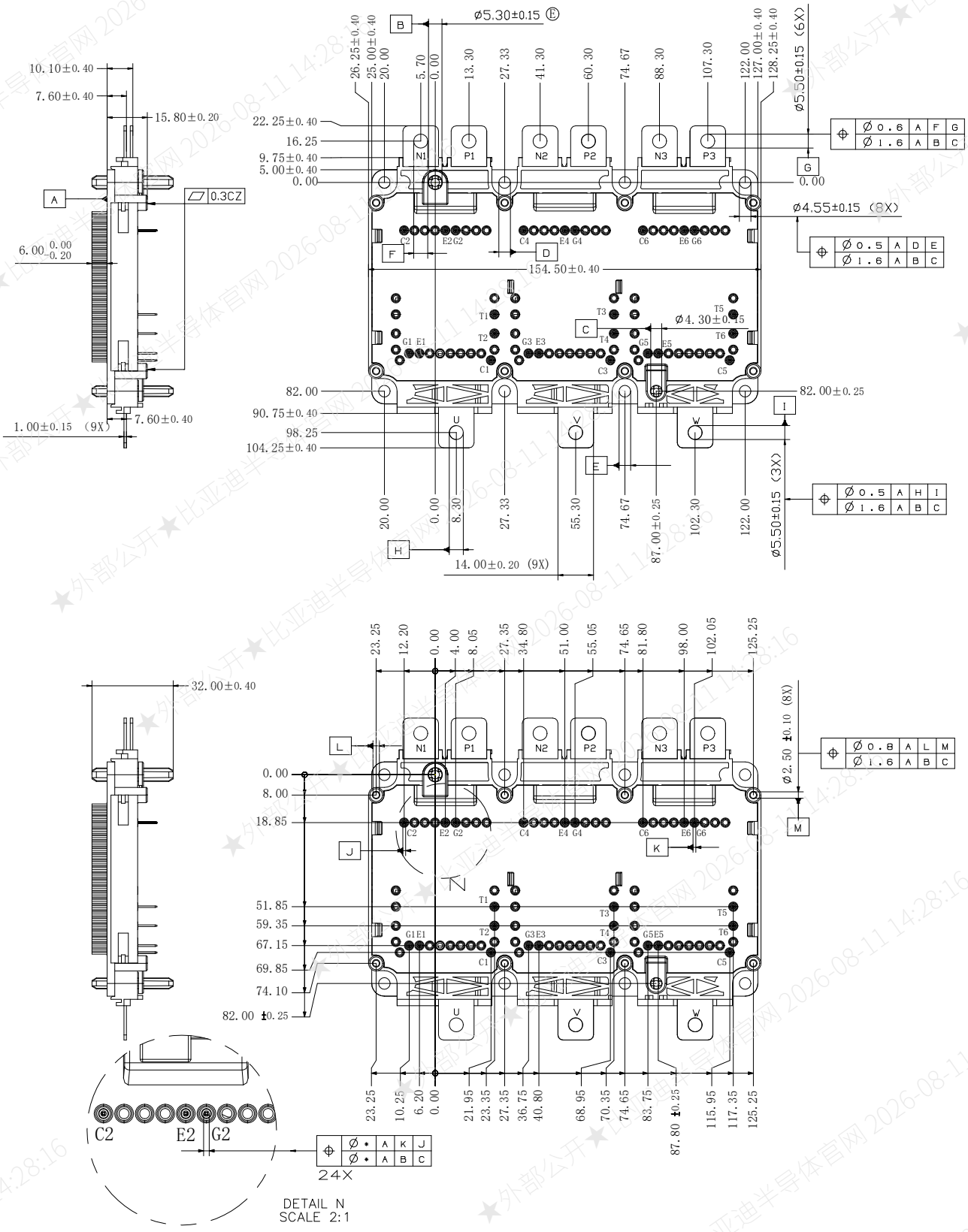


Fig.18: Pressure drop in cooling circuit

❒ Circuit Diagram



- **Package outlines**



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℃ 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.**
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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.**
- The information presented in this specification constitutes the latest product details compiled and recorded by the Company with reasonable efforts at the time of publication. To ensure greater accuracy, the Company reserves the right to make periodic corrections, modifications, and version updates to this specification without prior notice. Customers should always refer to the latest version when using or consulting this document.