

BGW600F12B34L6

IGBT Power Module

General Description

BYD IGBT Power Module BGW600F12B34L6 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.

比亚迪IGBT功率模块BGW600F12B34L6具备低导通压降、低开关损耗以及高短路耐受能力，内含高性能的沟槽栅场截止型IGBT芯片和超快软恢复反并联续流二极管，在10KHz开关频率范围内的应用中表现出优良性能。

Applications

- Automotive application

汽车应用领域

- Hybrid and electric vehicle

混合动力与电动汽车

- Inverters for motor drive

电机驱动与逆变器

Key Features

- Full bridge module

全桥模块

- Compact & High power density design

紧凑型高功率密度设计

- 1200V Fine Trench&field stop technology

1200V沟槽栅场截止技术

- Ultra low conduction and switching loss

超低的导通与开关损耗

- Short circuit ruggedness

高短路耐受能力

- Including ultra fast & soft recovery anti-parallel FRD

内置超快软恢复反并联续流二极管

- Low Inductive Design

低电感设计

- The direct cooled oval PinFin Base Plate

直冷式椭圆针形底板

- $T_{vj\text{ op}}=150^{\circ}\text{C}$

最高结温($T_{vj\text{ op}}$): 150°C

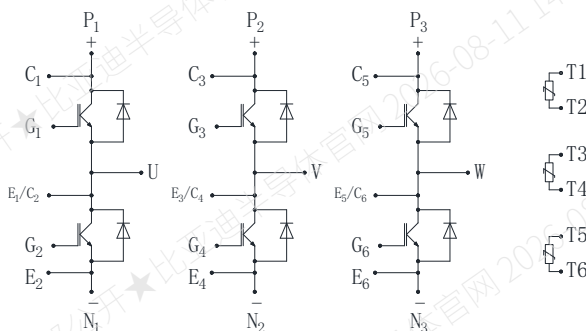
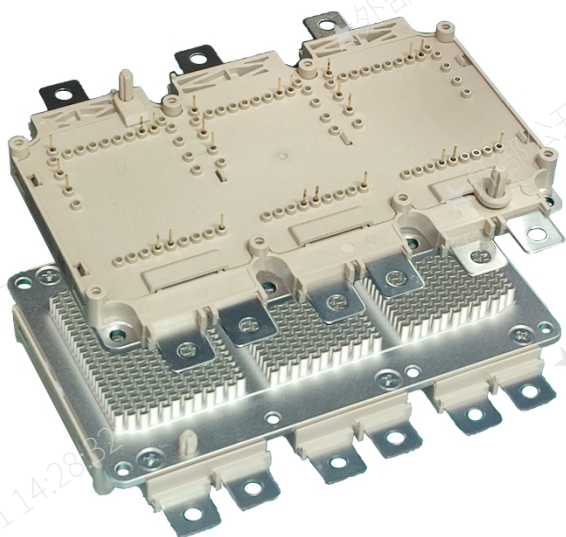
- Short-time extended Operation Temperature

$T_{vj\text{ op}}=175^{\circ}\text{C}$

短期扩展工作结温($T_{vj\text{ op}}$): 175°C

- RoHS compliant

符合ROHS标准



**BGW600F12B34L6**

● IGBT/绝缘栅双极型晶体管

□ Maximum Rated Values/最大额定值

Symbol	Parameter	Conditions	Value	Unit
V_{CES}	Collector-emitter voltage 集电极-发射极电压	$T_{vj}=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-emitter voltage 栅极-发射极峰值电压	$T_{vj}=25^{\circ}\text{C}$	± 20	V
I_{CN}	Implemented Collector current 额定集电极电流	-	600	A
$I_{C\text{ nom}}$	Continuous DC Collector current 连续集电极直流电流	$T_F=65^{\circ}\text{C}$, $T_{vj\text{ max}}=175^{\circ}\text{C}$	450	A
I_{CRM}	Repetitive peak collector current 集电极重复峰值电流	Pulse, $t_p=1\text{ms}$, $T_{vj}=25^{\circ}\text{C}$	1200	A
P_{tot}	Total power dissipation 总耗散功率	$T_F=65^{\circ}\text{C}$, $T_{vj\text{ max}}=175^{\circ}\text{C}$	1100	W

□ Characteristics Values/特征值

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{CE\text{ sat}}$	Collector-Emitter Saturation Voltage 集电极-发射极饱和电压	$I_C=600\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=25^{\circ}\text{C}$		1.74		V
		$I_C=600\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=150^{\circ}\text{C}$		2.12		
		$I_C=600\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=175^{\circ}\text{C}$		2.17		
V_{GEth}	Gate threshold voltage 栅极阈值电压	$V_{CE}=V_{GE}$, $I_C=18\text{mA}$, $T_{vj}=25^{\circ}\text{C}$	4.9	6.0	6.5	
Q_G	Gate charge 栅极电荷	$V_{GE}=-8\text{V}\dots+15\text{V}$, $V_{CE}=600\text{V}$		1.77		μC
R_{Gint}	Internal gate resistance 内部栅极电阻	$T_{vj}=25^{\circ}\text{C}$		0.83		Ω
C_{ies}	Input capacitance 输入电容	$T_{vj}=25^{\circ}\text{C}$, $f=100\text{KHz}$, $V_{CE}=50\text{V}$, $V_{GE}=0\text{V}$		37.76		nF
C_{oes}	Output capacitance 输出电容			1.40		nF
C_{res}	Reverse transfer capacitance 反向传输电容			0.18		nF
I_{CES}	Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$			1	mA
I_{GES}	Gate-emitter leakage current 栅极-发射极漏电流	$V_{CE}=0\text{V}$, $V_{GE}=20\text{V}$, $T_{vj}=25^{\circ}\text{C}$			400	nA

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t_{don}	Turn-on delay time 开通延迟时间	$I_C = 600\text{ A}$ $V_{CE} = 600\text{ V}$ $V_{GE} = -8V...+15\text{ V}$ $R_{Gon} = 2.5\Omega$ $R_{Goff} = 5\Omega$ $L_S = 30nH$	$T_{vj}=25^{\circ}C$		0.159		μs
			$T_{vj}=150^{\circ}C$		0.171		μs
			$T_{vj}=175^{\circ}C$		0.173		μs
t_r	Rise time 上升时间		$T_{vj}=25^{\circ}C$		0.078		μs
			$T_{vj}=150^{\circ}C$		0.098		μs
			$T_{vj}=175^{\circ}C$		0.104		μs
$t_{d\ off}$	Turn-off delay time, 关断延迟时间		$T_{vj}=25^{\circ}C$		0.426		μs
			$T_{vj}=150^{\circ}C$		0.483		μs
			$T_{vj}=175^{\circ}C$		0.494		μs
t_f	Fall time 下降时间		$T_{vj}=25^{\circ}C$		0.227		μs
			$T_{vj}=150^{\circ}C$		0.376		μs
			$T_{vj}=175^{\circ}C$		0.410		μs
E_{on}	Turn-on energy loss 开通损耗能量		$T_{vj}=25^{\circ}C$		50.13		mJ
			$T_{vj}=150^{\circ}C$		82.43		mJ
			$T_{vj}=175^{\circ}C$		91.14		mJ
E_{off}	Turn-off energy loss 关断损耗能量		$T_{vj}=25^{\circ}C$		56.61		mJ
			$T_{vj}=150^{\circ}C$		80.44		mJ
			$T_{vj}=175^{\circ}C$		85.68		mJ
I_{sc}	SC data 短路数据	$V_{GE}\leq 15V, V_{CC}=800\text{ V}$ $V_{CEmax}=V_{CES}-$ $L_{sCE}\cdot di/dt$	$tp\leq 6\mu s, T_{vj}=25^{\circ}C$		2640		A
			$tp\leq 3\mu s, T_{vj}=175^{\circ}C$		2050		

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● Diode/二极管

□ Maximum Rated Values/最大额定值

Symbol	Parameter	Conditions	Value	Unit
V_{RRM}	Repetitive peak reverse voltage 反向重复峰值电压	$T_{vj}=25^{\circ}\text{C}$	1200	V
I_{FN}	Implemented forward current 额定正向电流	-	600	A
I_F	Continuous DC forward current 连续正向直流电流	$T_F=65^{\circ}\text{C}$, $T_{vj\max}=175^{\circ}\text{C}$	450	A
I_{FRM}	Repetitive peak forward current 正向重复峰值电流	Pulse, $t_p=1\text{ms}$, $T_{vj}=25^{\circ}\text{C}$	1200	A
I^2t	I^2t -value I^2t 值	$V_R=0\text{V}$, $t_p=10\text{ms}$, $T_{vj}=150^{\circ}\text{C}$ $V_R=0\text{V}$, $t_p=10\text{ms}$, $T_{vj}=175^{\circ}\text{C}$	9000 7000	A^2s A^2s

□ Characteristics Values/特征值

Symbol Parameter	Conditions	Value			Unit
		Min.	Typ.	Max.	
V_F Forward voltage 正向电压	$I_F=600\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$		2.2		V
	$I_F=600\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=150^{\circ}\text{C}$		1.97		
	$I_F=600\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=175^{\circ}\text{C}$		1.95		
I_{RM} Peak reverse recovery current 反向恢复峰值电流	$T_{vj}=25^{\circ}\text{C}$		293.4		A
	$T_{vj}=150^{\circ}\text{C}$		331.8		
	$T_{vj}=175^{\circ}\text{C}$		339.8		
Q_r Recovered charge 恢复电荷	$I_F=600\text{A}$ $V_R=600\text{V}$ $V_{GE}=-8\text{V}$ $R_{Gon}=2.5\Omega$ $R_{Goff}=5\Omega$ $L_S=30\text{nH}$	$T_{vj}=25^{\circ}\text{C}$	43.17		μC
		$T_{vj}=150^{\circ}\text{C}$	85.69		μC
		$T_{vj}=175^{\circ}\text{C}$	98.91		μC
E_{rec} Reverse recovery energy 反向恢复损耗		$T_{vj}=25^{\circ}\text{C}$	19.92		mJ
		$T_{vj}=150^{\circ}\text{C}$	35.606		mJ
		$T_{vj}=175^{\circ}\text{C}$	40.05		mJ

**BGW600F12B34L6**● **NTC-Thermistor/负温度系数热敏电阻**

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
R ₂₅	Rated resistance 额定电阻值	T _C =25℃		5.0		KΩ
ΔR/R	Deviation of R100 R100 偏差	T _C =100℃, R ₁₀₀ =493	-5		5	%
P ₂₅	Power dissipation 耗散功率	T _C =25℃			20.0	mW
B _{25/50}	B-value/B-值	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
B _{25/80}	B-value/ B-值	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
B _{25/100}	B-value/ B-值	$R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

● **Module/模块**

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
T _{vj max}	Maximum junction temperature 最大结温				175	℃
T _{vjop}	Temperature under switching conditions 工作结温	T _{op} continuous	-40		150	℃
		For 10s within a period of 30s, occurrence maximum 3000 times over lifetime	150		175	
T _{stg}	Storage temperature 储存温度	Storage Temperature Range	-40		125	℃
V _{ISOL}	Isolation test voltage 绝缘测试电压	RMS, f=50Hz, t=30s	3800			V
Δp	Press drop in cooling circuit 冷却回路中的压降	ΔV/Δt=10.0 dm ³ /min; T _F =65℃		77		mbar
p	Maximum drop in cooling circuit (relative) 冷却回路中的最大压降(相对于参考点)	T _{baseplate} < 40℃ T _{baseplate} > 40℃			2.5 2.0	bar
L _{sCE}	Stray inductance module 模块杂散电感			10		nH

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$R_{CC'+EE'}$	Module lead resistance terminal to chip 模块引线电阻,端子-芯片	$T_{vj}=25^{\circ}\text{C}$, per switch		0.75		m Ω
$R_{thjF\text{ IGBT}}$	IGBT, thermal resistance, junction to coolant 结-冷却液热阻	per IGBT/单个IGBT $\Delta V/\Delta t=10.0\text{ dm}^3/\text{min}$; $T_F=65^{\circ}\text{C}$		0.100		K/W
$R_{thjF\text{ Diode}}$	Diode, thermal resistance, junction to coolant 结-冷却液热阻	per diode/单个二极管 $\Delta V/\Delta t=10.0\text{ dm}^3/\text{min}$; $T_F=65^{\circ}\text{C}$		0.136		K/W
M_1	Mounting torque for module mounting 模块的安装扭距	Screw M4 baseplate to heatsink Screw EJOT Delta PCB to frame	1.8 0.45	2.00 0.50	2.20 0.55	N.m
M_2	Terminal connection torque 端子的连接扭距	Screw M5	3		6	N.m
m	Weight 重量			740		g
	Material of module baseplate 模块基板材料		Cu+Ni			
	Internal isolation 内部绝缘	ceramics	Si_3N_4			
d_{Creep}	Creepage distance 爬电距离	Terminal to heatsink	9.0			mm
		Terminal to terminal	9.0			
d_{Clear}	Clearance 电气间隙	Terminal to heatsink	4.5			mm
		Terminal to terminal	4.5			
$L\times W\times H$	Dimension 尺寸		154.5 $\times$ 126.5 $\times$ 32			mm
D_{pin}	Pin Hole Diameter 针孔直径		1.5		1.7	mm
D	Pin Diameter 针直径	Designer Pin Diameter		0.84		mm
δ	Baseplate Warpage 底板弧度	Warpage along the length Warpage along the width	-0.25 -0.20		0.25 0.15	mm

□ Characteristics Diagrams/特性曲线

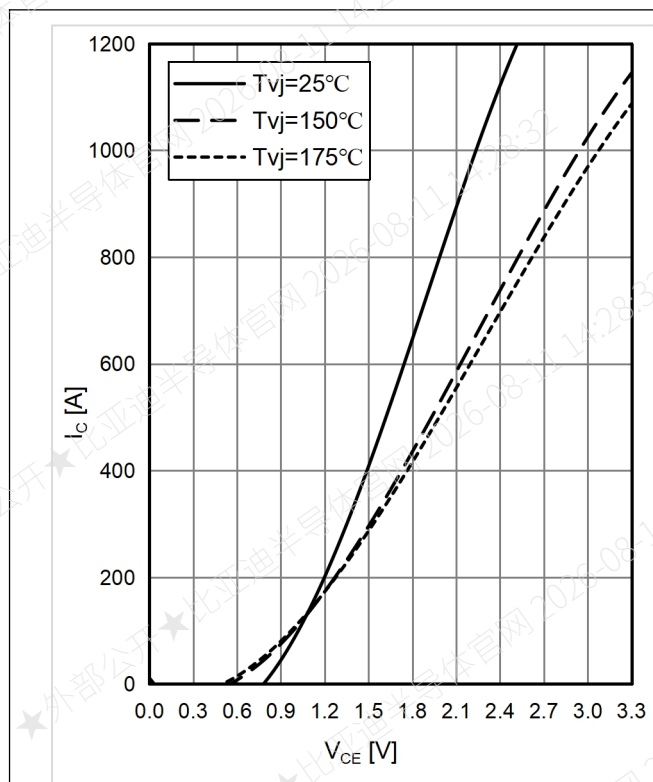


Fig.1: IGBT Output Characteristics

图1: IGBT输出特性

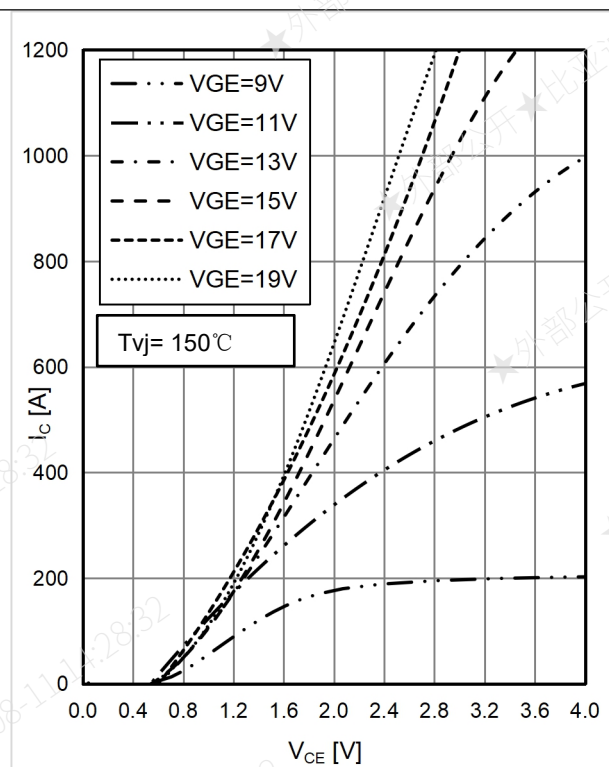


Fig.2: IGBT Output characteristics

图2: IGBT输出特性

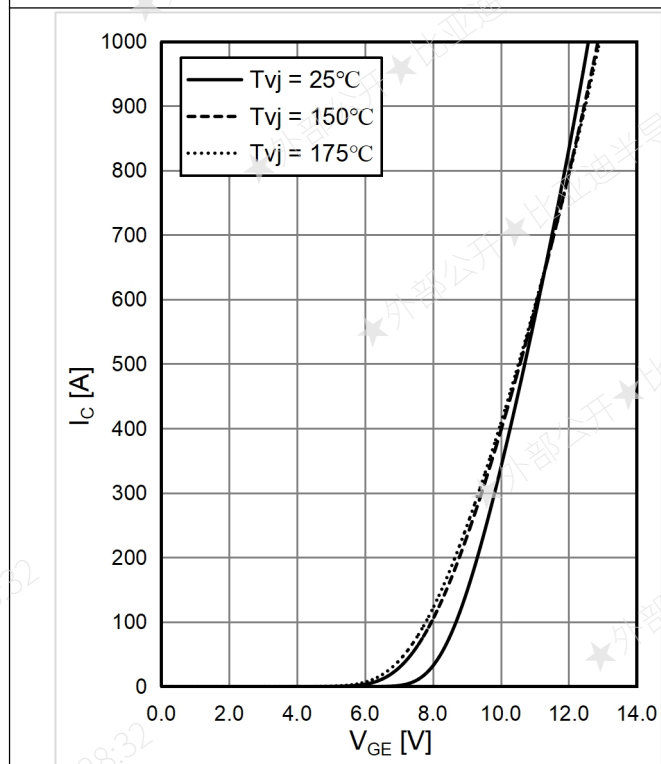


Fig.3: IGBT Transfer Characteristics

图3: IGBT传输特性

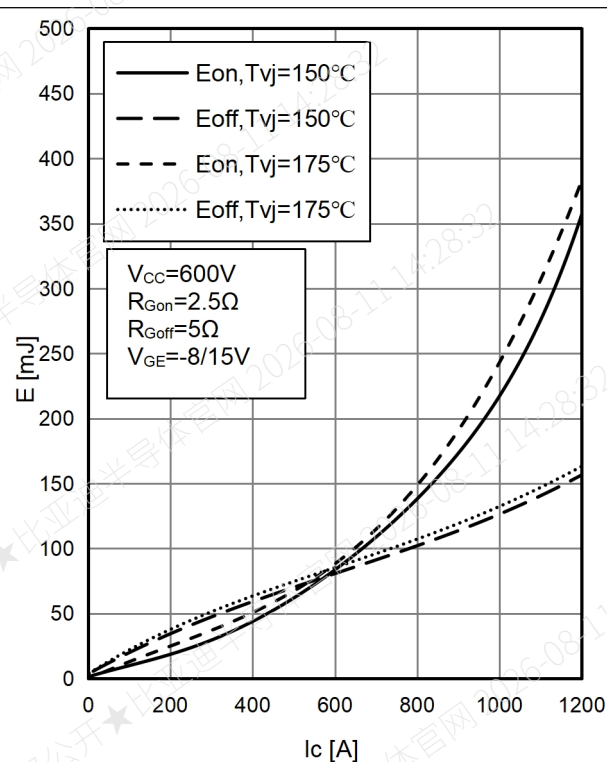


Fig.4: IGBT Switching Loss vs. I_C

图4: IGBT开关损耗与集电极电流关系

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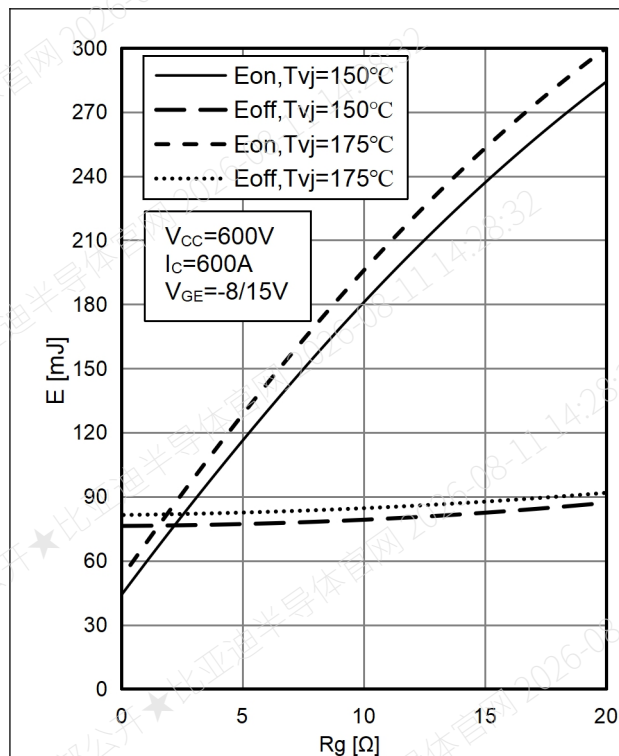


Fig.5: IGBT Switching Loss vs. Rg
图5: IGBT开关损耗与门极电阻关系

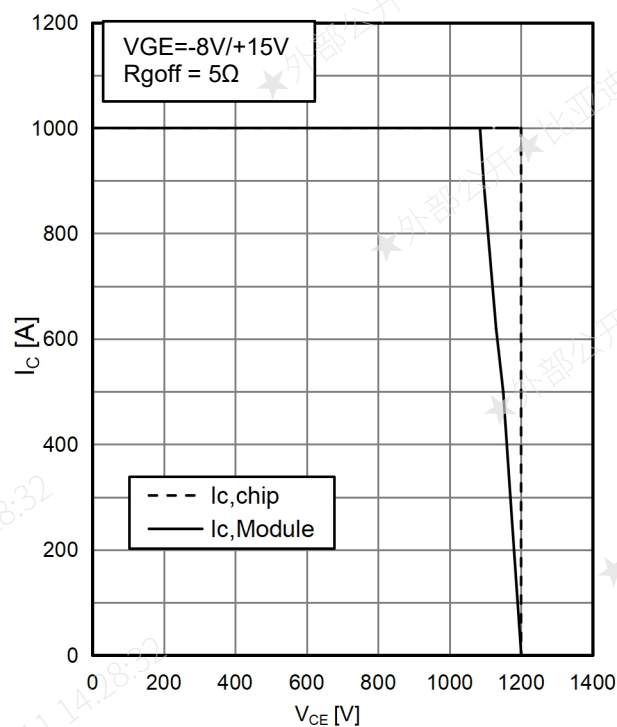


Fig.6: Reverse Bias Safe Operating Area
图6: 反偏安全工作区

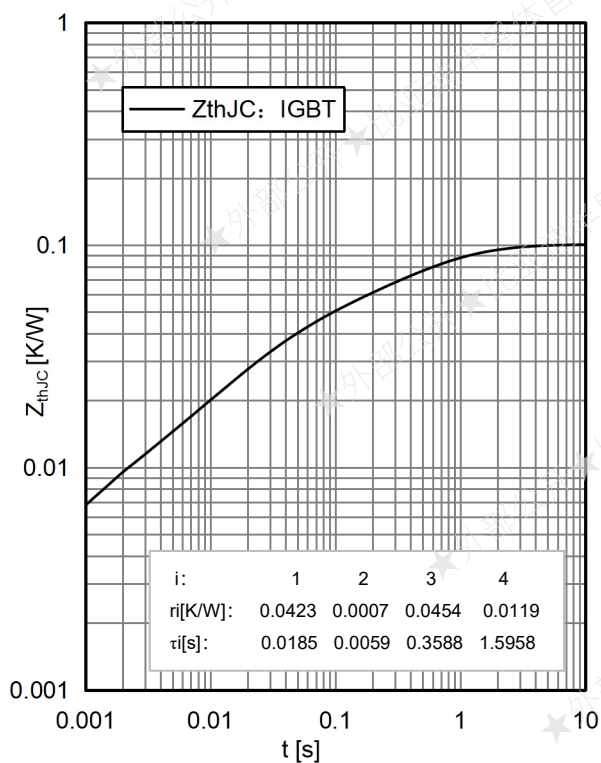


Fig.7: IGBT transient thermal impedance
图7: IGBT瞬态热阻抗

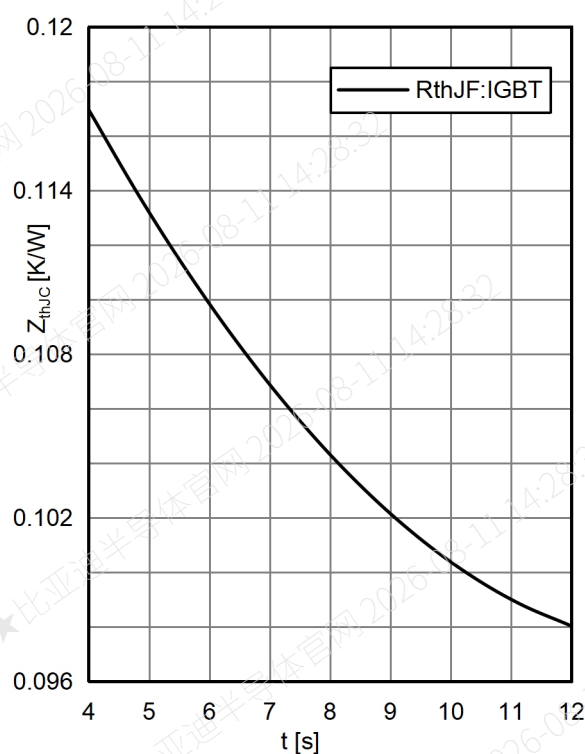


Fig.8: IGBT thermal impedance
图8: IGBT热阻抗

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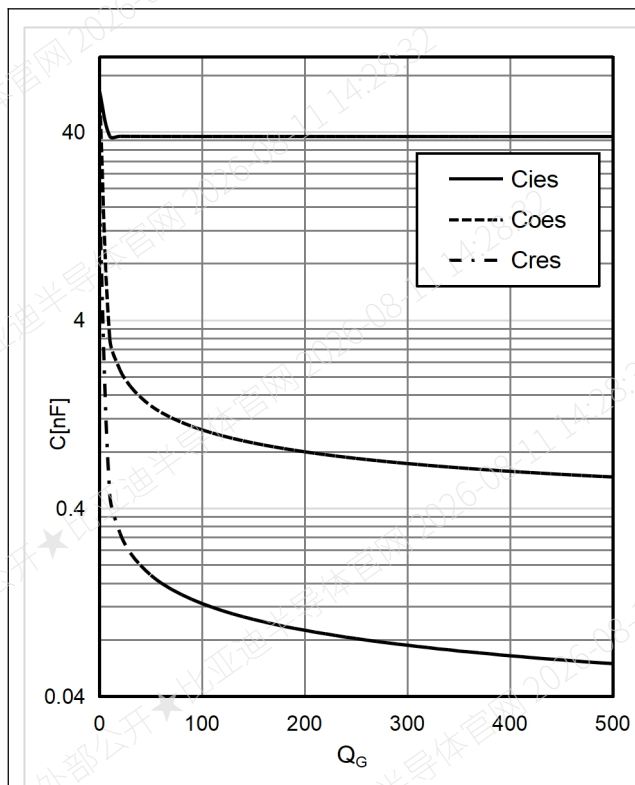


图9: IGBT容量特性

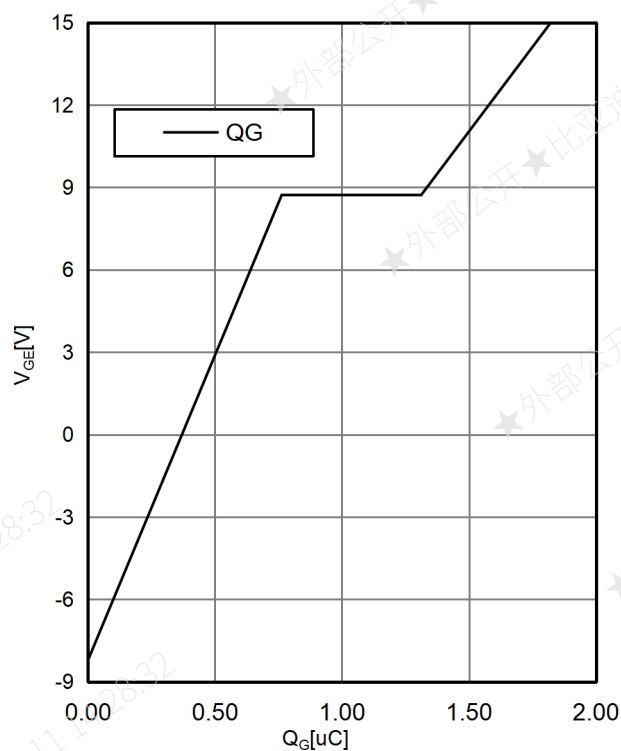


图10: IGBT栅极电荷

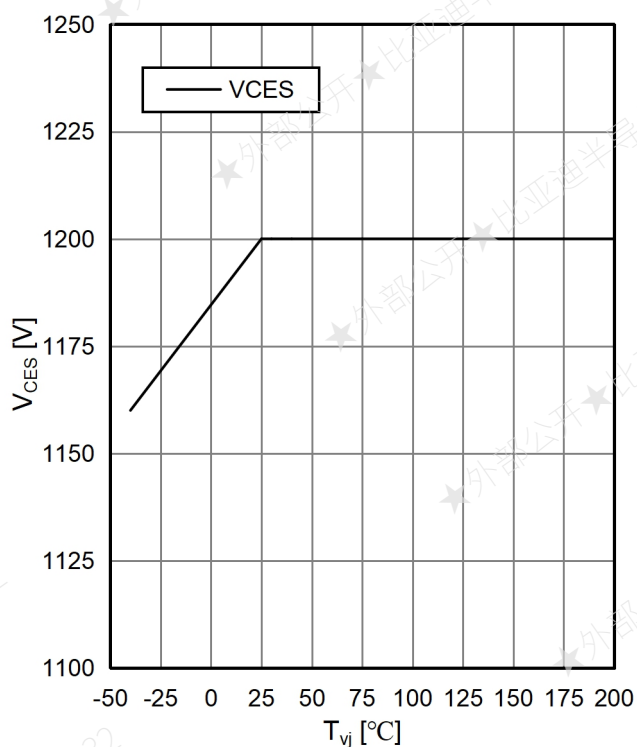


图11: 最大集电极-发射极电压

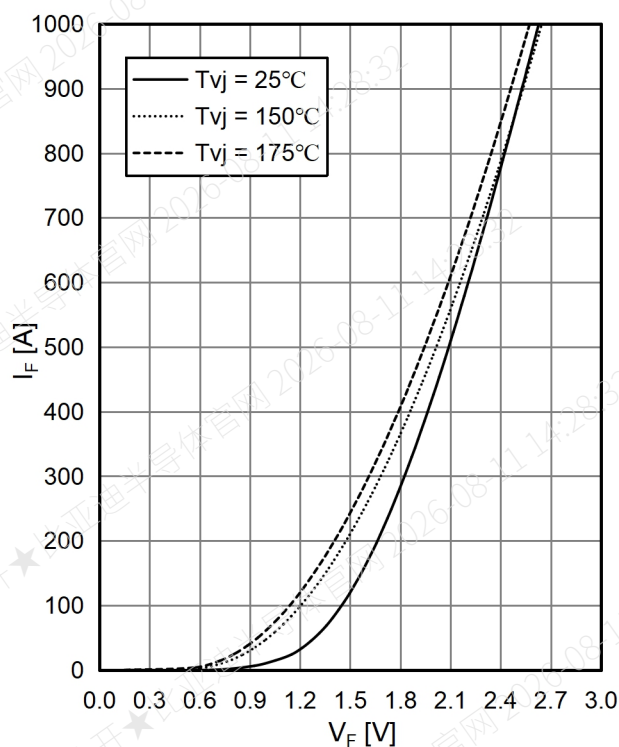
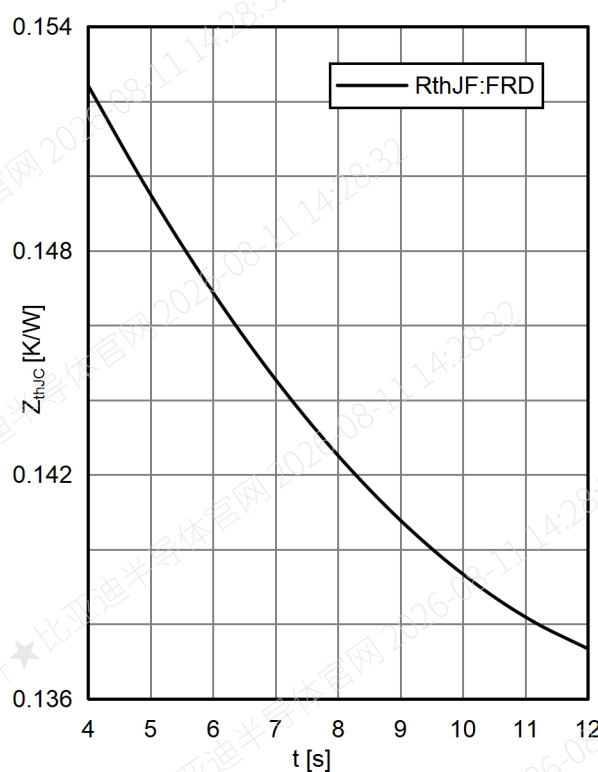
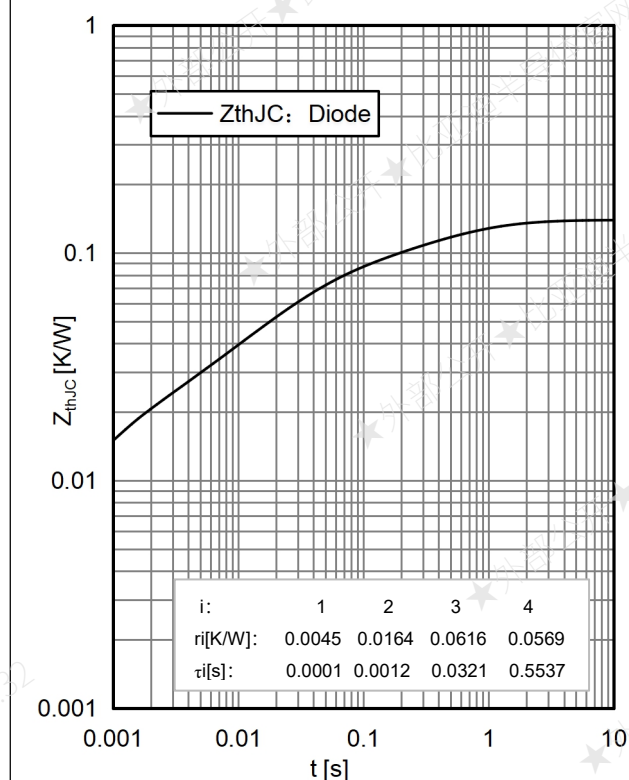
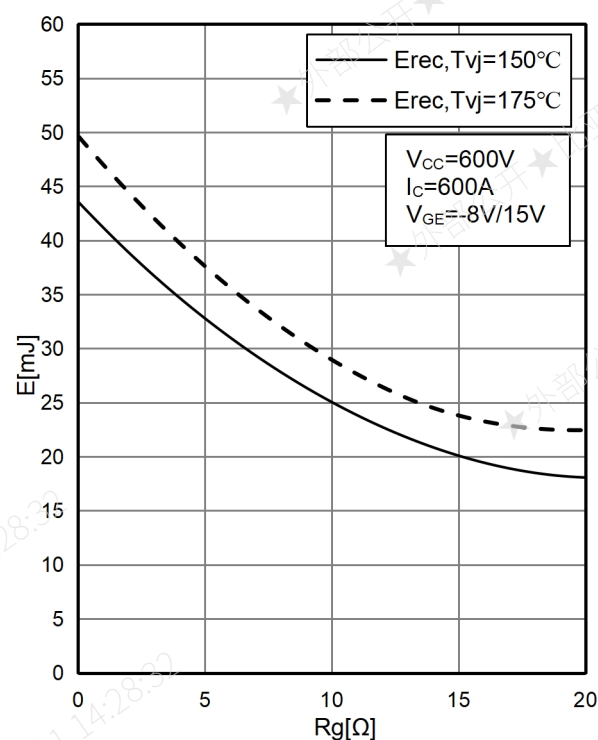
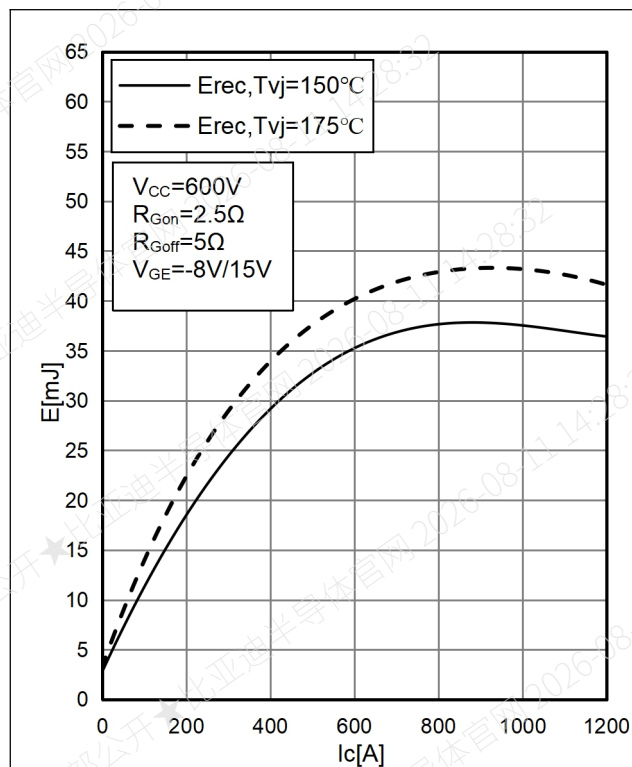


图12: 二极管正向特性

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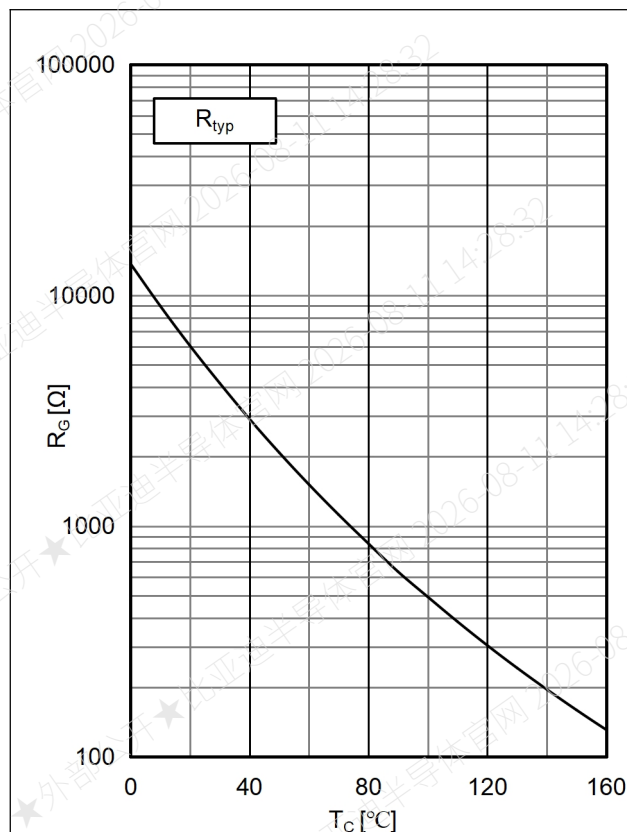


Fig.17: NTC temperature characteristic (typical)

图17: 典型的NTC电阻-温度特性

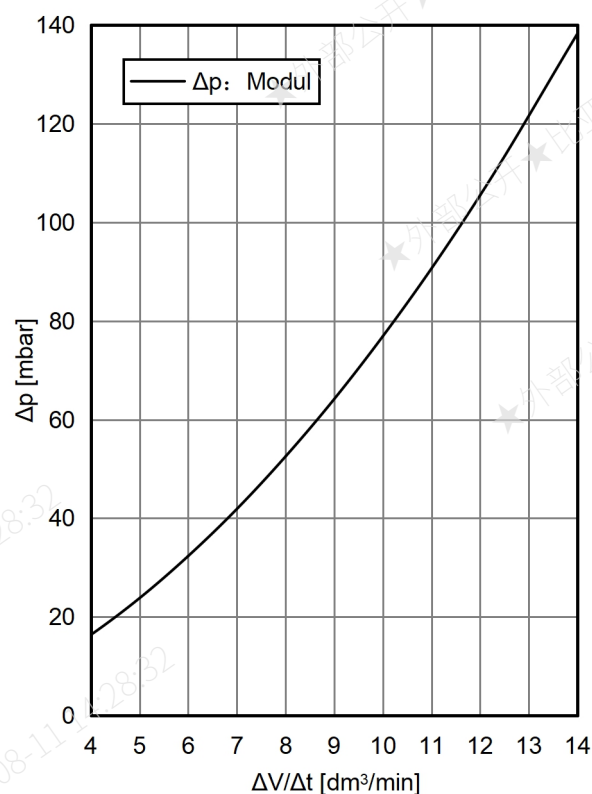
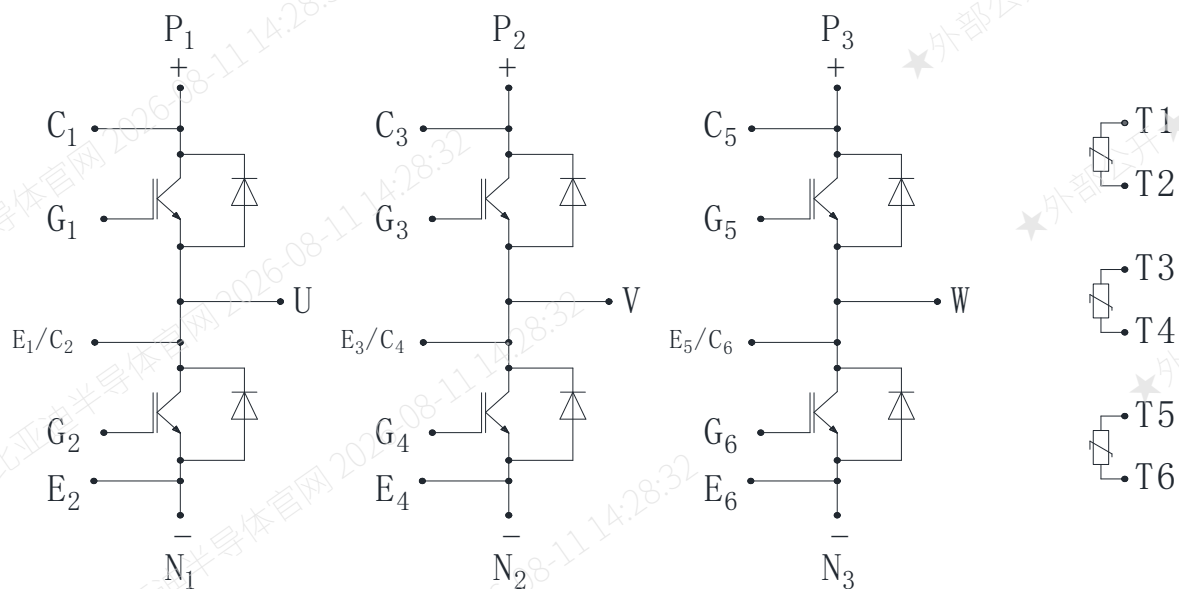


Fig.18: Pressure drop in cooling circuit

图18: 冷却回路中的压降

BGW600F12B34L6**□ Circuit Diagram/接线图**

Technical drawing of a power MOSFET module (2SK1000) showing top and side views with dimensions and pin configurations.

Top View Dimensions:

- Overall width: 154.50 ± 0.40
- Overall height: 107.30
- Pin pitch: 27.33
- Pin 1 location: 13.30 from left edge, 5.70 from top edge.
- Pin 2 location: 41.30 from left edge, 5.70 from top edge.
- Pin 3 location: 60.30 from left edge, 5.70 from top edge.
- Pin 4 location: 74.67 from left edge, 5.70 from top edge.
- Pin 5 location: 88.30 from left edge, 5.70 from top edge.
- Pin 6 location: 107.30 from left edge, 5.70 from top edge.
- Pin 7 location: 122.00 from left edge, 5.70 from top edge.
- Pin 8 location: 128.25 ± 0.40 from left edge, 5.70 from top edge.
- Pin 9 location: 142.00 from left edge, 5.70 from top edge.
- Pin 10 location: 154.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 11 location: 167.00 from left edge, 5.70 from top edge.
- Pin 12 location: 179.50 from left edge, 5.70 from top edge.
- Pin 13 location: 192.00 from left edge, 5.70 from top edge.
- Pin 14 location: 204.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 15 location: 217.00 from left edge, 5.70 from top edge.
- Pin 16 location: 229.50 from left edge, 5.70 from top edge.
- Pin 17 location: 242.00 from left edge, 5.70 from top edge.
- Pin 18 location: 254.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 19 location: 267.00 from left edge, 5.70 from top edge.
- Pin 20 location: 279.50 from left edge, 5.70 from top edge.
- Pin 21 location: 292.00 from left edge, 5.70 from top edge.
- Pin 22 location: 304.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 23 location: 317.00 from left edge, 5.70 from top edge.
- Pin 24 location: 329.50 from left edge, 5.70 from top edge.
- Pin 25 location: 342.00 from left edge, 5.70 from top edge.
- Pin 26 location: 354.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 27 location: 367.00 from left edge, 5.70 from top edge.
- Pin 28 location: 379.50 from left edge, 5.70 from top edge.
- Pin 29 location: 392.00 from left edge, 5.70 from top edge.
- Pin 30 location: 404.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 31 location: 417.00 from left edge, 5.70 from top edge.
- Pin 32 location: 429.50 from left edge, 5.70 from top edge.
- Pin 33 location: 442.00 from left edge, 5.70 from top edge.
- Pin 34 location: 454.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 35 location: 467.00 from left edge, 5.70 from top edge.
- Pin 36 location: 479.50 from left edge, 5.70 from top edge.
- Pin 37 location: 492.00 from left edge, 5.70 from top edge.
- Pin 38 location: 504.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 39 location: 517.00 from left edge, 5.70 from top edge.
- Pin 40 location: 529.50 from left edge, 5.70 from top edge.
- Pin 41 location: 542.00 from left edge, 5.70 from top edge.
- Pin 42 location: 554.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 43 location: 567.00 from left edge, 5.70 from top edge.
- Pin 44 location: 579.50 from left edge, 5.70 from top edge.
- Pin 45 location: 592.00 from left edge, 5.70 from top edge.
- Pin 46 location: 604.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 47 location: 617.00 from left edge, 5.70 from top edge.
- Pin 48 location: 629.50 from left edge, 5.70 from top edge.
- Pin 49 location: 642.00 from left edge, 5.70 from top edge.
- Pin 50 location: 654.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 51 location: 667.00 from left edge, 5.70 from top edge.
- Pin 52 location: 679.50 from left edge, 5.70 from top edge.
- Pin 53 location: 692.00 from left edge, 5.70 from top edge.
- Pin 54 location: 704.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 55 location: 717.00 from left edge, 5.70 from top edge.
- Pin 56 location: 729.50 from left edge, 5.70 from top edge.
- Pin 57 location: 742.00 from left edge, 5.70 from top edge.
- Pin 58 location: 754.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 59 location: 767.00 from left edge, 5.70 from top edge.
- Pin 60 location: 779.50 from left edge, 5.70 from top edge.
- Pin 61 location: 792.00 from left edge, 5.70 from top edge.
- Pin 62 location: 804.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 63 location: 817.00 from left edge, 5.70 from top edge.
- Pin 64 location: 829.50 from left edge, 5.70 from top edge.
- Pin 65 location: 842.00 from left edge, 5.70 from top edge.
- Pin 66 location: 854.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 67 location: 867.00 from left edge, 5.70 from top edge.
- Pin 68 location: 879.50 from left edge, 5.70 from top edge.
- Pin 69 location: 892.00 from left edge, 5.70 from top edge.
- Pin 70 location: 904.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 71 location: 917.00 from left edge, 5.70 from top edge.
- Pin 72 location: 929.50 from left edge, 5.70 from top edge.
- Pin 73 location: 942.00 from left edge, 5.70 from top edge.
- Pin 74 location: 954.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 75 location: 967.00 from left edge, 5.70 from top edge.
- Pin 76 location: 979.50 from left edge, 5.70 from top edge.
- Pin 77 location: 992.00 from left edge, 5.70 from top edge.
- Pin 78 location: 1004.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 79 location: 1017.00 from left edge, 5.70 from top edge.
- Pin 80 location: 1029.50 from left edge, 5.70 from top edge.
- Pin 81 location: 1042.00 from left edge, 5.70 from top edge.
- Pin 82 location: 1054.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 83 location: 1067.00 from left edge, 5.70 from top edge.
- Pin 84 location: 1079.50 from left edge, 5.70 from top edge.
- Pin 85 location: 1092.00 from left edge, 5.70 from top edge.
- Pin 86 location: 1104.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 87 location: 1117.00 from left edge, 5.70 from top edge.
- Pin 88 location: 1129.50 from left edge, 5.70 from top edge.
- Pin 89 location: 1142.00 from left edge, 5.70 from top edge.
- Pin 90 location: 1154.50 ± 0.40 from left edge, 5.70 from top edge.
- Pin 91 location: 1167.00 from left edge, 5.70 from top edge.
- Pin 92 location: 1179.50 from left edge, 5.70 from top edge.
- Pin 93 location: 1192.00



**免责声明 | DISCLAIMER**

- **Application:** This product is suitable for general vehicle-grade electrical applications.

使用范围: 本产品适用于一般车规级电气应用。

- **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.

质保期: 除双方在合作协议或其他书面文件中另行约定外, 本规格书所述产品质保期自出货起12个月。

■ **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.

与产品相关的特别说明:

● **运输:**

1) 包装箱颠簸或坠落可能导致模块受损。

2) 模块遇水受潮可能导致故障失效。在雨雪天气尤其要注意保护模块防止淋湿。

● **贮存:**

贮存地点温度与湿度应分别控制在5~35° C和30~75%RH。如果贮存环境远高于或低于指示的变化范围, 将危害模块的性能与可靠性。

● **使用:**

1) 灌装硅胶的模块, 须插针向上正置安装。

2) 模块不应当暴露在水, 有机溶剂, 腐蚀性气体、易燃易爆性气体, 微尘, 腐蚀性药剂中, 上述任何一种情况都会导致严重故障。

3) 防静电措施: 为了防止静电积累从而损坏栅极设备, 应采取以下预防措施: 信号端子与发射极之间应始终用导电泡棉或其他材料短接, 直到即将使用模块之前才移除。绝对不要用裸手触摸信号端子。在安装过程中(移除导电泡棉或其他材料后), 确保设备和您的身体接地。建议在工作台及其周围地板上覆盖导电垫并接地。使用接地烙铁头。

- Our company is committed to enhancing product quality and stability. This specification serves solely to delineate technical product details.

- 本公司致力于提高产品质量与稳定性。本规格书之目的, 仅在于陈述产品相关技术信息。

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任何超出本文件中建议存储条件、使用条件及绝对最大额定参数条件（或部分明确值）使用，造成的产品损坏或连带事故发生，本公司不承担相关责任。当客户在使用产品时，应根据最新版本文件上规定的操作步骤或说明条件进行使用或测试。客户有责任遵从安全规则（包括冗余设计、防火措施、故障预防等）设计安全及稳定的系统环境，在实际应用前、或实际应用中验证本文件所述的任何功能，以确保适用性、安全性（预防可能发生的任何事故、火灾或社会伤害等）及可靠性。建议客户在测试前可咨询本公司，以验证产品信息是否可以涵盖应用需求。

- 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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- The information presented in this specification constitutes the latest product details compiled and recorded by our Company with reasonable efforts at the time of publication. To ensure greater accuracy,

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- This specification is written in both Chinese and English, and in case of any conflict between the Chinese and English versions, the Chinese version shall prevail.

本文件以中英文双语书写，如有不同之处，以中文内容为准。