中国中车
CRRC

PRODUCT CATALOGUE

产品手册

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

株洲总部地址：湖南省株洲市石峰区田心高科园
电话：+86-731-28498238
传真：+86-731-28498851
网址：https://ctsc.csrzic.com

Headquarters Address: Tianxin High-Tech Park, Shifeng District, Zhuzhou City, Hunan Province, China
Phone: +86-731-28498238
Fax: +86-731-28498851
Website: https://ctsc.csrzic.com

宜兴中车时代半导体有限公司
地址：江苏省无锡市宜兴市经开区学府路 666号

Yixing CRRC Times Semiconductor Co., Ltd.
Address: No. 666, Xuefu Road, Yixing Economic and Technological Development Distric, Wuxi City, Jiangsu Province, China

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

企业简介
COMPANY *PROFILE*

株洲中车时代半导体股份有限公司是中国中车旗下股份制企业中车时代电气(其前身及母公司一中车株洲电力机车研究所有限公司创立于1959年)的子公司，早从1964年开始功率半导体技术的研发与产业化，2008年战略并购英国丹尼克斯公司，通过十余年持续投入和平台提升，已成为国际少数同时掌握大功率晶闸管、IGCT、IGBT及SiC器件及其组件技术的IDM(集成设计制造)模式代表企业，拥有芯片设计与制造一模块封装一测试一应用完整产业链。公司将致力成为轨道交通、输配电、新能源汽车、发电等领域功率半导体器件首选供应商。

Zhuzhou CRRC Times Semiconductor Co., Ltd. is a subsidiary of CRRC Times Electric, a joint-stock company under CRRC (its predecessor and parent company — CRRC Zhuzhou Institute Co., Ltd. was founded in 1959). The company has specialized in power semiconductor R&D and industrialization since 1964. Following the strategic acquisition of UK's Dynex Semiconductor in 2008, and over a decade of continuous investment and platform upgrades, it has emerged as one of the world's few leading IDM enterprises mastering core technologies of high-power thyristors, IGCTs, IGBTs, SiC devices and modules. Boasting a complete industrial chain (chip design & manufacturing, module packaging, testing, application),the company strives to be the preferred supplier of power semiconductors for rail transit, power transmission and distribution, new energy, vehicles and power generation.

发展历程
DEVELOPMENT *HISTORY*

4200+
产业员工
Employees

1100+
工程技术人员
Engineering employees

300+
境外员工
Overseas employees

40+
博士
Doctors

1964
开始研发大功率半导体技术

Initiated R&D of high-power semiconductor technologies

2008
并购Dynex公司75%的股份

Acquired Dynex 75% shares

2009
6英寸双极器件生产线、国内首条
大功率IGBT模块封装线建设投产

6-inch bipolar device production line and China's first high-power

IGBT module packaging line have been constructed and put into operation

2011
IGBT进入轨道交通领域
开始SiC技术研究，获02重大专项支持

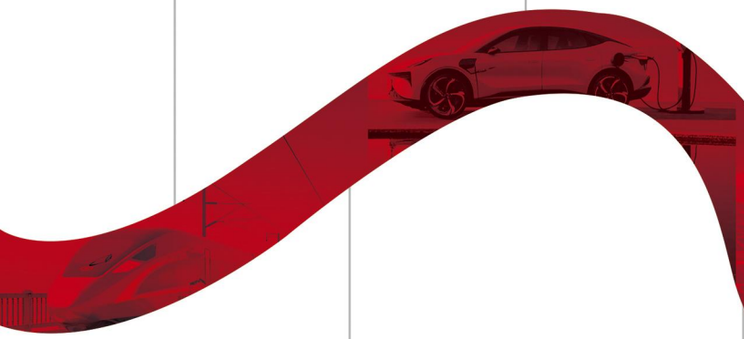
IGBT enters the rail transit sector

Initiates SiC technology research with support from the 02 Major Special Project

2014
8英寸IGBT晶圆线建成投产
国家能源大功率电力电子器件研发中心

Completion and commissioning of the 8-inch IGBT wafer line

National Energy R&D Center for High-Power Power Electronic Devices



2017
IGBT进入汽车领域
SiC产线完成调试并试运行

IGBT has entered the automotive sector

The SiC production line has completed commissioning and commenced trial operation

2019
成立株洲中车时代半导体有限公司
参股设立武汉智新半导体有限公司
全面控股Dynex100%

Established Zhuzhou CRRC Times Semiconductor Co., Ltd.

Participated in establishing Intelligent Power Semiconductor Co., Ltd.

Gained 100% full control of Dynex

2021
完成首批员工股权激励
参股设立广州青蓝时代半导体有限公司
获“绿色工厂”称号

Completed the first batch of employee equity incentives

Participated in establishing Guangzhou Qinglan Era Semiconductor Co., Ltd.

Awarded the title of 'Green Factory'

2022
三期规划落地实施，总投资111.2亿元
功率半导体与集成技术全国重点实验室获批

Implementation of Phase III Plan with a total investment of RMB 11.12 billion

Approval of National Key Laboratory of Power Semiconductors and Integration Technology

2024
中低压功率器件产业化建设项目
宜兴产线正式运营投产

Yixing production line officially operational for Medium & low-voltage power device industrialization project

2025
中低压功率器件产业化建设项目
株洲产线正式运营投产

The Zhuzhou production line of the Medium and Low-Voltage Power Device Industrialization Project was officially commissioned and put into operation

产业布局

INDUSTRY *LAYOUT*

株洲/Zhu Zhou 总部/Headquarters

株洲中车时代半导体股份有限公司
研发中心、营销中心
8英寸SiC器件产业化基地
8英寸IGBT产业化基地
6英寸双极器件产业化基地

Zhuzhou CRRC Times Semiconductor Co., Ltd.
R&D Center, Marketing Center
8-inch SiC Device Industrialization Base
8-inch IGBT Industrialization Base
6-inch Bipolar Device Industrialization Base

宜兴 Yi xing

宜兴中车时代半导体有限公司
中低压功率器件（SiC模块封装产线基地）

Yixing CRRC Times Semiconductor Co., Ltd.
Industrialization Base for Medium and Low Voltage Power Devices

广州 Guang Zhou

广州青蓝时代半导体有限公司
新能源汽车用IGBT封装生产线

Guangzhou Cyan Times Semiconductor Co., Ltd
IGBT Module Assembly Line for New Energy Vehicles

武汉 Wu Han

智新半导体有限公司
新能源汽车用IGBT封装生产线

Intelligent Power Semiconductor Co., Ltd.
IGBT Module Assembly Line for New Energy Vehicles

英国 UK

英国丹尼克斯半导体有限公司
功率半导体林肯研发中心
6英寸功率半导体器件产业化基地

Dynex Semiconductor Co., Ltd.
Lincoln R&D Center for Power Semiconductor
6-inch Power Semiconductor Device Industrialization Base

CONTENTS

IGBT &FRD

SiC

双极 BIPOLAR

01

第一章
CHAPTER ONE

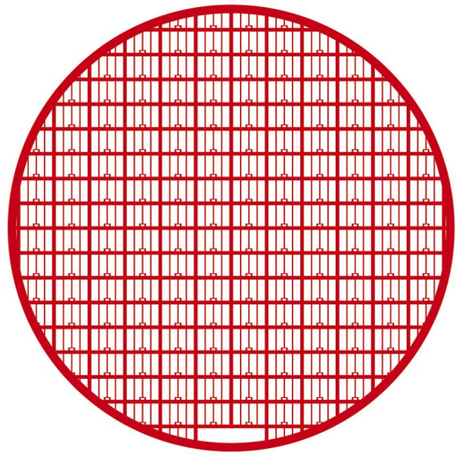
IGBT 及 FRD 芯片

IGBT & FRD
CHIPS

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

IGBT & FRD CHIPS

IGBT 及 FRD 芯片



IGBT 芯片 IGBT CHIPS

产品介绍 PRODUCT INTRODUCTION

中车IGBT芯片采用精细沟槽元胞设计结合软穿通技术，具有低导通损耗与开关损耗的特点，提供产品覆盖750V-1200V电压、40A-375A电流范围。

CRRC's IGBT chips adopt a design combining fine trench cell structure and soft punch-through technology, featuring low on-state loss and switching losses. The product range covers voltages from 750V to 1200V and currents from 40A to 375A.

产品特点 CHARACTERISTIC

沟槽栅	Trench Gate	低开关损耗	Low Switching Losses
软穿通	Soft Punch Through	软关断	Soft Turn Off
低导通损耗	Low On-State Loss	高工作结温	T_{vjmax}=175°C

产品 /Product	技术 /Technology	尺寸 /Size	V_{CE}	I_{nom}	$V_{CE(SAT)}$@25°C		$V_{GE(th)}$	I_{CES}	I_{GES}	T_{vjmax}
					60A	I_{nom}				
		mm	V	A	V		V	μA	nA	°C
TI075TESA9S0	5th-TMOS	10.458*9.958	750	200	1.05	1.70	6.0	2	100	150
TI075EEUC6S0	7.5th-STMOS+	12.9*6.9	750	250	0.92	1.34	6.0	2	100	175
TI075EESA8S0	7th-STMOS	10.5*8.0	750	250	1.00	1.40	6.0	2	100	175
TI075EEUB8S0	7.5th-STMOS+	11.2*8.9	750	315	1.05	1.40	6.0	2	100	175
TI075SESBAS1	7th-STMOS	11.2*10	750	315	0.90	1.40	6.0	2	100	175
TI075FESBAS2	6th-RTMOS	11.1*10	750	315	0.95	1.65	6.0	2	100	175
TI075EESBAS2	7.5th-STMOS+	11.2*10	750	315	1.00	1.20	6.0	2	100	175
TI075SESC9S0	7th-STMOS	12.9*9.27	750	375	0.90	1.35	5.9	2	100	175
TR075SESGBS0	8th-RCMOS	16.2*11.2	750	400	1.00	2.05	6.3	2	100	175
TI075EEUEAS0	7.5th-STMOS+	14.8*10	750	415	0.84	1.22	6.0	2	100	175
TI075EEUCCS0	7.5th-STMOS+	12.9*12.5	750	450	0.83	1.29	6.0	2	100	175
TI095SMS77H5	7th-STMOS	7.1*7.1	950	100	1.50	2.00	5.5	2	100	175
TI095SMS99H6	7th-STMOS	9*9	950	200	1.35	1.80	5.5	2	100	175
TI095SMS99S6	7th-STMOS	9*9	950	200	1.00	1.45	5.5	2	100	175
TI120SES33L6	7th-STMOS	3.3*3.3	1200	10	/	1.57	6.0	2	100	175
TI120SES44L5	7th-STMOS	4.5*4.5	1200	25	/	1.56	6.0	2	100	175
TI120SCS55L5	7th-STMOS	4.8*4.8	1200	35	/	1.60	6.0	2	100	175
TI120SCS66S0	7th-STMOS	6.1*6.6	1200	50	/	1.50	6.0	2	100	175
TI120SMS77S0	7th-STMOS	7.4*7.4	1200	75	/	1.32	6.0	2	100	175
TI120SMS97S0	7th-STMOS	9.8*7.5	1200	100	/	1.30	6.0	2	100	175
TI120TESE7H0	5th-TMOS	14.5*7.4	1200	110	1.35	1.75	6.0	2	100	150
TI120SESA6H1	7th-STMOS	10.7*6.7	1200	140	/	1.83	5.8	2	100	175
TI120TESEAH0	5th-TMOS	14*10.9	1200	150	1.35	1.75	6.0	2	100	150
TI120FESEAH0	6th-RTMOS	14*10.9	1200	200	1.15	1.75	6.2	2	100	150
TI120TESFCH0	5th-TMOS	15.9*12	1200	200	1.10	1.70	6.2	2	100	150
TI120FESB9S0	6th-RTMOS	11.1*9.7	1200	200	1.10	1.68	6.0	2	100	150
TI120SESB9S1	7th-STMOS	11.1*9.7	1200	200	1.15	1.55	6.0	2	100	175
TI120SESGBS0	7th-STMOS	16*11.2	1200	300	0.95	1.45	6.0	2	100	175

FRD 芯片 FRD CHIPS

产品介绍 PRODUCT INTRODUCTION

中车FRD芯片采用寿命控制与薄片技术，具有低导通损耗与开关损耗以及软恢复的特点，产品覆盖750V-1200V电压、30A-375A电流范围。

CRRC's FRD chips adopt lifetime control and thin wafer technologies, featuring low on-state loss, low switching losses, and soft recovery. The products cover a voltage range of 750V-1200V and a current range of 30A-375A.

产品特点 CHARACTERISTIC

软恢复	Soft & Fast Switching
正温度系数	Positive Temperature Coefficient
易并联	Easy Paralleling
高工作结温	T_{vjmax}=175°C

产品 /Product	技术 /Technology	尺寸 /Size	V_R	I_{nom}	V_F@25°C		I_R	T_{vjmax}
					60A	I_{nom}		
		mm	V	A	V		μA	°C
TF075HLS95S3	5th FRD	9.1*5.34	750	200	1.15	1.60	2	175
TF075TLSA5S1	6th FRD	10.4*5.3	750	275	1.10	1.60	2	175
TF075ELS95S0	7.5th FRD	9.5*5.4	750	315	1.20	1.90	2	175
TF075ELSB5S0	7.5th FRD	11.1*5.4	750	315	1.10	1.75	2	175
TF075SLSB5S1	7th FRD	11.1*5.4	750	315	1.10	1.95	2	175
TF075ELUC5S0	7.5th FRD	12.5*9	750	350	1.10	1.70	2	175
TF075SLSC6S0	7th FRD	12.1*6	750	375	1.05	1.70	2	175
TF075ELSA7S0	7.5th FRD	10.5*7.0	750	375	1.10	1.70	2	175
TF075ELUD5S0	7.5th FRD	13.4*5.5	750	400	1.05	1.65	2	175
TF075ELUC8S0	7.5th FRD	12.9*5	750	550	1.00	1.80	2	175
TF095SLS55H5	7th FRD	5.3*5.3	950	100	1.70	2.30	2	175
TF095SLS55S5	7th FRD	5.3*5.3	950	100	1.40	1.55	2	175
TF120SLS23L5	7th FRD	3*2.3	1200	10	/	1.70	2	175
TF120SLS42S0	7th FRD	4.0*2.7	1200	25	/	1.38	2	175
TF120SLS44S0	7th FRD	4*4.1	1200	35	/	1.50	2	175
TF120SLS35S0	7th FRD	5.4*3.8	1200	50	/	1.18	2	175
TF120SLS55S0	7th FRD	5.5*5.3	1200	75	/	1.23	2	175
TF120SLS75S0	7th FRD	7*5.4	1200	100	/	1.30	2	175
TF120SLS84S0	7th FRD	8.2*4.1	1200	100	/	1.53	2	175
TF120HLS77S1	5th FRD	7.2*7.2	1200	110	1.50	1.90	2	175
TF120SLS94H0	7th FRD	9.4*4.1	1200	140	/	2.38	2	175
TF120HLS99S0	5th FRD	9.2*9.2	1200	150	1.36	1.85	2	175
TF120SLSB5S0	7th FRD	11.1*5.6	1200	200	1.26	1.95	2	175
TF120HLSC8S1	5th FRD	12.2*8.1	1200	200	1.26	1.80	2	175
TF120TLSAAS0	6th FRD	10.8*10.8	1200	300	1.05	1.80	2	175
TF120SLSBBS5	7th FRD	11.3*11.3	1200	335	1.12	1.90	2	175

产品图示
PRODUCT
DIAGRAM

IGBT 芯片 IGBT CHIPS

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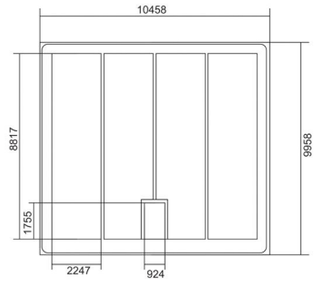

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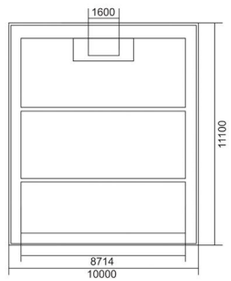

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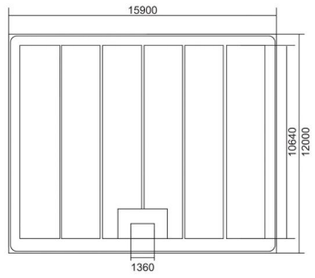

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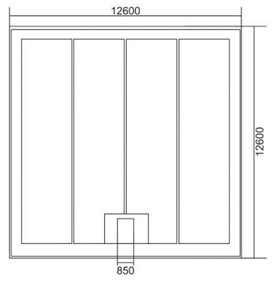

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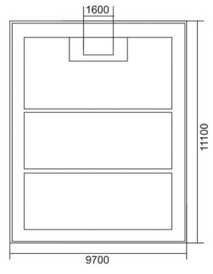

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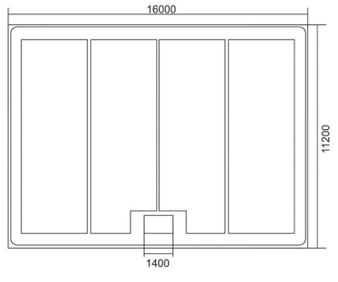

长度单位：微米
Unit: μm

产品图示
PRODUCT
DIAGRAM

FRD 芯片 FRD CHIPS

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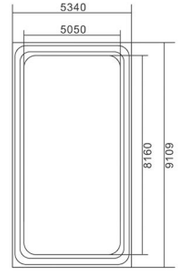

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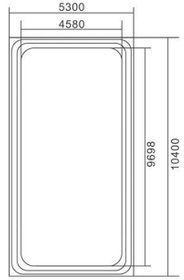

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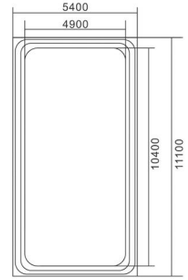

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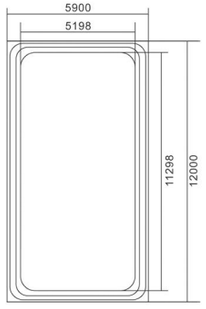

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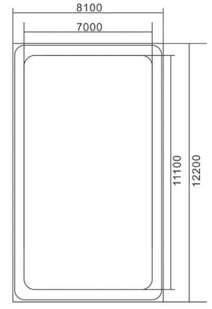

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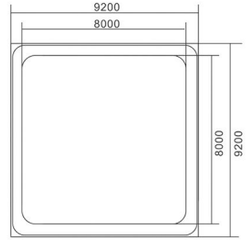

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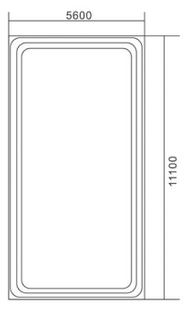

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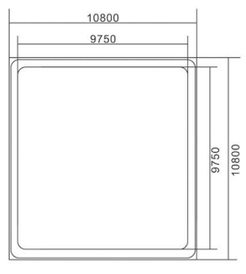


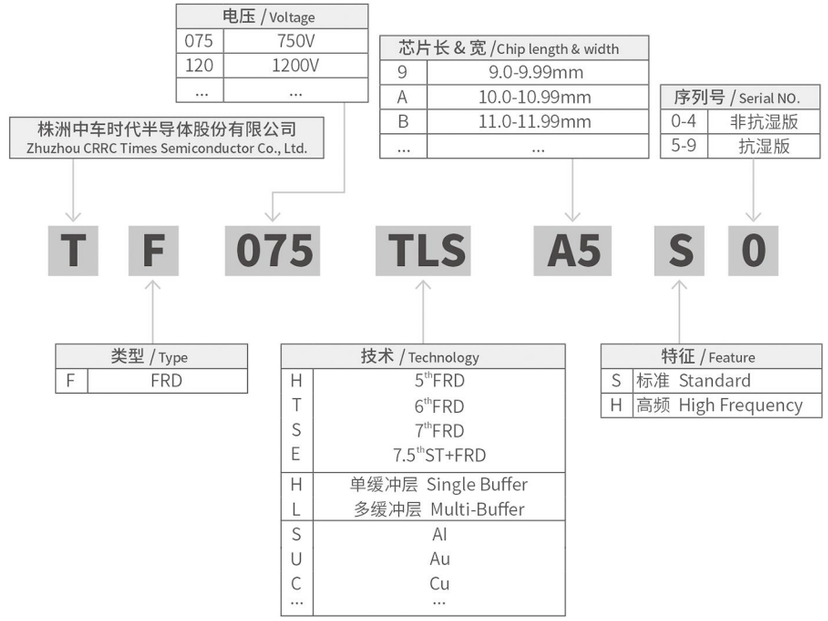
长度单位：微米
Unit: μm

型号说明
NOMENCLATURE

IGBT 芯片 IGBT CHIPS

型号说明
NOMENCLATURE

FRD 芯片 FRD CHIPS



符号说明
SYMBOLS

符号 Symbols	参数名称	Characteristics
V_{CE}	集电极 - 发射极电压	Collector-Emitter Voltage
$V_{CE(SAT)}$	集电极 - 发射极饱和电压	Collector-Emitter Saturation Voltage
$V_{GE(TH)}$	栅极 - 发射极阈值电压	Gate-Emitter Threshold Voltage
I_{CES}	集电极 - 发射极漏电流	Zero Gate Voltage Collector Current
I_{GES}	栅极 - 发射极漏电流	Gate-Emitter Leakage Current
V_R	二极管反向电压	Diode Reverse Voltage
I_{NOM}	额定电流	Nominal Current
V_F	二极管正向电压	Diode Forward Voltage
I_R	二极管反向漏电流	Diode Reverse Leakage Current
T_{VJMAX}	最大工作结温	Max. Junction Temperature

02

第二章
CHAPTER TWO

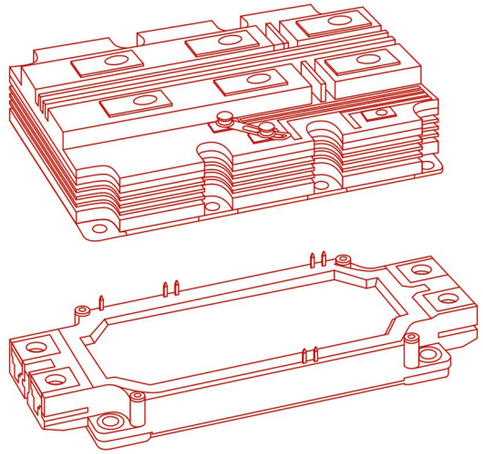
IGBT 及 FRD 模块

IGBT & FRD
MODULES

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

IGBT & FRD MODULES

IGBT 及 FRD 模块



高压 IGBT 模块 HV IGBT MODULES

产品介绍
PRODUCT INTRODUCTION

采用中车第四代DMOS+芯片和第五代TMOS芯片，具有低导通压降、软关断特性、正温度系数和易并联等特点。该系列产品涵盖3300V至6500V电压范围，封装和电路结构灵活多变，适用于各种并联应用场景。产品采用高热匹配的AlSiC基板和AlN衬板材料封装而成，在热循环、功率循环、机械冲击等可靠性方面具有明显优势，可以满足频繁启动和长距离运行的工况需求。已批量应用于电力机车、高速动车组、地铁等轨道交通领域和其他大功率变频器装置领域。

It adopts CRRC's 4th Generation DMOS+ and 5th Generation TMOS chips, featuring ultra-low on-state voltage drop, soft turn-off, positive temperature coefficient, and easy parallel operation. Covering 3300V to 6500V, the series offers flexible packaging and circuit structures, suitable for various parallel applications. Packaged with thermally matched AlSiC substrates and AlN liners, it excels in reliability (thermal cycling, power cycling, mechanical shock), meeting demands for frequent starts and long-distance operations. It has been mass-applied in rail transit (electric locomotives, high-speed EMUs, subways) and other high-power frequency converter fields.

产品特点
CHARACTERISTIC

低导通压降	Low $V_{CE(SAT)}$
高短路能力	High Short Circuit Capability
正温度系数电压	$V_{CE(SAT)}$ With Positive Temperature Coefficient
高功率循环及热循环能力	High Power And Thermal Cycling Capability

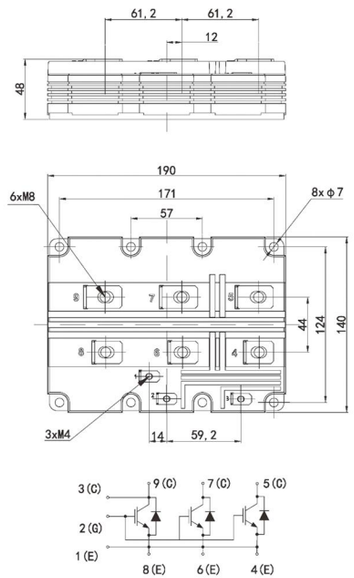
型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TIM800DDM17-TSA000	1200	75	1700	1600	2.3	560	150	0.018	DD	140×130×48	AlSiC
TIM1200DDM17-TSA000	1200	75	1700	2400	1.72	1327	150	0.012	DD	140×130×48	AlSiC
TIM250PHM33-PSA011	250	100	3300	500	2.5	1375	150	0.048	PH	140×73×38	AlSiC
TG450HF33X1-TSA000	450	95	3300	900	2.5	1695	150	0.031	X1	144×100×40	AlSiC
TIM500GDM33-PSA011	500	100	3300	1000	2.4	2850	150	0.024	GD	160×130×38	AlSiC
TIM1000ECM33-PSA011	1000	95	3300	2000	2.1	6500	150	0.012	EC	190×140×38	AlSiC
TIM1000NSM33-PSA011	1000	95	3300	2000	2.4	5770	150	0.012	NS	140×130×38	AlSiC
TIM1500ESM33-PSA012	1500	95	3300	3000	2.4	8020	150	0.008	ES	190×140×38	AlSiC
TIM1500E2SM33-PSA012	1500	95	3300	3000	2.6	7800	150	0.0084	ES	190×140×38	AlSiC
TG1600HF33P1-TSA000	1600	60@TF	3300	3200	2.2	8090	150	0.024@ Rth(J-F)	PCU	278×226.3×56	/
TIM1600N3SM33-TSA000	1600	100	3300	3200	2.6	7300	150	0.01	NS	140×130×38	AlSiC
TIM2400E3SM33-TSA000	2400	100	3300	4800	2.6	10950	150	0.01	ES	190×140×48	AlSiC

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TIM800XSM45-PSA011	800	85	4500	1600	2.3	9425	125	0.013	XS	140×130×48	AlSiC
TIM800XSM45-PSA012	800	80	4500	1600	2.7	7800	125	0.013	XS	140×130×48	AlSiC
TIM1000XSM45-TSA000	1000	90	4500	2000	2.94	11220	150	0.0128	XS	140×130×48	AlSiC
TIM1200ASM45-PSA011	1200	85	4500	2400	2.3	14060	125	0.008	AS	190×140×48	AlSiC
TIM1200ASM45-PSA012	1200	80	4500	2400	2.7	13400	125	0. 008	AS	190×140×48	AlSiC
TIM1200ESM45-PSA011	1200	85	4500	2400	2.3	14060	125	0.008	ES	190×140×38	AlSiC
TIM1500A2SM45-TSA100	1500	80	4500	3000	3.04	18209	150	0.008	AS	190×140×48	AlSiC
TIM1500A2SM45-TSA000	1500	80	4500	3000	2.6	15290	150	0.008	A2	190×140×48	AlSiC
TIM250P2SM65-PSA011	250	80	6500	500	4.2	5034	125	0.026	P2S	140×73×48	AlSiC
TIM500XSM65-PSA011	500	80	6500	1000	3. 1	10427	125	0. 013	XS	140×130×48	AlSiC
TG750HF65P1-S300	750	60@TF	6500	1500	2.6	13624	125	0.023@ Rth(J-F)	PCU	278×226.3×56	/
TIM750ASM65-PSA011	750	80	6500	1500	3.0	14280	125	0.0085	AS	190×140×48	AlSiC
TIM1000A2SM65-TSA000	1000	80	6500	2000	2.45	21132	150	0.008	AS	190×140×48	AlSiC

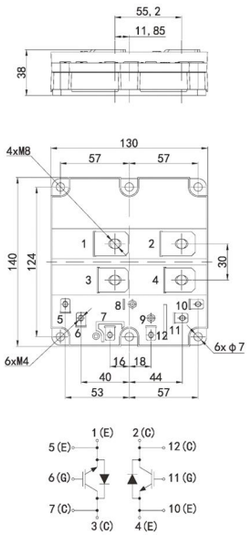
产品图示
PRODUCT DIAGRAM

高压 IGBT 模块 HV IGBT MODULES

AS



DD

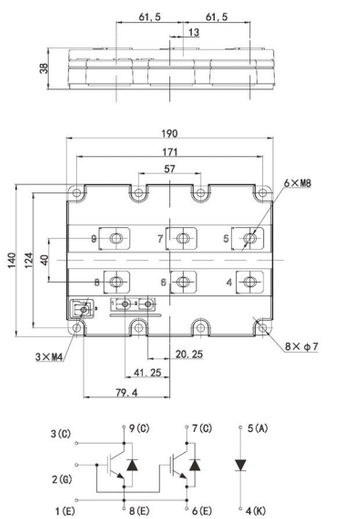


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

高压 IGBT 模块 HV IGBT MODULES

EC



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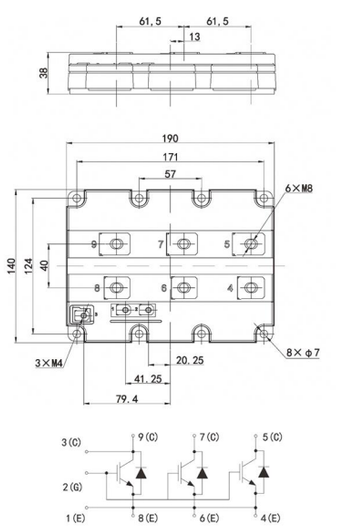

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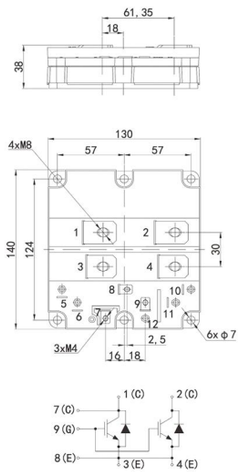
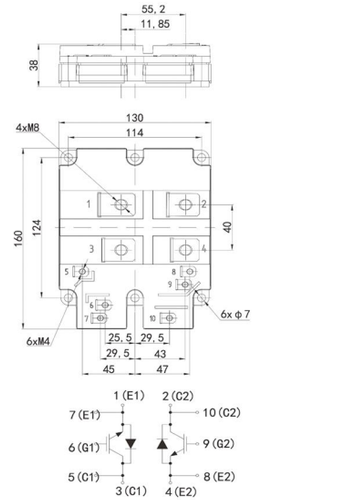


GD

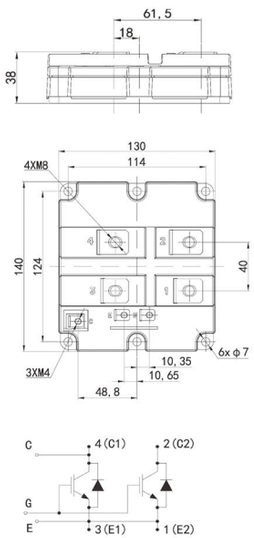


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

高压 IGBT 模块 HV IGBT MODULES

NS



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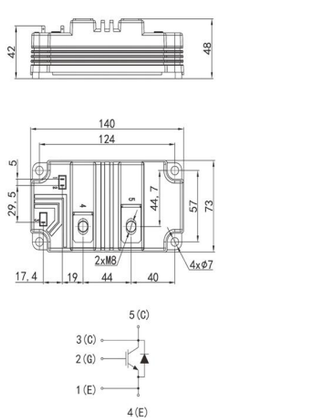

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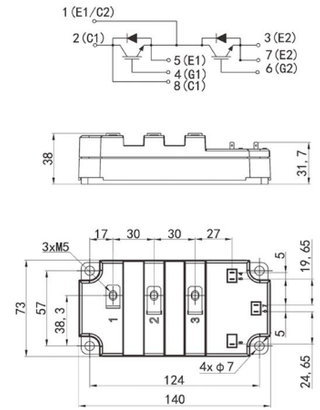
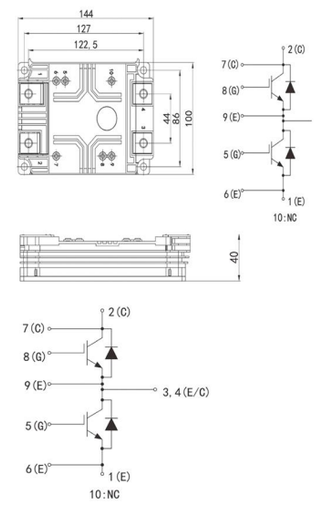


X1

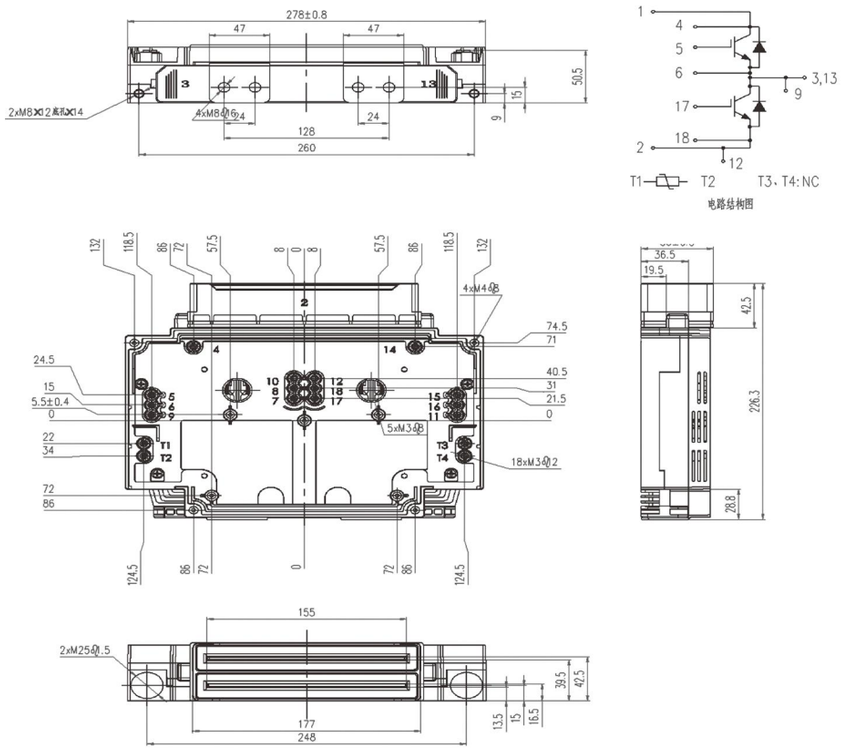


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

高压 IGBT 模块　HV IGBT MODULES

PCU



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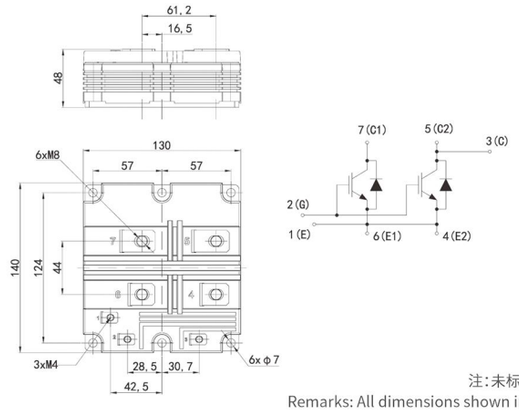


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

汽车 IGBT 模块　AUTOMOTIVE IGBT MODULES

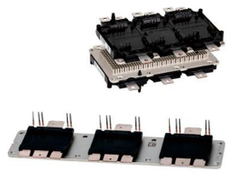
产品介绍
PRODUCT INTRODUCTION

采用中车第六代、七代精细沟槽芯片，具有高电流密度、低开关损耗、高工作结温等特点。采用直接水冷基板，选用高性能导热材料，该系列产品涵盖400A至1200A电流范围，单模块最大可满足250kW电机需求。具备低运行损耗特征，满足汽车的急速启停、陡坡爬升、高速运行、振动颠簸等工况。产品已批量应用于新能源电动汽车领域。

Adopting CRRC's 6th Generation and 7th Generation fine trench chips, they feature high current density, low switching losses, and high operating junction temperature. Equipped with direct water-cooled substrates and high-performance thermal conductive materials, the series covers a current range of 400A–1200A, with a single module capable of meeting the requirements of 250kW motors. Boasting low operating loss, they suit automotive operating conditions such as rapid start-stop, steep slope climbing, high-speed driving, and vibration. The products have been mass-applied in new energy electric vehicles.

产品特点
CHARACTERISTIC

低导通压降	Low $V_{CE(SAT)}$
低杂散电感	Low Inductive Design
低开关损耗	Low Switching Losses
高功率密度	High Power Density
高工作结温	High Operating Junction Temperature



型号 Type	I_C A	I_C @T_C (S 模块为 T_F)	V_{CES}	I_{CRM}	$V_{CE(SAT)}$ @I_C &T_C=25℃	E_{SW} @T_{VJM}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline 代码 Code	尺寸 Dimensions	基板材料 Base Material
	A	℃	V	A	V	mJ	℃	K/W	/	mm	/
TG1000HF08L5-S5A01	1000	100	750	2000	1.10	60	175	0.07(JF)	L5	110×63×25.5	Cu
TG500FF08L7-S5A13	500	350A@25	750	1000	1.70	35.4	175	0.222(JF)	L7	84×107.8×26.36	Cu
TG500FF08L7-S5A15	500	350A@25	750	1000	1.70	35.4	175	0.222(JF)	L7	84×107.8×26.36	Cu
TG600FF08L7-S5A13	600	375A@85	750	1200	1.40	34.8	175	0.159(JF)	L7	84×107.8×26.36	Cu
TG600FF08L7-S5A15	600	375A@85	750	1200	1.40	34.8	175	0.159(JF)	L7	84×107.8×26.36	Cu
TG800FF08L10-S5A11	800	450A@85	750	1600	1.20	63.6	175	0.141(JF)	L10	218×69×30.35	Cu
TG450HF12M1-S3A00	450	100	1200	900	1.65	142	150	0.052	M1	151.8×62×20.8	Cu
TG600HF12M1-G3A00	600	100	1200	1200	1.85	171	150	0.049	M1	151.8×62×20.8	Cu
TG900HF12M1-S5A00	900	100	1200	1800	1.45	281	175	0.052	M1	151.8×62×20.8	Cu
TG1000HF12M1-S5A00	1000	80	1200	2000	2.05	413	175	0.0351	M1	151.8×62×20.8	Cu

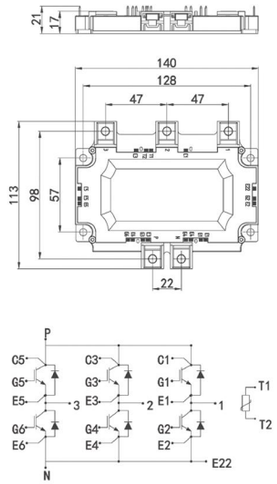
汽车 IGBT 模块 AUTOMOTIVE IGBT MODULES

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C (S 模块为 T_F)			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TG400FF08S0-S4A00	400	65	750	800	1.30	44.5	150	0.12	S0	140×113×21	Cu
TG400FF08S2-S3A11	400	60	750	800	1.70	50.5	150	0.165(JF)	S2	140×112×29.6	Cu
TG500FF08S2-S5A10	500	375A@60	750	500	1.30	68.1	175	0.15	S2+	140×113×30.95	Cu
TG420FF08S2-S5A00	420	200A@75	750	840	1.10	27.8	175	0.137	S2+	140×113×30.95	Cu
TG560FF08S2-S5A13	560	375A@65	750	1120	1.20	41.1	175	0.196(JF)	S2+	140×113×30.95	Cu
TG650FF08S2-S5A02	650	80	750	1300	1.10	56.5	175	0.205(JF)	S2+	140×113×30.95	Cu
TG650FF08S2P-S5A13	650	375A@75	750	1300	1.25	42.2	150	0.177(JF)	S2+	140×113×30.95	Cu
TG800FF08S2-S5A03	800	375A@75	750	1600	1.10	40.2	175	0.12(JF)	S2+	140×113×30.95	Cu
TG600FF08S3-S3A01	600	65	750	1200	1.55	70	150	0.12(JF)	S3	154.5×126.5×32	Cu
TG600FF08S3-S5A02	600	80	750	1200	1.10	37	175	0.16(JF)	S3	154.5×126.5×32	Cu
TG600FF08S3-S5A12	600	300A@100	750	1200	1.15	39.3	175	0.165(JF)	S3	154.5×126.5×32	Cu
TG660FF08S3-S4A03	660	80	750	1320	1.20	66.1	175	0.08	S3	154.5×126.5×32	Cu
TG680FF08S3-S5A02	680	375A@85	750	1360	1.15	48.2	175	0.155 (JF)	S3	154.5×126.5×32	Cu
TG680FF08S3-S5A03	680	375A@80	750	1360	1.15	48.2	175	0.155 (JF)	S3	154.5×126.5×32	Cu
TG680FF08S3L-S5A02	680	375A@85	750	1360	1.15	48.2	175	0.155 (JF)	S3	154.5×142.5×32	Cu
TG800FF08S3-S5A15	800	450A@100	750	1600	1.15	44.1	175	0.105(JF)	S3	154.5×126.5×32	Cu
TG820FF08S3-S4A11	820	80	750	1640	1.20	66.1	175	0.12(JF)	S3	154.5×126.5×32	Cu
TG820FF08S3-S5A01	820	65	750	1640	1.15	62.5	175	0.12(JF)	S3	154.5×126.5×32	Cu
TG820FF08S3-S5A12	820	450A@100	750	1640	1.15	57.6	175	0.128(JF)	S3	154.5×126.5×32	Cu
TG820FF08S3L-S5A12	820	450A@100	750	1640	1.15	57.6	175	0.128(JF)	S3	154.5×142.5×32	Cu
TG820FF08S6-S5A12	820	450A@60	750	1640	1.10	30	175	0.12(JF)	S6	137×102×33.32	Cu
TG820FF08S6-S5A12	820	100	750	1640	1.20	62	175	0.1	S6	139×92×33	Cu
TG950FF08S3-S4A01	950	95	750	1900	1.20	66.1	175	0.10(JF)	S3	154.5×126.5×32	Cu
TG950FF08S3-S5A01	950	95	750	1900	1.15	62.5	175	0.10(JF)	S3	154.5×126.5×32	Cu
TG950FF08S3-S5A12	950	450A@100	750	1900	1.15	57.6	175	0.096(JF)	S3	154.5×126.5×32	Cu
TG950FF08S3L-S5A12	950	450A@100	750	1900	1.15	57.6	175	0.096(JF)	S3	154.5×142.5×32	Cu
TG950FF08S3P-S5A12	950	450A@100	750	1900	1.15	57.6	175	0.096(JF)	S3	154.5×126.5×32	Cu
TG1000FF08S3-S5A12	1000	450A@85	750	2000	1.00	63.9	175	0.087(JF)	S3	154.5×126.5×32	Cu
TG1000FF08S3-S5A22	1000	450A@100	750	2000	1.10	57.8	175	0.087(JF)	S3	154.5×126.5×32	Cu
TG1200FF08S3-R6A02	1200	100	750	2400	1.10	60	175	0.062(JF)	S3	154.5×126.5×32	Cu
TG400FF12S3-S5A03	400	300A@70	1200	800	1.35	67.4	175	0.16(JF)	S3	154.5×126.5×32	Cu
TG600FF12S3-S4A01	600	80	1200	1200	1.50	211	175	0.10(JF)	S3	154.5×126.5×32	Cu
TG600FF12S3-S5A03	600	80	1200	1200	1.40	200	175	0.90(JF)	S3	154.5×126.5×32	Cu
TG600FF12S3P-S5A03	600	450A@70	1200	1200	1.40	147	175	0.095(JF)	S3	154.5×142.5×32	Cu
TG600FF13S3-S5A03	600	100	1300	1200	1.50	173	175	0.084	S3	154.5×126.5×32	Cu
TG500FF08S6-S5A10	500	375A@60	750	1000	1.30	59.8	175	0.13	S6	137×102×27.32	Cu
TG400FF08S7-S5A12	400	200A@95	750	800	1.20	19.8	175	0.321(JF)	S7	143.5×116.8×25.76	Cu
TG560FF08S7L-S5A12	560	375A@90	750	1120	1.15	37.4	175	0.18(JF)	S7	143.5×132.8×25.76	Cu
TG560FF08S7L-S5A13	560	375A@85	750	1120	1.25	40.7	175	0.18(JF)	S7	143.5×132.8×25.76	Cu
TG560FF08S7-S5A22	560	375A@90	750	1120	1.15	44.2	175	0.18(JF)	S7	143.5×132.8×25.76	Cu
TG650FF08S7L-S5A12	650	375A@85	750	1300	1.10	41.1	175	0.165(JF)	S7	143.5×116.8×25.76	Cu
TG700FF08S7-S5A12	700	375A@100	750	1400	1.15	47.4	175	0.152(JF)	S7	143.5×116.8×25.76	Cu
TG800FF08S7L-S5A12	800	375A@85	750	1600	1.10	41.1	175	0.136(JF)	S7	143.5×116.8×25.76	Cu

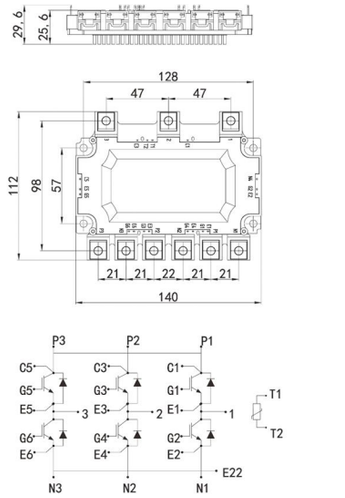
产品图示 PRODUCT DIAGRAM

汽车 IGBT 模块 AUTOMOTIVE IGBT MODULES

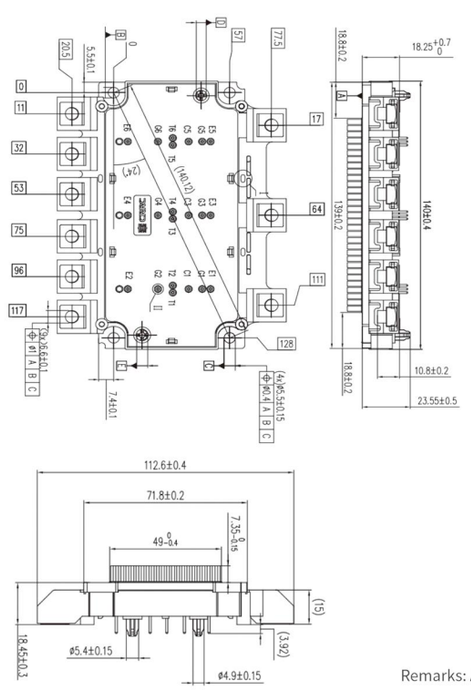
S0



S2



S2+

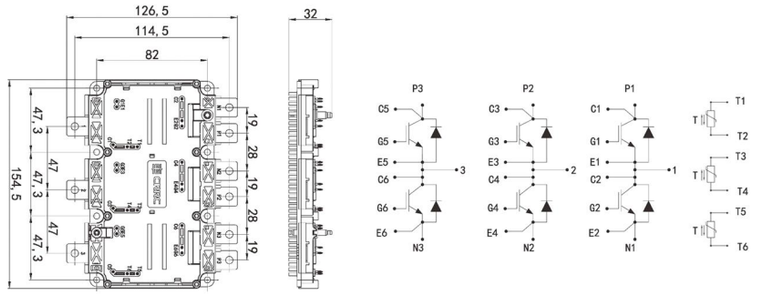


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

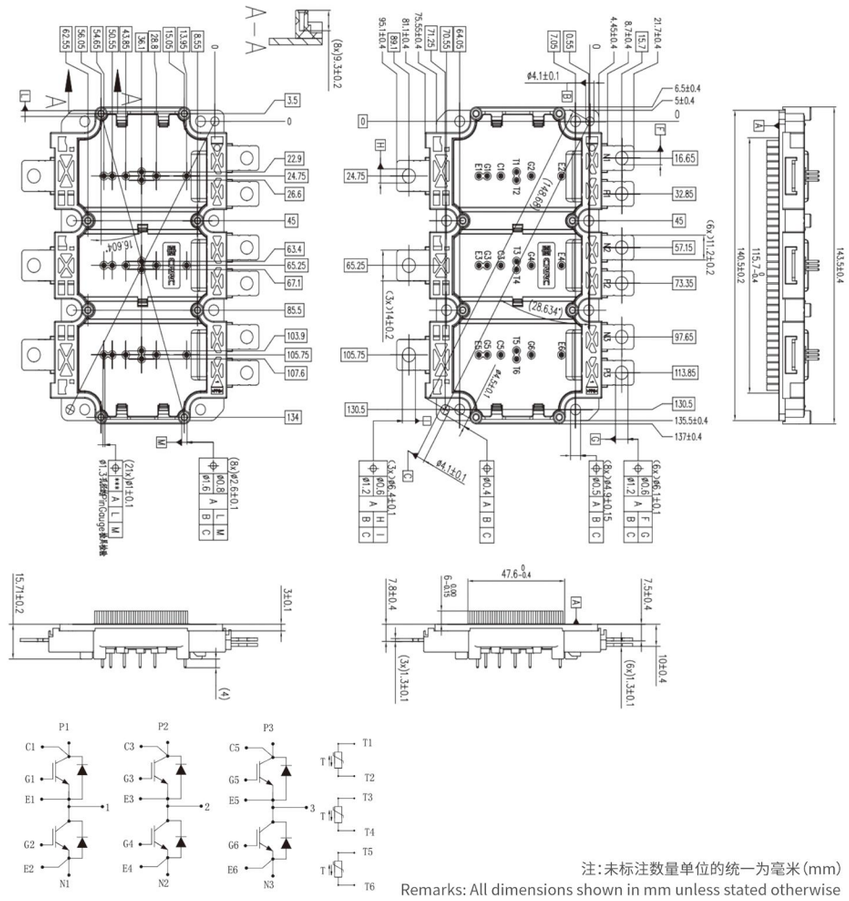
产品图示
PRODUCT DIAGRAM

汽车 IGBT 模块 AUTOMOTIVE IGBT MODULES

S3



S7

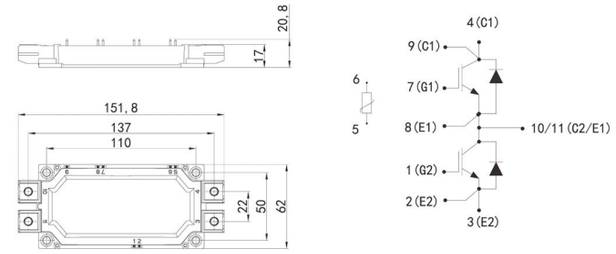


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

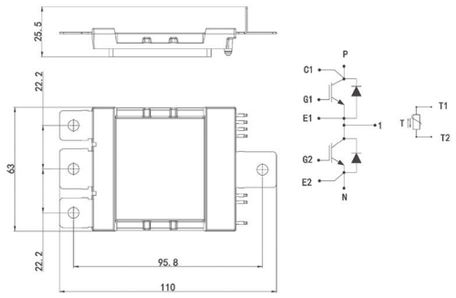
产品图示
PRODUCT DIAGRAM

汽车 IGBT 模块 AUTOMOTIVE IGBT MODULES

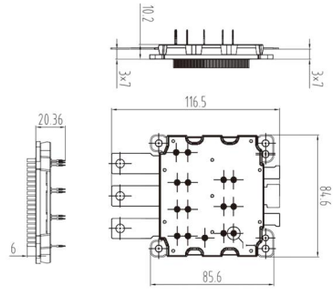
M1



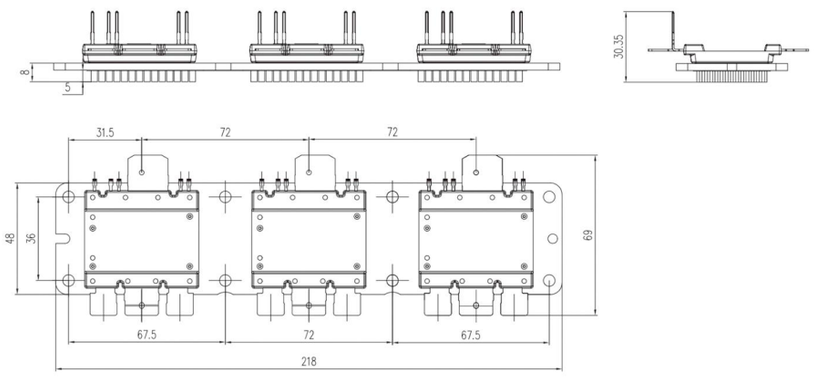
L5



L7



L10



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

压接式 IGBT 模块　PRESS-PACK IGBT MODULES

产品介绍
PRODUCT INTRODUCTION

采用中车第四代 DMOS+ 和第五代 TMOS 芯片，具有低导通压降、低开关损耗、软关断特性等特点。该系列产品采用双面焊接和柔性压接技术，具有高压大容量、高可靠性、高过载能力等特点，可满足远距离、大容量的柔性直流输电工程的需求，满足复杂高压电磁环境适应性以及高可靠运行的要求。已批量应用于多个柔性直流输电工程。

CRRC press-pack IGBT uses CRRC 4th Generation DMOS+ and 5th Generation TMOS IGBT chip featuring low on-stage voltage drop, low switching losses and soft turn-off characteristics. CRRC Press-Pack IGBT module family uses double-sided soldering and flexible press-fit technology, has the benefits of high power capacity, high reliability and high overload capacity. CRRC Press-Pack IGBT module family can meet the requirement of long distance, high power flexible HVDC application. CRRC Press-Pack IGBT module family has been widely applied to multiple HVDC projects.

产品特点
CHARACTERISTIC

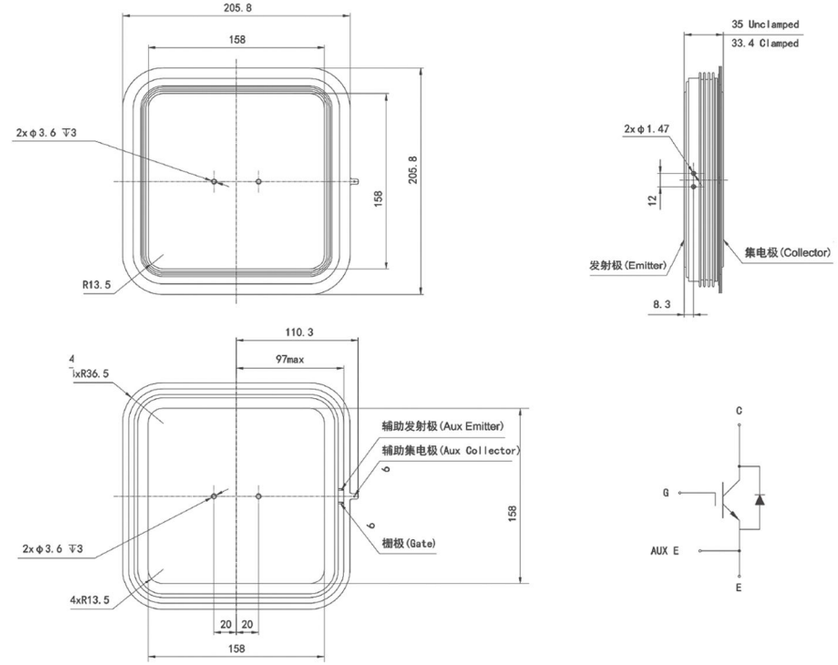
双面散热	Double-Side Cooling
失效短路	Short-Circuit Failure Mode
低杂散电感	Low Inductive Design
高热循环能力	High Thermal Cycling Capability

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C (S 模块为 T_F)			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TG1500SW45YB-P200	1500	90	4500	3000	2.95	19900	125	0.006	YB	φ190×33.4	Cu
TG1500SW45ZF-P200	1500	90	4500	3000	2.95	21800	135	0.0043	ZF1	237×237×26.5	Mo
TG2000SW45ZF-P200	2000	90	4500	4000	2.95	31000	135	0.0033	ZF2	237×237×26.5	Mo
TG2000SW45ZC-P200	2000	90	4500	4000	2.95	27900	135	0.0043	ZC	205.8×205.8×33.4	Cu
TG2000SW45YA-T200	2000	90	4500	4000	2.7	31573	150	0.0055	YA	φ172 X 26.5	Cu
TG2000SW45ZC-P210	2000	90	4500	4000	2.95	27900	135	0.0043	ZC	205.8×205.8×33.4	Cu
TG2500SG45ZF-P200	2500	90	4500	5000	3.2	27800	135	0.0036	ZF1	237×237×26.5	Mo
TG3000SW45ZF-P200	3000	90	4500	6000	2.95	47300	135	0.0022	ZF3	237×237×26.5	Mo
TG3000SW45ZC-P200	3000	90	4500	6000	2.95	39700	135	0.003	ZC	205.8×205.8×33.4	Cu
TG3000SW45ZC-P210	3000	90	4500	6000	2.95	39700	135	0.003	ZC	205.8×205.8×33.4	Cu
TG5000SG45ZF-T200	5000	90	4500	10000	2.85	69200	150	0.0018	ZF3	237×237×26.5	Mo
TG5000SG45ZF-P200	5000	90	4500	10000	3.2	76500	135	0.0018	ZF3	237×237×26.5	Mo
TG2000SW65ZF-T200	2000	90	6500	4000	3.05	42500	135	0.0043	ZF2	237×237×26.5	Mo
TG2000SW65ZF-T210	2000	90	6500	4000	3.05	57600	135	0.0044	ZF3	237×237×26.5	Mo
TG3000SW65ZF-T200	3000	90	6500	6000	3.1	60600	135	0.0029	ZF3	237×237×26.5	Mo

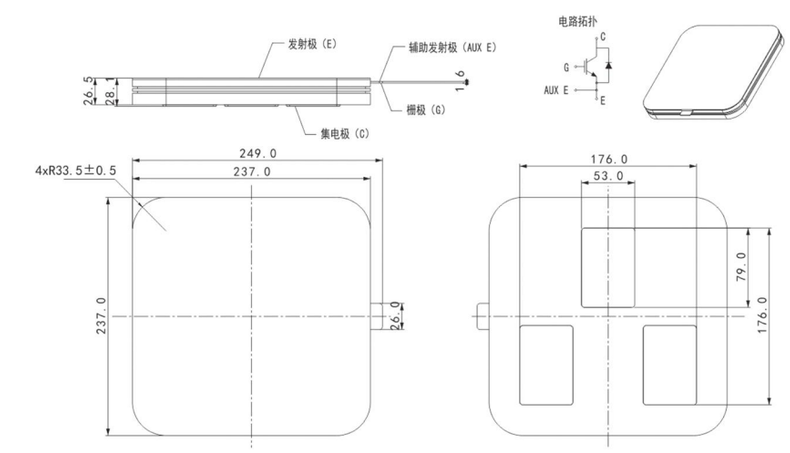
产品图示
PRODUCT DIAGRAM

压接式 IGBT 模块　PRESS-PACK IGBT MODULES

ZC



ZF1

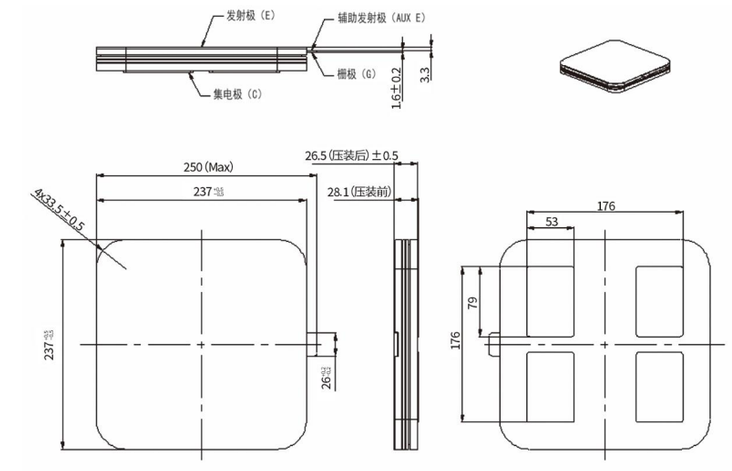


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

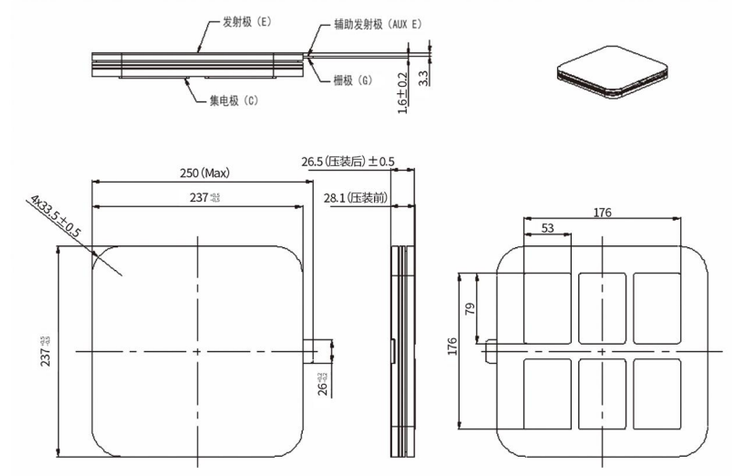
产品图示
PRODUCT DIAGRAM

压接式 IGBT 模块 PRESS-PACK IGBT MODULES

ZF2



ZF3

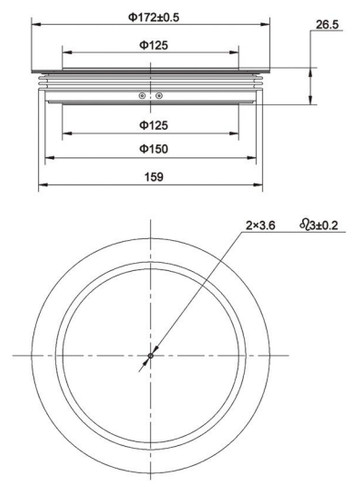


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

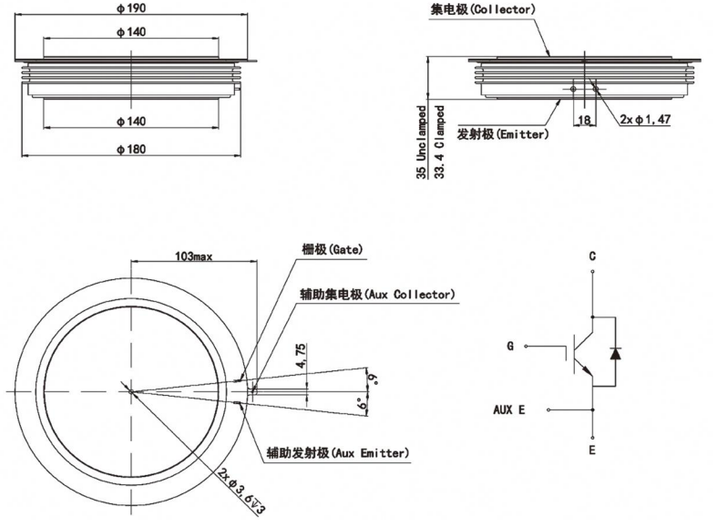
产品图示
PRODUCT DIAGRAM

压接式 IGBT 模块 PRESS-PACK IGBT MODULES

YA



YB



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

中低压 IGBT 模块 MV AND LV IGBT MODULES

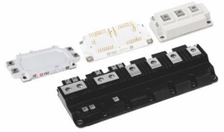
产品介绍
PRODUCT INTRODUCTION

采用中车第七代超精细沟槽芯片，具有高电流密度、低开关损耗、高工作结温等特点。采用Cu基板，选用高性能导热材料，具有散热性能好、高电流密度、高可靠性等特点。该系列产品涵盖电流40A至3600A，电压950V至1700V，具备定制化调整的能力，可根据客户需求调整IGBT安全工作裕量、耗损分配、过载能力等特性，适应各行业应用。产品已批量应用于新能源风电、光伏、储能、变频器、SVG、中频感应加热等领域。

CRRC's 7th Generation fine trench chips are adopted, featuring high current density, low switching loss, and high operating junction temperature. With Cu substrates and high-performance thermal conductive materials, it offers excellent heat dissipation, high current density, and high reliability. Covering a current range of 40A-3600A and voltage range of 950V-1700V, the series supports customization—adjusting IGBT safe operating margin, loss distribution, overload capacity, etc., based on customer needs to adapt to diverse industrial applications. It has been mass-applied in new energy wind power, photovoltaic, energy storage, frequency converters, SVG, medium-frequency induction heating and other fields.

产品特点
CHARACTERISTIC

低导通压降	Low $V_{CE(SAT)}$
低开关损耗	Low Switching Losses
高功率密度	High Power Density
高工作结温	High Operating Junction Temperature



型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C (S 模块为 T_F)			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TIM2400ESM17-TSA000	2400	100	1700	4800	1.75	2840	150	0.0065	ES	190×140×38	AlSiC
TIM3600E2SM17-TSA000	3600	95	1700	7200	1.95	3680	150	0.0075	ES	190×140×38	AlSiC
TIM1600FSM17-PSA011	1600	80	1700	3200	2.3	1800	125	0.009	FS	140×130×38	AlSiC
TIM2400N2SM17-TSA000	2400	95	1700	4800	1.95	2070	150	0.0137	NS	140×130×38	AlSiC
TG1400HF12H1-S300	1400	100	1200	2800	1.8	486	150	0.02	H1	250×89×38	Cu
TG1000HF17H1-S300	1000	100	1700	2000	1.85	980	150	0.02	H1	250×89×38	Cu
TG1400HF17H1-S300	1400	100	1700	2800	1.75	1300	150	0.0166	H1	250×89×38	Cu
TG1800HF17H1-S500	1800	100	1700	3600	2.2	2250	150	0.0165	H1	250×89×38	Cu
TG900HF12H2-S300	900	100	1200	1800	1.8	300	150	0.0295	H2	171.8×89×38	Cu
TG650CP17H2-S300	650	100	1700	1300	1.85	610	150	0.03	H2	171.8×89×38	Cu
TG650PC17H2-S300	650	100	1700	1300	1.85	610	150	0.03	H2	171.8×89×38	Cu
TG650HF17H2-S300	650	95	1700	1300	1.85	610	150	0.03	H2	171.8×89×38	Cu

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C (S 模块为 T_F)			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TG300HF12M1-S300	300	100	1200	600	1.65	98.9	150	0.078	M1	151.8×62×20.8	Cu
TG450HF12M1-S3A00	450	100	1200	900	1.65	91.5	150	0.052	M1	151.8×62×20.8	Cu
TG450HF12M1-S5A00	450	100	1200	900	1.57	122	175	0.0875	M1	151.8×62×20.8	Cu
TG600HF12M1-G3A00	600	100	1200	1200	1.85	115	150	0.049	M1	151.8×62×20.8	Cu
TG600HF12M1-S3A00	600	100	1200	1200	1.7	194	150	0.049	M1	151.8×62×20.8	Cu
TG600HF12M1-S5A00	600	80	1200	1200	1.57	175.1(150℃)	175	0.057	M1	151.8×62×20.8	Cu
TG750HF12M1-S500	750	90	1200	1500	1.6	274(150℃)	175	0.051	M1	151.8×62×20.8	Cu
TG750HF12M1-S501	750	100	1200	1500	1.4	287	175	0.0376	M1	151.8×62×20.8	Cu
TG300HF17M1-S300	300	100	1700	600	1.8	235	150	0.08	M1	151.8×62×20.8	Cu
TG450HF17M1-S300	450	100	1700	900	1.8	381	150	0.055	M1	151.8×62×20.8	Cu
TG450HF17M1-S312	450	100	1700	900	1.8	381	150	0.055	M1	151.8×62×20.8	Cu
TG500HF17M1-S310	500	100	1700	1000	1.85	410	150	0.06	M1	151.8×62×20.8	Cu
TG600HF17M1-S300	600	100	1700	1200	1.8	470	150	0.046	M1	151.8×62×20.8	Cu
TG600HF17M1-S310	600	100	1700	1200	1.7	401	150	0.046	M1	151.8×62×20.8	Cu
TG600HF17M1-S312	600	100	1700	1200	1.7	537	150	0.046	M1	151.8×62×20.8	Cu
TG600CP17M1-S310 Chop	600	100	1700	1200	1.7	401	150	0.046	M1	151.8×62×20.8	Cu
TG600PC17M1-S310 Chop	600	100	1700	1200	1.7	401	150	0.046	M1	151.8×62×20.8	Cu
TG600HF17M1-S500	600	100	1700	1200	1.95	401	175	0.060	M1	151.8×62×20.8	Cu
TG800CP17M1-S500 Chop	800	100	1700	1600	1.95	665	175	0.039	M1	151.8×62×20.8	Cu
TG800PC17M1-S500 Chop	800	100	1700	1600	1.95	665	175	0.039	M1	151.8×62×20.8	Cu
TG800HF17M1-S500	800	100	1700	1600	1.95	665	175	0.039	M1	151.8×62×20.8	Cu
TG800HF17M1-S520	800	100	1700	1600	1.95	665	175	0.039	M1	151.8×62×20.8	Cu
TG800HF17M1-S521	800	100	1700	1600	1.95	665	175	0.056 (RthJF)	M1	151.8×62×20.8	Cu
TG600HF12M1-S5A01	600	100	1200	1200	1.4	224	175	0.0945(JF)	M1_PINFIN	151.8×62×28.15	Cu
TG600HF12M1-S5A01	600	100	1200	1200	1.4	224	175	0.0945(JF)	M1_PINFIN	151.8×62×28.15	Cu
TG600HF17M1-S501	600	55	1200	1200	1.69	516	175	0.082(JF)	M1_PINFIN	151.8×62×28.15	Cu
TG900HF12M1-S5A01	900	80	1200	1800	1.5	327	175	0.075(JF)	M1_PINFIN	151.8×62×28.15	Cu
TG1000HF12M1-S5A11	1000	80	1200	2000	1.6	413	175	0.064(JF)	M1_PINFIN	151.8×62×28.15	Cu
TG450HF12M1-S501	450	80	1700	900	1.45	176.4	175	0.1125(JF)	M1_PINFIN	151.8×62×28.15	Cu
TG35CIB12M2-S500	35	100	1200	70	1.27 (逆变) 1.55 (chop)	9.03 (逆变) 5.80 (chop)	175	0.79 (逆变) 0.98 (chop)	M2	107.5×45×20.5	Cu
TG50CIB12M2-S500	50	100	1200	100	1.35 (逆变) 1.55 (chop)	14.12 (逆变) 5.07 (chop)	175	0.56 (逆变) 0.95 (chop)	M2	107.5×45×20.5	Cu
TG75CIB12M2-S500	75	90	1200	150	1.8 (inversion) 1.6 (chop)	21.81 (inversion) 11.24 (chop)	175	0.475 (inversion) 0.66 (chop)	M2	107.5×45×20.8	Cu
TG75CIB12M2-S501	75	100	1200	150	1.45 (逆变) 1.55 (chop)	20.42 (逆变) 15.37 (chop)	175	0.3 (逆变) 0.6 (chop)	M2	107.5×45×20.5	Cu
TG100CIB12M2-S500	100	95	1200	200	1.50 (逆变) 1.50 (chop)	29.9 (逆变) 14.58 (chop)	175	0.37 (逆变) 0.6 (chop)	M2	107.5×45×20.5	Cu

中低压 IGBT 模块 MV AND LV IGBT MODULES

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	$R_{thJC\ IGBT}$	封装外形 Assembly Outline		
	A	@T_C (S 模块为T_F)			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TG75CIB12M3-S500	75	100	1200	150	1.60 (逆变) 1.25 (chop)	17.54 (逆变) 10.21 (chop)	175	0.44 (逆变) 0.6 (chop)	M3	122×62×21.05	Cu
TG100CIB12M3-S500	100	100	1200	200	1.40 (逆变) 1.50 (chop)	25.47 (逆变) 8.40 (chop)	175	0.33 (逆变) 0.6 (chop)	M3	122×62×21.05	Cu
TG150CIB12M3-S500	150	100	1200	300	1.35 (逆变) 1.40 (chop)	37.07 (逆变) 20.68 (chop)	175	0.27 (逆变) 0.32 (chop)	M3	122×62×21.05	Cu
TG200CIB12M3-S500	200	100	1200	400	1.30 (逆变) 1.40 (chop)	40.84 (逆变) 28.62 (chop)	175	0.20 (逆变) 0.26 (chop)	M3	122×62×21.05	Cu
TG10CIB12U1-S500	10	100	1200	20	1.55 (逆变) 1.55 (chop)	1.85 (逆变) 1.97 (chop)	175	2.09 (逆变) 2.05 (chop)	U1	62.8×33.8×15.5	/
TG15CIB12U1-S500	15	110	1200	30	1.55 (逆变) 1.55 (chop)	2.55 (逆变) 2.82 (chop)	175	1.74 (逆变) 1.86 (chop)	U1	62.8×33.8×15.5	/
TG25CIB12U1-S500	25	60	1200	50	1.60 (逆变) 1.60 (chop)	5.50 (逆变) 5.95 (chop)	175	1.55 (逆变) 1.55 (chop)	U1	62.8×33.8×15.5	/
TG25CIB12U2-S500	25	100	1200	50	1.55 (逆变) 1.55 (chop)	5.09 (逆变) 5.80 (chop)	175	1.25 (逆变) 1.25 (chop)	U2	62.8×56.8×15.5	/
TG35CIB12U2-S500	35	100	1200	70	1.55 (逆变) 1.55 (chop)	7 (逆变) 7.56 (chop)	175	1.15 (逆变) 1.24 (chop)	U2	62.8×56.8×15.5	/
TG50CIB12U2-S500	50	75	1200	100	1.50 (逆变) 1.60 (chop)	11.84 (逆变) 7.89 (chop)	175	0.91 (逆变) 1.09 (chop)	U2	62.8×56.8×15.5	/
TH200D3B10U4-S500	100	/	950	200	1.23	1.21	150	0.428	U4	112×62×16.4	Cu
TH200F3B10U4-S500	200	65	950	400	1.4	4.15	150	0.2048	U4	112×62×16.4	Cu
TH200F3B10U4B-S500	200	65	950	400	1.4	4.15	150	0.2048	U4	112×62×16.4	Cu
TH200F4B10U4-S500	200	65	950	400	1.4	4.15	150	0.22	U4	112×62×16.4	Cu
TH400AN10U4-S500	400	/	950	800	1.28(T1\T4) 1.05(T2\T3) 1.6(T5\T6)	12.1(T1\T4) 24.3(T2\T3) 16.9(T5\T6)	150	0.15(T1\T4\ T2\T3) 0.2847(T5\T6)	U4	112×62×16.4	CU
TG600NP10U4-S500	600	50	950	1200	1.4	29.9	150	0.0882	U4	112×62×16.4	Cu
TG650NP10U4B-S501	650	50	950	1300	1.4	29.9	150	0.0882	U4	112×62×16.4	Cu
TG600NP10U4B-S500	600	50	1000	1200	1.4	29.9	150	0.0882	U4	112×62×16.4	Cu
TG450NP11U4-S500	450	100	1100	900	1.58@250A	43.31	150	0.076	U4	112×62×16.4	Cu
TG450NP11U4-S501	450	100	1100	900	1.58@250A	43.31	150	0.076	U4	112×62×16.4	Cu
TG300HF12W1-S300	300	100	1200	600	1.75	104.75	150	0.093	W1	106.4×61.4×30.9	Cu
TG450HF12W1-S400	450	100	1200	900	1.77	164.23	150	0.058	W1	106.4×61.4×30.9	Cu
TG600HF12W1-G300	600	100	1200	1200	1.75	209.5	150	0.0485	W1	106.4×61.4×30.9	Cu
TG600DW12W1-S300	600	100	1200	1200	1.75	141.5	150	0.0485	W1	106.4×61.4×30.9	Cu
TG800HF12W1-S400	800	100	1200	1600	1.5	298.6	150	0.0485	W1	106.4×61.4×30.9	Cu
TG800HF12W1-S500	800	90	1200	1600	1.4	224	175	0.0485	W1	106.4×61.4×30.9	Cu
TG800HF12W1-S501	800	100	1200	1600	1.4	277	175	0.0441	W1	106.4×61.4×30.9	Cu
TG800HF12W1-S520	800	90	1200	1600	1.4	321	175	0.0489	W1	106.4×61.4×30.9	Cu
TG1300HF23X2-S500	1300	90	2300	2600	1.6	2419	150	0.0117	X2	144×99.8×40	Cu

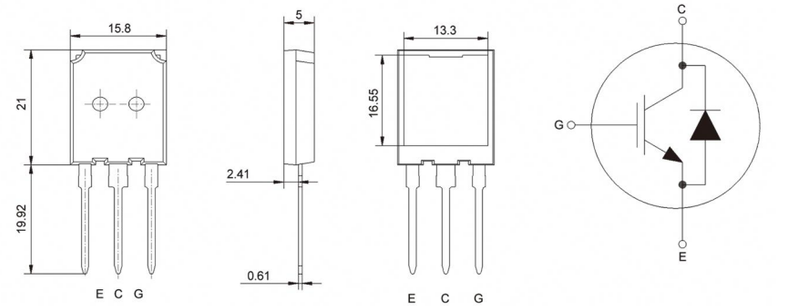
TO Si 器件 TO Si POWER DEVICES

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	R_{thJC}	封装外形 Assembly Outline		
	A	@T_C			@I_C &T_C=25℃	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TG140S12B2A-504B	190	100	1200	280	1.5	16.7	175	0.115	B2	41.2×15.9×5.1	/
TG100S12B2A-514B	126	100	1200	300	1.65	18.94	175	0.13	B2	41.2×15.9×5.1	/

产品图示 PRODUCT DIAGRAM

中低压 IGBT 模块 MV AND LV IGBT MODULES

B2



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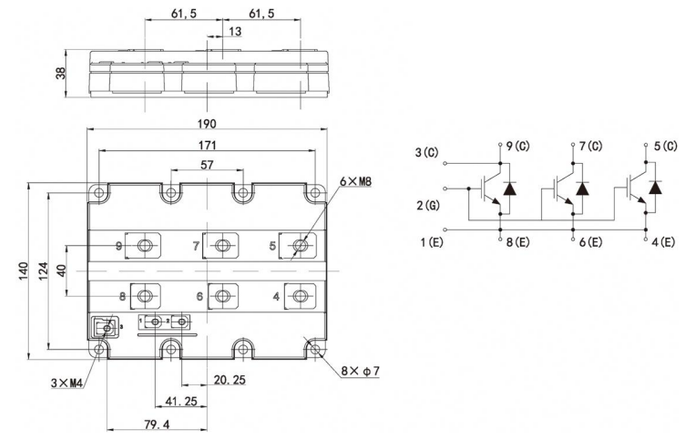

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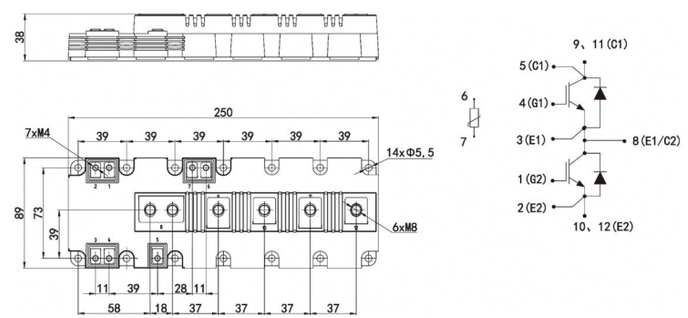
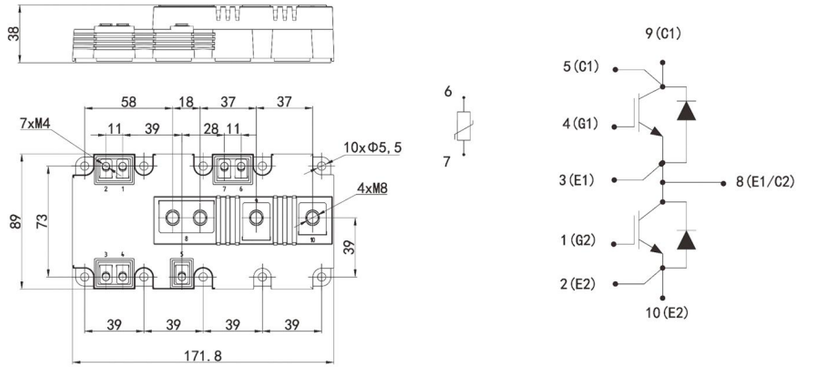


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

中低压 IGBT 模块 MV AND LV IGBT MODULES

H2



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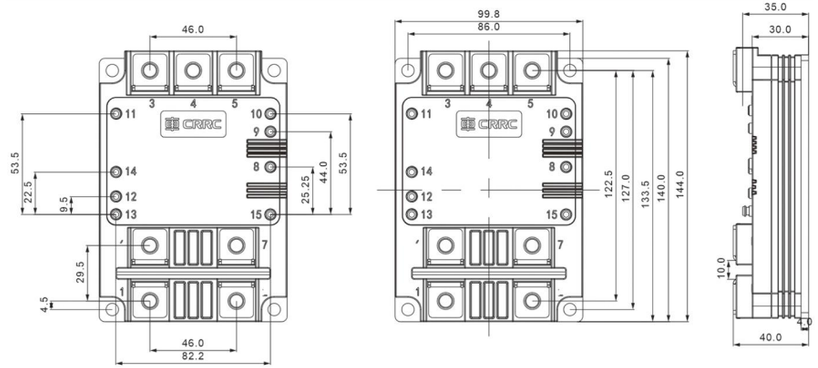

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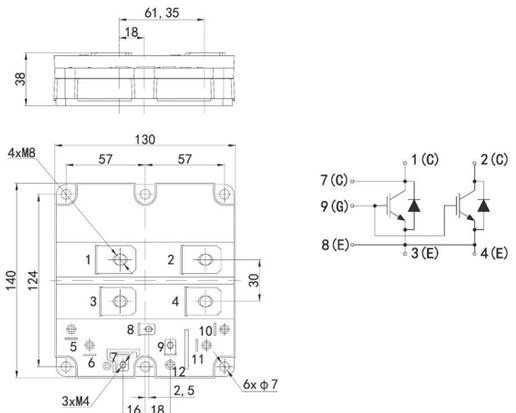
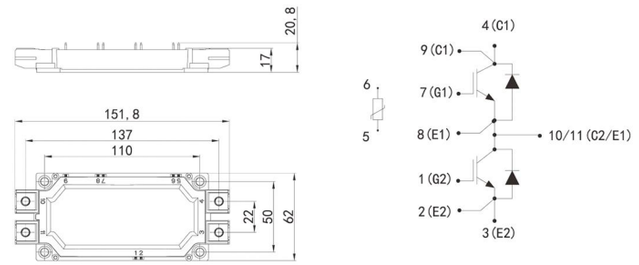


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

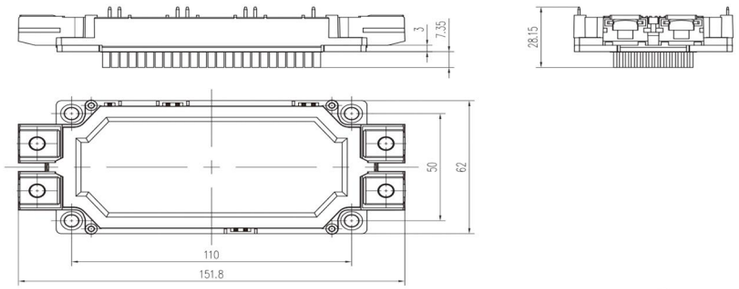
产品图示
PRODUCT DIAGRAM

中低压 IGBT 模块 MV AND LV IGBT MODULES

M1



M1-PINFIN



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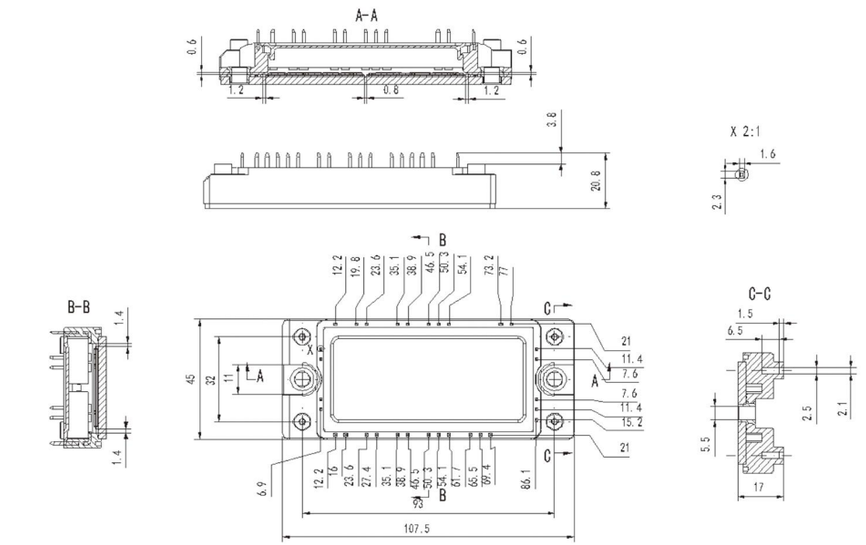
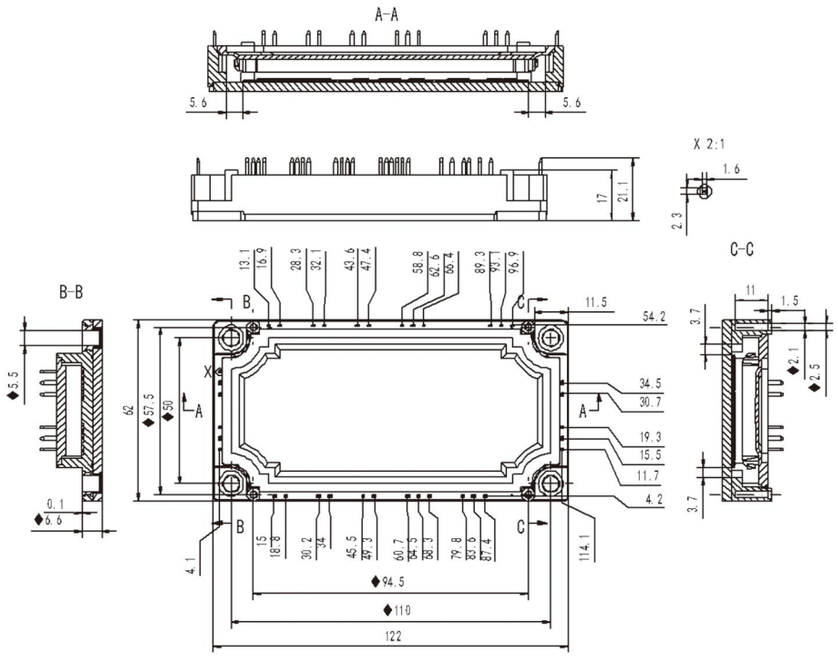


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

中低压 IGBT 模块 MV AND LV IGBT MODULES

M3



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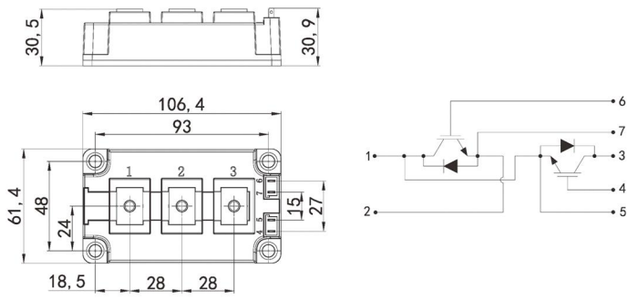

注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

中低压 IGBT 模块 MV AND LV IGBT MODULES

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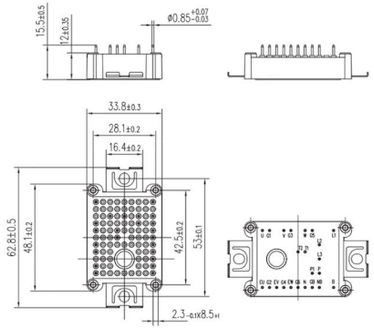

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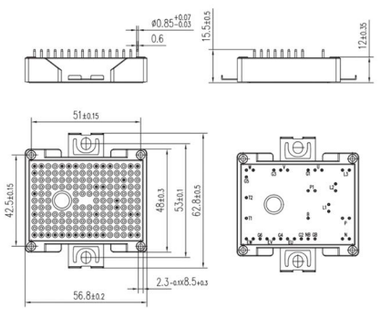

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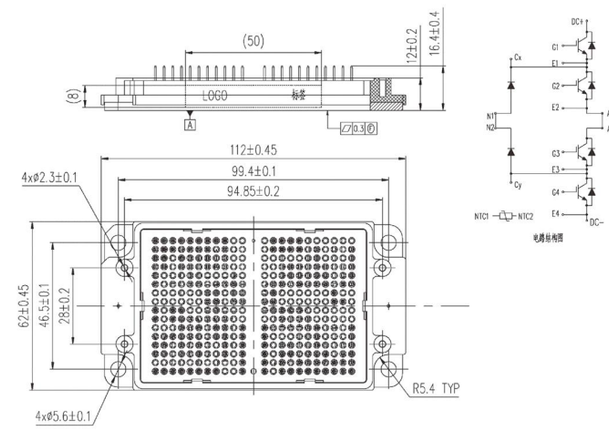


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

FRD 模块 FRD MODULES

产品介绍
PRODUCT INTRODUCTION

采用中车第六代注入效率控制 FRD，具有低导通损耗，软恢复特性，正温度系数，高工作结温等特点。该系列产品具备足够安全工作裕量和高可靠性，涵盖 1200V 至 6500V 电压范围，批量应用于轨道交通和工业领域。

CRRC's 6th Generation injection efficiency-controlled FRD is adopted, featuring low on-state loss, soft recovery characteristics, positive temperature coefficient, and high operating junction temperature. With sufficient safe operating margin and high reliability, the series covers a voltage range of 1200V-6500V and has been mass-applied in rail transit and industrial fields.

产品特点
CHARACTERISTIC

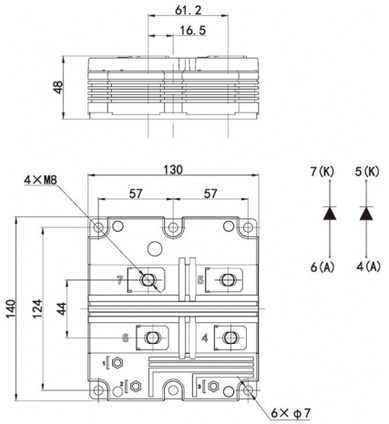
- 高电流密度 High Current Density
- 高热循环能力 High Thermal Cycling Capability
- 高浪涌能力 High I^2t Capability
- 高工作结温 High Operating Junction Temperature

型号 Type	I_C		V_{CES}	I_{CRM}	V_F	E_{SW}	T_{VJM}	$R_{thJC\ FRD}$	封装外形 Assembly Outline		
	A	@T_C			@I_C &T_C=25℃				代码 Code	尺寸 Dimensions	基板材料 Base Material
		℃	V	A	V	mJ	℃	K/W	/	mm	/
TFM3600E2SM17-D200	3600	95	1700	7200	1.85	1240 (E_{rec})	150	0.0095	ES	190×140×38	AlSiC
TF1500SF33K1-D200	1500	/	3300	3000	2.25	2200 (E_{rec})	150	0.0145	K1	130×90×38	AlSiC
TFM1500NDM33-D200	1500	/	3300	3000	2.4	2600 (E_{rec})	150	0.015	ND	140×130×38	AlSiC
TFM1000N2DM33-D200	1000	95	3300	2000	2.15	1800 (E_{rec})	150	0.021	ND	140×130×38	AlSiC
TFM400P2DM65-D200	400	/	6500	800	2.8	1723 (E_{rec})	125	0.037	P2	140×73×48	AlSiC
TF100HF12T1-D300	100	/	1200	200	1.6	/	150	0.28	T1	94×35×30	Cu
TFM750XDM65-D200	750	80	6500	1500	2.70	3300(E_{rec})	125	0.018	XD	140×130×48	AlSiC
TFM1500XDM45-D200	1500	/	4500	3000	2.55	5300(E_{rec})	150	0.016	XD	140×130×48	AlSiC
TFM1200XDM45-D200	1200	/	4500	2400	2.7	3900 (E_{rec})	125	0.016	XD	140×130×48	AlSiC

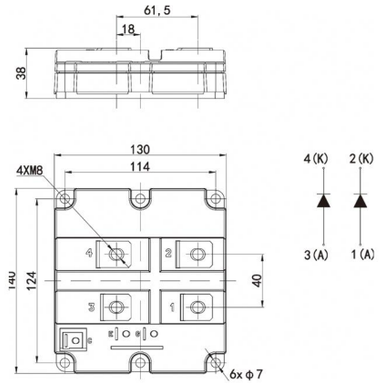
产品图示
PRODUCT DIAGRAM

FRD 模块 FRD MODULES

XD



ND



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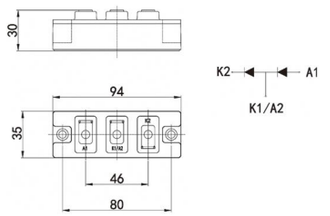

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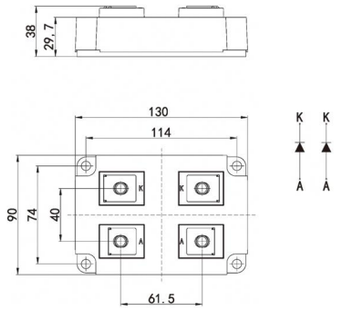

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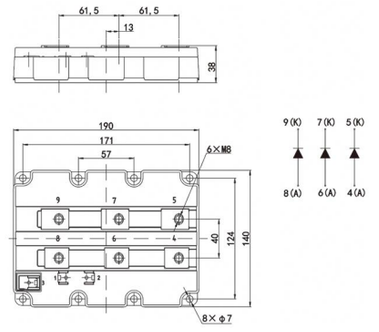

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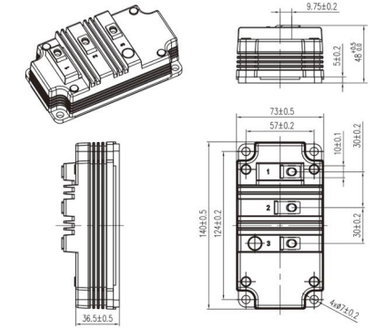
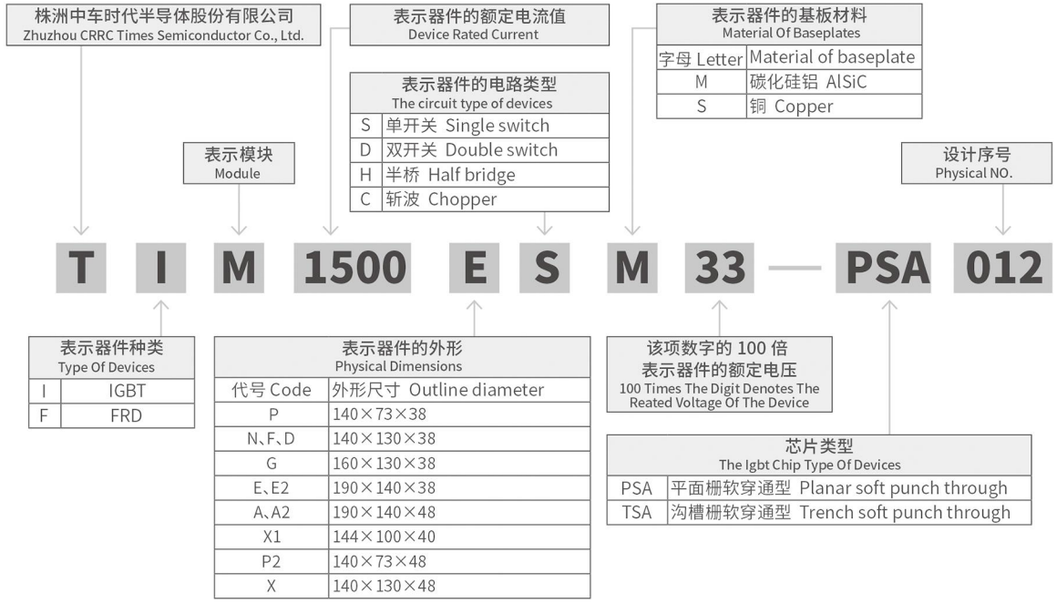


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

型号说明
NOMENCLATURE

高压 IGBT 模块 HV IGBT MODULES

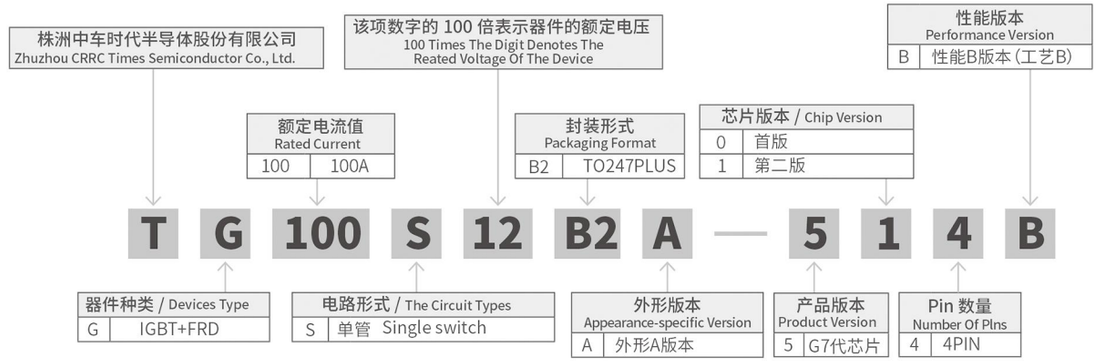


型号说明
NOMENCLATURE

中低压及压接式 IGBT 模块 MV&LV AND PRESS-PACK IGBT MODULES

型号说明
NOMENCLATURE

TO Si 器件 TO Si POWER DEVICES



符号说明
SYMBOLS

绝缘栅双极晶体管 INSULATED GATE BIPOLAR TRANSISTOR

符号 Symbols	参数名称	Characteristics
V_{CES}	集电极 - 发射极电压	Collector-emitter voltage
V_{GES}	栅极 - 发射极电压	Gate-emitter voltage
I_C	集电极直流电流	DC collector current
I_{CRM}	集电极重复峰值电流	Peak collector current
P_{tot}	总耗散功率	Total power dissipation
V_{isol}	绝缘电压	Isolation voltage
Q_{PD}	局部放电	Partial discharge
$R_{thJC\ IGBT}$	IGBT 结壳热阻	IGBT thermal resistance junction to case
$R_{thJC\ Diode}$	二极管结壳热阻	Diode thermal resistance junction to case
R_{thCH}	接触热阻	IGBT thermal resistance case to heatsink
T_{VJM}	最高 (等效) 结温	Max. (Virtual) junction temperature
T_{stg}	存储温度	Storage temperature
M	安装力矩	Mounting torque
I_{CES}	集电极截止电流	Collector cut-off current
I_{GES}	栅极漏电流	Gate leakage current
$V_{GE(TH)}$	栅极 - 发射极阈值电压	Gate-Emitter threshold voltage
$V_{CE(SAT)}$	集电极 - 发射极饱和电压	Collector-Emitter saturation voltage
I_F	二极管正向直流电流	Diode DC forward current
I_{FRM}	二极管正向重复峰值电流	Diode Peak forward current
V_F	二极管正向电压	Diode Forward voltage
C_{ies}	输入电容	Input capacitance
Q_g	栅极电荷	Gate charge
C_{res}	反向传输电容	Reverse transfer capacitance
I_{SC}	短路电流	Short circuit current
$t_{d(off)}$	关断延迟时间	Turn-off delay time
t_f	下降时间	Falling time
E_{OFF}	关断能量	Turn off energy
$t_{d(on)}$	开通延迟时间	Turn-on delay time
t_r	上升时间	Rising time
E_{ON}	开通能量	Turn on energy
Q_{rr}	二极管反向恢复电荷	Diode Reverse recovery charge
I_{rr}	二极管反向恢复电流	Diode Reverse recovery current
E_{rec}	二极管反向恢复损耗	Diode Reverse recovery energy
E_{sw}	IGBT 总开关损耗	IGBT total switching energy (E_{on}+E_{off})

03

第三章
CHAPTER THREE

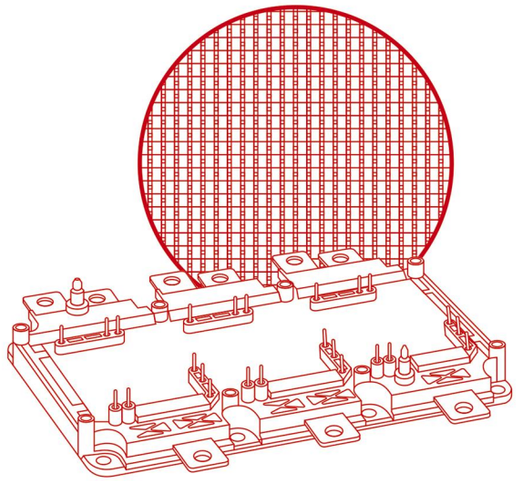
SiC芯片及模块

SiC CHIPS & MODULES

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

SiC CHIPS & MODULES

SiC芯片及模块



SiC SBD 芯片 SiC SBD CHIPS

产品介绍 PRODUCT INTRODUCTION

中车第 3 代中低压 SiC SBD 芯片,具有高浪涌能力等特点,适用于光伏领域;
中车第 2 代高压 SiC SBD 芯片芯片具有正温度系数高耐压等特点适用于轨道交通电网领域。

CRRC's 3rd Generation medium-low voltage SiC SBD chips feature high surge current capability, suitable for the photovoltaic sector.

The 2nd-gen high-voltage SiC SBD chips boast positive temperature coefficient and high withstand voltage, applicable to rail transit and power grid fields.

产品特点 CHARACTERISTIC

软恢复	Soft & Fast Switching
正温度系数	Positive Temperature Coefficient
易并联	Easy Paralleling
高工作结温	T_{vjmax}=175°C

中低压 SiC SBD 芯片 MV and LV SiC SBD Chips

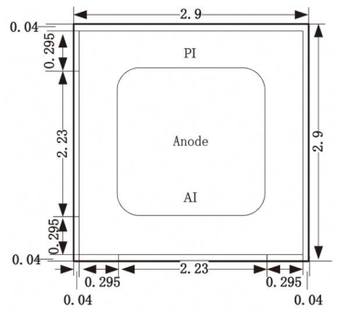
型号 Type	V_{DC}	V_{RRM}	$I_{F(AVG)}$	T_J	T_{stg}	V_F		I_R
						T_J=25°C	T_J=150°C	T_J=150°C
	V	V	A	°C	°C	V		μA
TS120PLS22C2	1200	1200	10	-40 ~ +175	-40 ~ +150	1.40	1.75	10
TS120PLS22C3	1200	1200	15	-40 ~ +175	-40 ~ +150	1.40	1.75	10
TS120PLS22C1	1200	1200	20	-40 ~ +175	-40 ~ +150	1.40	1.75	10
TS120PLS44C1	1200	1200	50	-40 ~ +175	-40 ~ +150	1.40	1.75	10

高压 SiC SBD 芯片 HV SiC SBD Chips

型号 Type	V_{DC}	V_{RRM}	$I_{F(AVG)}$	T_J	T_{stg}	V_F		I_R
						T_J=25°C	T_J=150°C	T_J=150°C
	V	V	A	°C	°C	V		μA
TS330PLS87A1	3300	3300	47	-40 ~ +150	-40 ~ +150	2.00	4.00	10

产品图示 PRODUCT DIAGRAM

TS120PLS22C1



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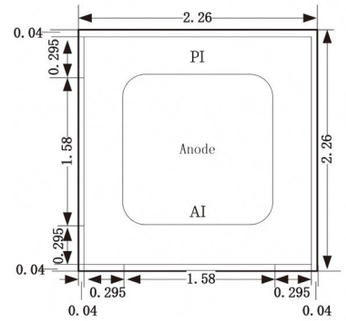

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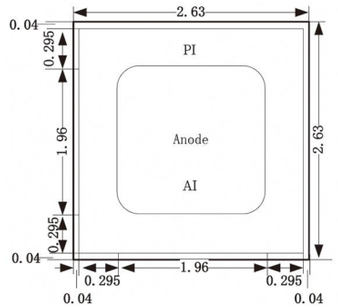

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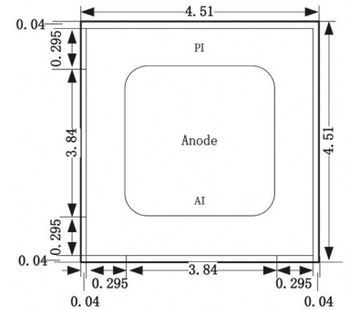

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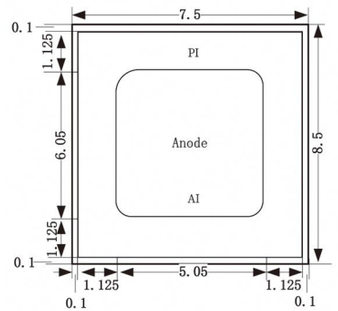


长度单位:毫米
Unit: mm

SiC MOSFET 芯片 SiC MOSFET CHIPS

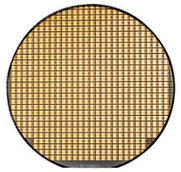
产品介绍
PRODUCT INTRODUCTION

中车第3代中低压 SiC MOSFET 芯片，采用精细平面栅结构，高可靠性栅极氧化技术、载流子扩展技术以及衬底减薄技术；中车第2代高压 SiC MOSFET 芯片，采用平面栅结构，高耐压终端技术，芯片内置栅电阻；芯片具有低开关损耗，高工作频率的特点。

CRRC's 3rd-gen medium-low voltage SiC MOSFET chips: fine planar gate structure, high-reliability gate oxidation, carrier expansion, and substrate thinning technologies. 2nd-gen high-voltage SiC MOSFET chips: planar gate structure, high-voltage termination technology, built-in gate resistor. Both feature low switching loss and high operating frequency.

产品特点
CHARACTERISTIC

- 高系统效率 High System Efficiency
- 更高的工作频率 Higher Operating Frequency
- 低开关损耗 Low Switching Losse



高压 SiC MOSFET 芯片 HV SiC MOSFET Chips

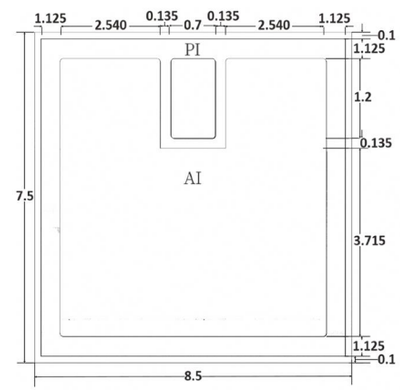
型号 Type	$V_{(BR)DSS}$	I_D	T_J	T_{stg}	$V_{GS(th)}$		$R_{DS(on)}$ @ V_{GS} =15V		I_{DSS}
					T_J =25°C	T_J =175°C	T_J =25°C	T_J =175°C	T_J =175°C
	V	A	°C	°C	V		mΩ		μA
TM330PES87B3	3300V	62.5	-40 ~ +175	-40 ~ +175	5.8	5.1	32	64	100

中低压 SiC MOSFET 芯片 MV and LV SiC MOSFET Chips

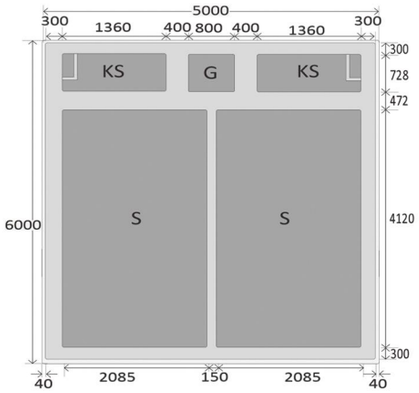
型号 Type	$V_{(BR)DSS}$	I_D	T_J	T_{stg}	$V_{GS(th)}$		$R_{DS(on)}$ @ V_{GS} =18V		I_{DSS}
					T_J =25°C	T_J =175°C	T_J =25°C	T_J =175°C	T_J =175°C
	V	A	°C	°C	V		mΩ		μA
TM120PES22C0	1200V	30	-40 ~ +175	-40 ~ +175	3.3	2.0	77	139	<20
TM120PES33C0	1200V	63	-40 ~ +175	-40 ~ +175	3.0	2.0	36	65	<20
TM120PES44C0	1200V	96	-40 ~ +175	-40 ~ +175	2.7	2.0	25	44	<20
TM120PES55B3	1200V	125	-40 ~ +175	-40 ~ +175	2.8	2.2	16	24	<20
TM120PEU55C3	1200V	130	-40 ~ +175	-40 ~ +175	2.8	2.2	13	20	<20
TM120PEU56B0	1200V	155	-40 ~ +175	-40 ~ +175	2.8	2.2	13	20	<20
TM075PEU65B0	750V	175	-40 ~ +175	-40 ~ +175	3.0	2.2	10	11.2	<20
TM075PEU05B0	750V	180	-40 ~ +175	-40 ~ +175	5.0	/	6	12	10

产品图示
PRODUCT DIAGRAM

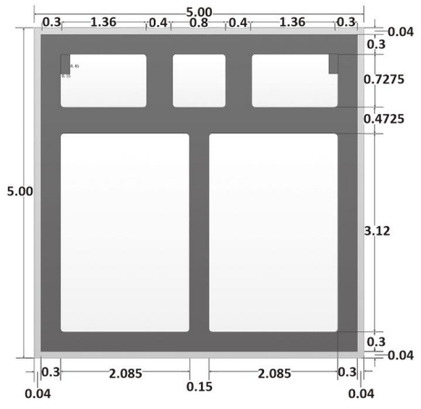
TM330PES87A2



TM075PEU05B0/ TM075PEU65B0



TM120PES55B3



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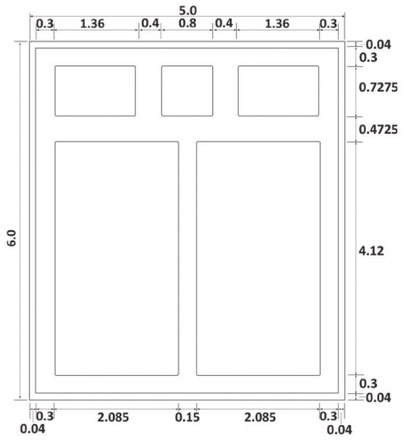
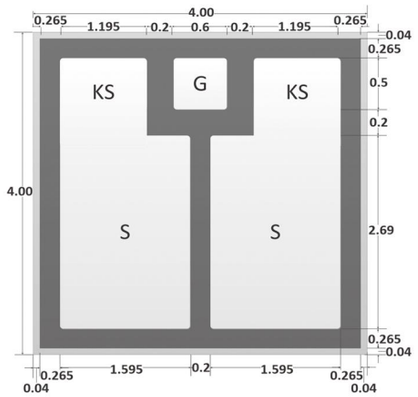


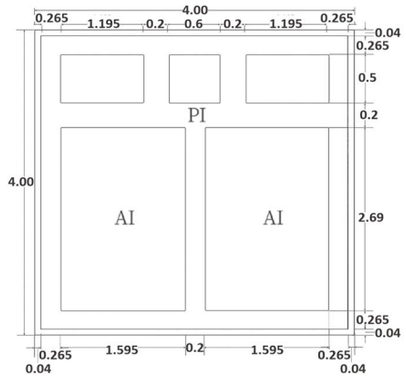
长度单位：毫米
Unit: mm

产品图示
PRODUCT DIAGRAM

TM120PEU55C3



TM120PES44C0



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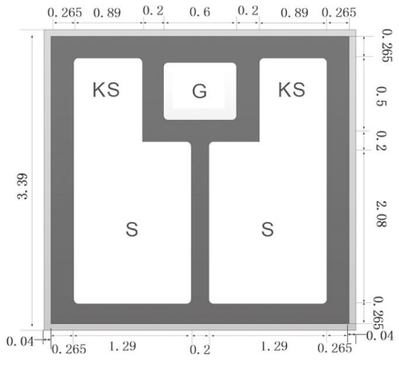
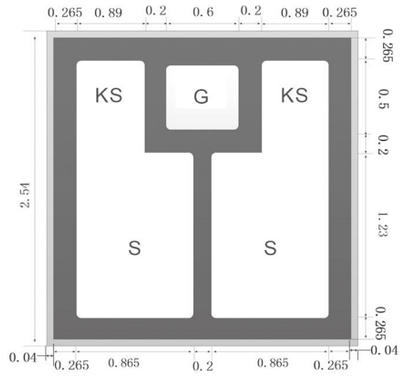


TM120PES22C0



长度单位：毫米
Unit: mm

SiC 模块 SiC MODULES

产品介绍
PRODUCT INTRODUCTION

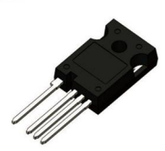
中车 SiC 模块采用中车第二代精细平面栅 SiC MOSFET，具有低开关损耗，高工作结温，低导通电阻等特点，配合银烧结、铜线键合等先进互连封装工艺，产品具备足够的鲁棒性。涵盖 750V 至 3300V 电压范围，适用于电动汽车及轨道交通领域。

CRRC's SiC modules adopt its 2nd Generation fine planar gate SiC MOSFETs, featuring ultra-low switching losses, high operating junction temperature, and low on-resistance. Combined with advanced interconnection packaging technologies such as silver sintering and copper wire bonding, the products offer sufficient robustness. Covering a voltage range of 750V-3300V, they are suitable for electric vehicles and rail transit fields.

产品特点
CHARACTERISTIC

无反向恢复损耗	No Reverse Recovery Loss
低开关损耗	Low Switching Losses
高功率密度	High Power Density
高工作结温	High Operating Junction Temperature
低杂散电感	Low Stray Inductance





混合 SiC 功率模块 HYBRID SiC POWER MODULES

型号 Type	I_C		V_{CES}	I_{CRM}	$V_{CE(SAT)}$	E_{SW}	T_{VJM}	R_{thJC}	封装外形 Assembly Outline		
	A	@T_C			@ I_C &T_C=25°C	@T_{VJM}			代码 Code	尺寸 Dimensions	基板材料 Base Material
		°C	V	A	V	mJ	°C	K/W	/	mm	/
THM1600FSM17-PSA011	1600	85	1700	3200	2.5	960	125	0.009	FS	140×130×38	AlSiC
THM500GDM33-PSA011	500	85	3300	1000	2.1	1900	150	0.021	GD	160×130×38	AlSiC
THM1500ESM33-PSA012	1500	95	3300	3000	2	6035	150	0.008	ES	190×140×38	AlSiC

全 SiC 模块 FULL SiC POWER MODULES

型号 Type	I_D		V_{DSS}	I_{DRM}	$V_{DS(on)}$ @ I_D &T_C=25°C	E_{SW} @T_{VJM}	T_{VJM}	R_{thJC}	封装外形 Assembly Outline		
	A	@T_C							代码 Code	尺寸 Dimensions	基板材料 Base Material
		°C	V	A	V	mJ	°C	K/W	/	mm	TO
TM840HF12L5-F3A01	840	65	1200	1680	1.30	104	175	0.077(JF)	L5	110×63×25.5	Cu
TM700FF08S3-F3A02	700	65	750	1400	1.16	60	175	0.1(JF)	S3	154.5×126.5×32	Cu
TM700FF08S3-F4A02	700	65	750	1400	0.88	57	175	0.105(JF)	S3	154.5×126.5×32	Cu
TM400FF12S3-F3A22	400	65	1200	800	1.30	48	175	0.147(JF)	S3	154.5×126.5×32	Cu
TM400FF12S3-F4A02	400	65	1200	800	1.05	46	175	0.147(JF)	S3	154.5×126.5×32	Cu
TM400FF12S3P-F3A02	400	65	1200	800	1.30	52	175	0.131(JF)	S3	154.5×126.5×32	Cu
TM400FF12S3P-F3A32	400	65	1200	800	1.30	48	175	0.131(JF	S3	154.5×126.5×32	Cu
TM540FF12S3P-F3A02	540	65	1200	1080	1.17	75	175	0.113(JF)	S3	154.5×126.5×32	Cu
TM500FF08S7P-F3A02	500	65	750	1000	1.33	47	175	0.136(JF)	S7	143.5×116.8×25.7	Cu
TM500FF08S7PL-F3A32	500	65	750	1000	1.33	42	175	0.136(JF)	S7	143.5×132.8×25.7	Cu
TM700FF08S7-F3A05	700	65	750	1400	1.16	45	175	0.095(JF)	S7	143.5×114.1×25.7	Cu
TM400FF12S7-F3A02	400	65	1200	800	1.30	72	175	0.136(JF)	S7	143.5×116.8×25.7	Cu
TM400FF12S7L-F3A02	400	65	1200	800	1.30	72	175	0.136(JF)	S7	143.5×132.8×25.7	Cu
TM400FF12S7PL-F3A32	400	65	1200	800	1.30	65	175	0.136(JF)	S7	143.5×132.8×25.7	Cu
TM540FF12S7-F3A05	540	65	1200	1080	1.17	73	175	0.113(JF)	S7	143.5×114.1×25.7	Cu
TM540FF12S7P-F3A02	540	65	1200	1080	1.17	93	175	0.113(JF)	S7	143.5×116.8×25.7	Cu
TM1000HF33X2-F200	1000	90	3300	2000	1.80	800	175	0.024	X2	144×100×40	AlSiC

TO SiC 二极管器件 TO SiC SBD DEVICE

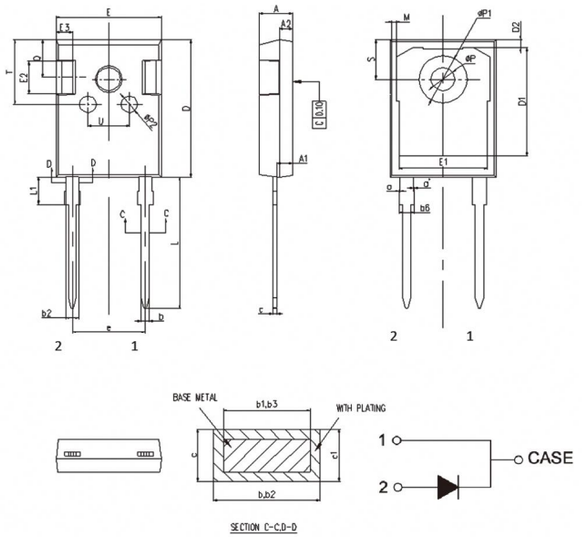
型号 Type	I_F		V_R	I_{FRM}	V_F @ I_F &T_C=25°C	E_{SW} @T_{VJM}	T_{VJM}	R_{thJC}	封装外形 Assembly Outline		
	A	@T_C							代码 Code	尺寸 Dimensions	封装类型 Package Type
		°C	V	A	V	mJ	°C	K/W	/	mm	TO
TS30D12B1A-313B	15/30	25	1200	60/120	1.4	/	175	0.72/0.36	B1	40.9×15.8×5.0	TO247-3
TS20S12B1A-302B	20	25	1200	80	1.4	/	175	0.62	B1	40.9×15.8×5.0	TO247-2
TS40D12B1A-313B	20/40	25	1200	80/160	1.4	/	175	0.62/0.31	B1	40.9×15.8×5.0	TO247-3
TS30S12B1A-312B	30	25	1200	120	1.37	/	175	0.36	B1	40.9×15.8×5.0	TO247-2
TS50S12B1A-302B	50	25	1200	200	1.4	/	175	0.238	B1	40.9×15.8×5.0	TO247-2
TS100S12B1A-312B	100	25	1200	400	1.45	/	175	0.134	B1	40.9×15.8×5.0	TO247-2

TO SiC MOSFET 器件 TO SiC MOSFET DEVICE

型号 Type	I_D		V_{DSS}	I_{DRM}	$R_{DS(on)}$ @ I_D &T_C=25°C	E_{SW} @T_{VJM}	T_{VJM}	R_{thJC}	封装外形 Assembly Outline		
	A	@T_C							代码 Code	尺寸 Dimensions	封装类型 Package Type
		°C	V	A	mΩ	mJ	°C	K/W	/	mm	TO
TM80S12B1B-304B	30	25	1200	60	77	0.52	175	0.723	B1	40.9×15.8×5.0	TO247-4
TM40S12B1A-303B	62	25	1200	124	34	1.03	175	0.47	B1	40.9×15.8×5.0	TO247-3
TM40S12B1B-304B	62	25	1200	124	35	0.75	175	0.47	B1	40.9×15.8×5.0	TO247-4
TM40S12B1C-304B	62	25	1200	124	35	0.75	175	0.47	B1	40.9×15.8×5.0	TO247-4(NL)
TM25S12B1A-303B	82	25	1200	164	25	2.03	175	0.34	B1	40.9×15.8×5.0	TO247-3
TM25S12B1B-304B	82	25	1200	164	25	1.54	175	0.34	B1	40.9×15.8×5.0	TO247-4
TM25S12B1C-304B	82	25	1200	164	25	1.54	175	0.34	B1	40.9×15.8×5.0	TO247-4(NL)
TM16S12B1B-304B	140	25	1200	280	16	2.42	175	0.24	B1	40.9×15.8×5.0	TO247-4
TM80S12B3A-307A	30	25	1200	60	77	0.43	175	0.863	B3	15×10.2×4.4	TO263-7
TM40S12B3A-307A	62	25	1200	124	36	0.82	175	0.489	B3	15×10.2×4.4	TO263-7
TM25S12B3A-307A	82	25	1200	164	25	1.63	175	0.34	B3	15×10.2×4.4	TO263-7

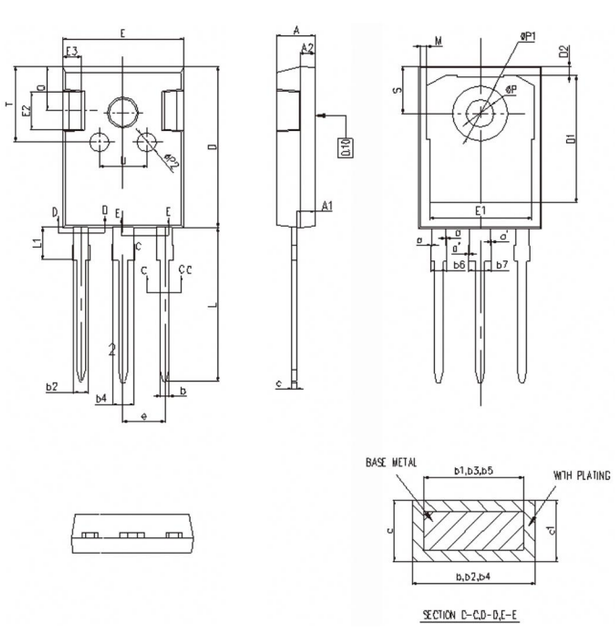
产品图示 PRODUCT DIAGRAM

B1 TO247-2



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
a	0	-	0.15
a'	0	-	0.15
b	1.11	-	1.36
b1	1.15	1.20	1.25
b2	1.91	-	2.21
b3	1.95	2.00	2.02
b6	-	-	2.25
c	0.51	-	0.75
c1	0.58	0.60	0.62
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	10.78	10.88	10.98
L	19.62	19.92	20.22
L1	3.93	-	4.46
M	0.35	-	0.95
P	3.40	3.60	3.80
P1	7.00	-	7.40
P2	2.40	2.50	2.60
Q	5.60	-	6.00
S	6.05	6.15	6.25
T	9.80	-	10.20
U	6.00	-	6.40

B1 TO247-3

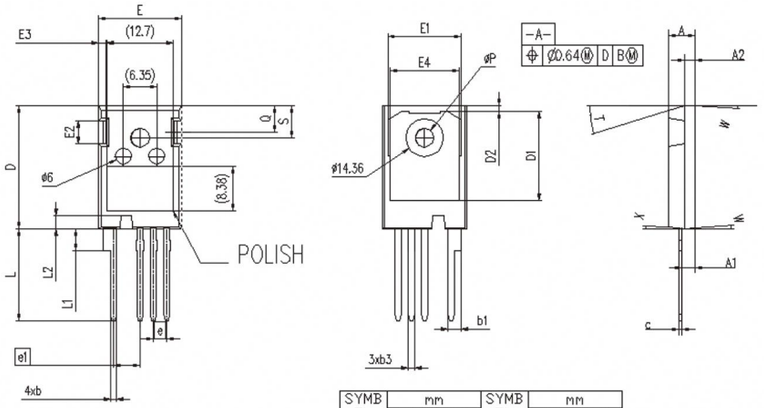


SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
a	0	-	0.15
a'	0	-	0.15
b	1.11	-	1.36
b1	1.15	1.20	1.25
b2	1.91	-	2.21
b3	1.95	2.00	2.02
b4	2.96	-	3.06
b5	2.95	3.00	3.02
b6	-	-	2.25
b7	-	-	3.25
c	0.51	-	0.75
c1	0.58	0.60	0.62
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.34	5.44	5.54
L	19.62	19.92	20.22
L1	3.93	-	4.46
M	0.35	-	0.95
P	3.40	3.60	3.80
P1	7.00	-	7.40
P2	2.40	2.50	2.60
Q	5.60	-	6.00
S	6.05	6.15	6.25
T	9.80	-	10.20
U	6.00	-	6.40

注:未标注数量单位的统一为毫米(mm)
Remarks: All dimensions shown in mm unless stated otherwise

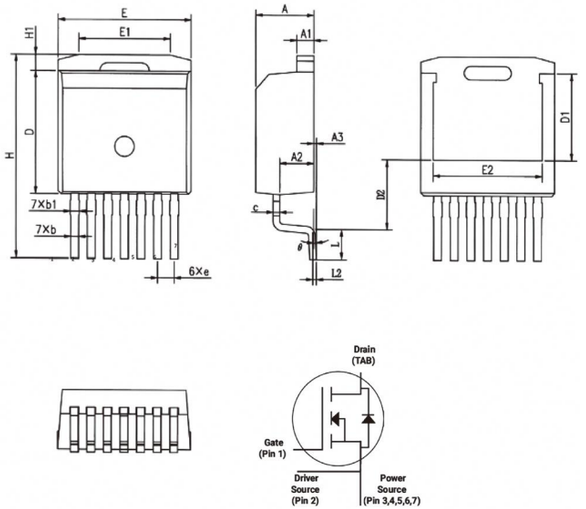
产品图示
PRODUCT DIAGRAM

B1 TO247-4



SYMB OL	mm		SYMB OL	mm	
	MIN	MAX		MIN	MAX
A	4.83	5.21	E3	1	1.9
A1	2.29	2.54	E4	12.38	13.43
A2	1.91	2.16	L	17.31	17.82
b	1.07	1.33	L1	3.97	4.37
b1	2.39	2.94	L2	2.35	2.65
b3	1.07	1.6	Q	5.49	6
b5	2.39	2.69	S	6.04	6.3
c	0.55	0.68	ΦP	3.51	3.65
D	23.3	23.6	e	2.54BSC	
D1	16.25	17.65	e1	5.08BSC	
D2	0.95	1.25	T	17.5° REF	
E	15.75	16.13	W	3.5° REF	
E1	13.1	14.15	X	4° REF	
E2	3.68	5.1			

B3 TO263-7



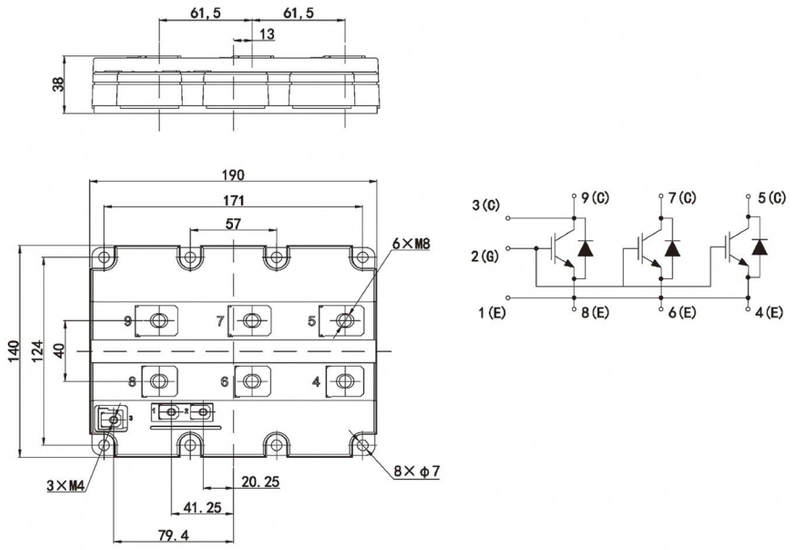
COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.30	4.43	4.56
A1	1.20	1.30	1.40
A2	2.45	2.60	2.75
A3	0.00	0.13	0.25
b	0.50	0.60	0.70
b1	0.60	0.70	0.90
c	0.45	0.50	0.60
D	8.93	9.08	9.23
D1	6.30	6.45	6.60
D2		5.18 REF	
e		1.27 BSC	
E	10.08	10.18	10.28
E1		7.00 REF	
E2	7.90	8.30	8.70
H	14.53	15.03	15.53
H1	0.98	1.20	1.42
L	1.90	2.20	2.50
L2		0.25 BSC	
θ	0°	3°	7°

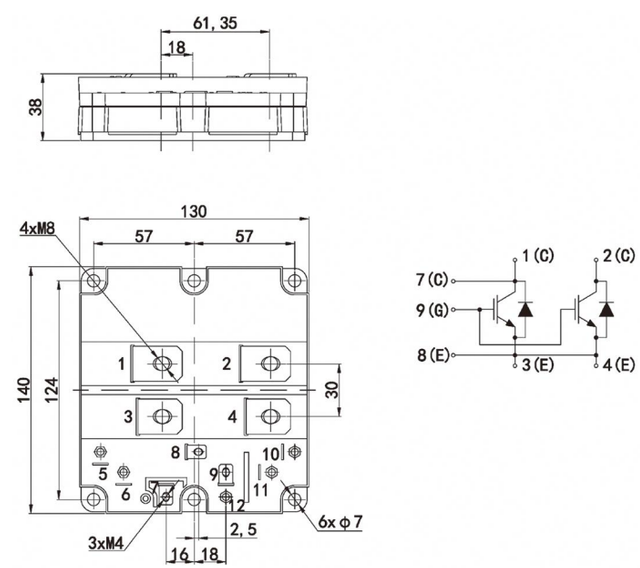
注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

ES



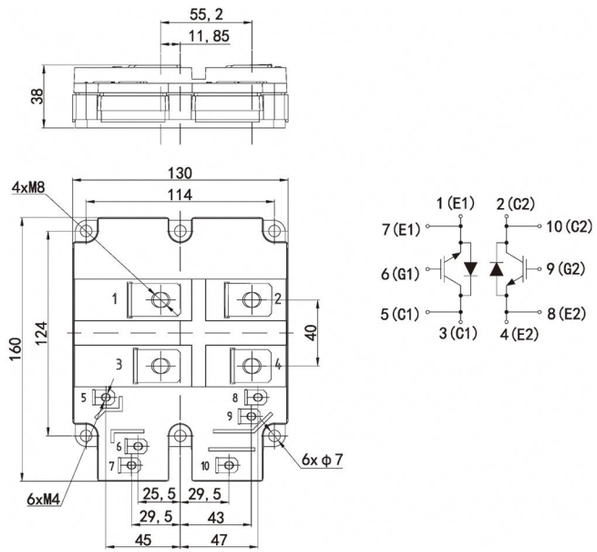
FS



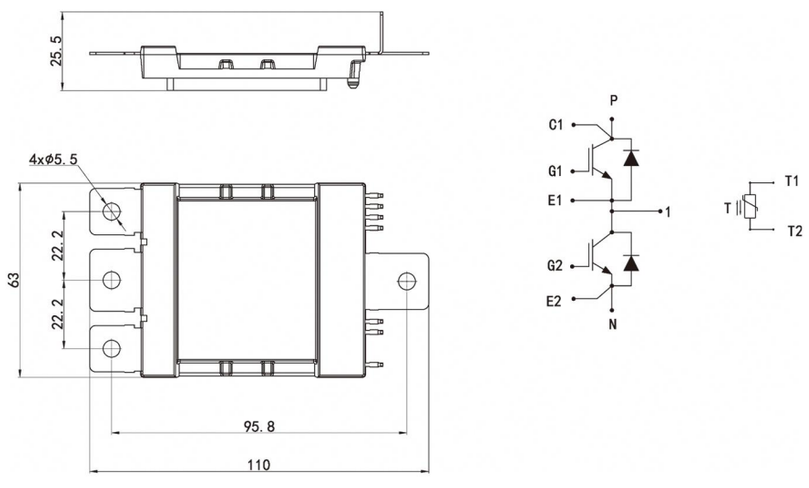
注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

GD



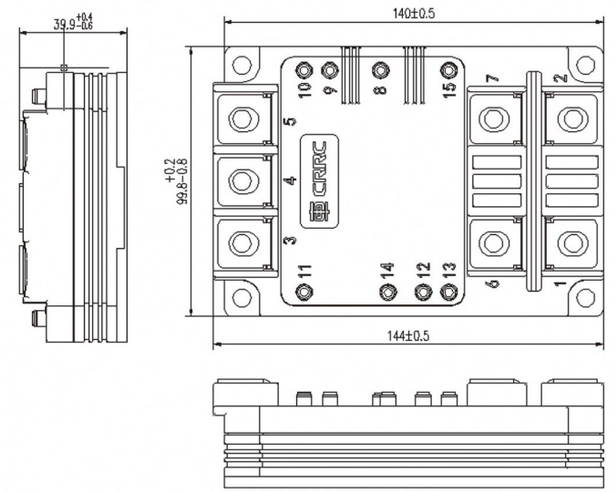
L5



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

X2



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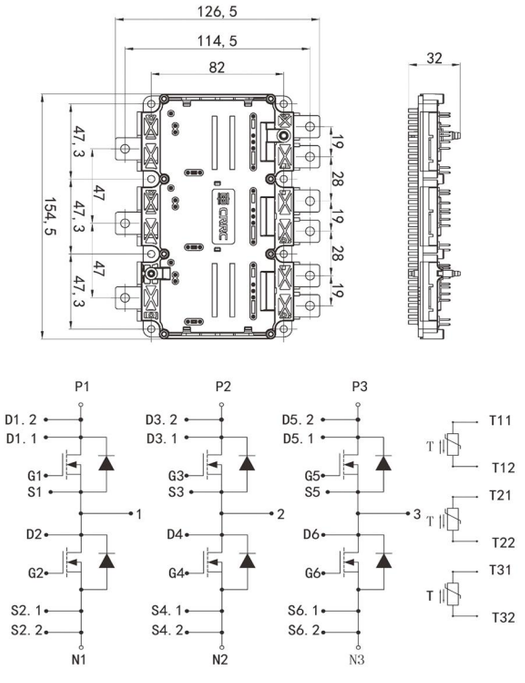
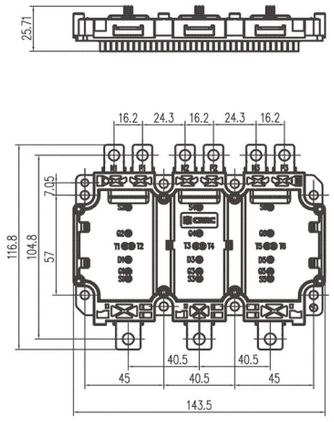
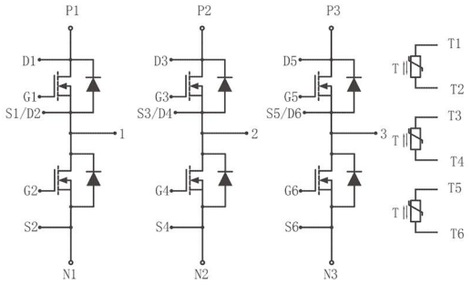


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

S7

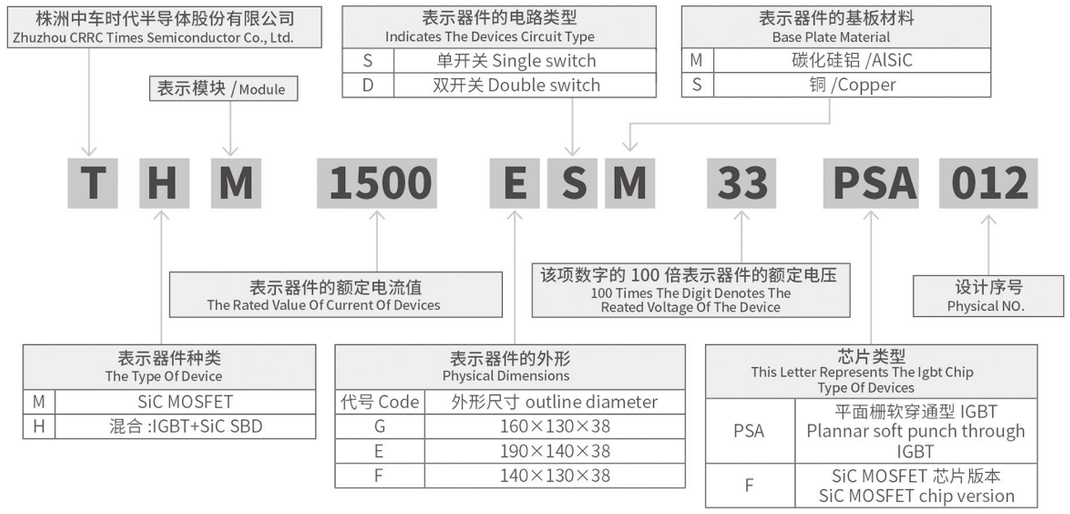




注：未标注数量单位的统一为毫米（mm）
Remarks:All dimensions shown in mm unless stated otherwise

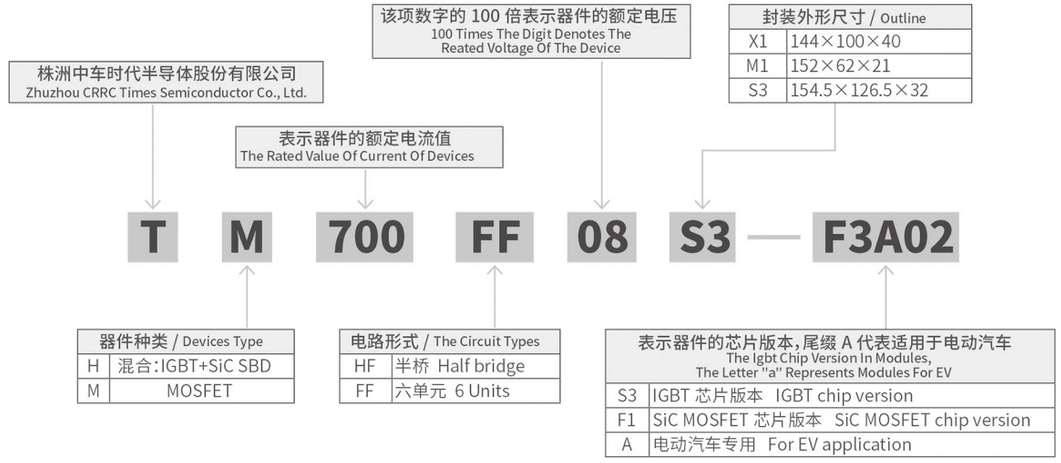
型号说明
NOMENCLATURE

混合 SiC 功率模块 HYBRID SiC POWER MODULES



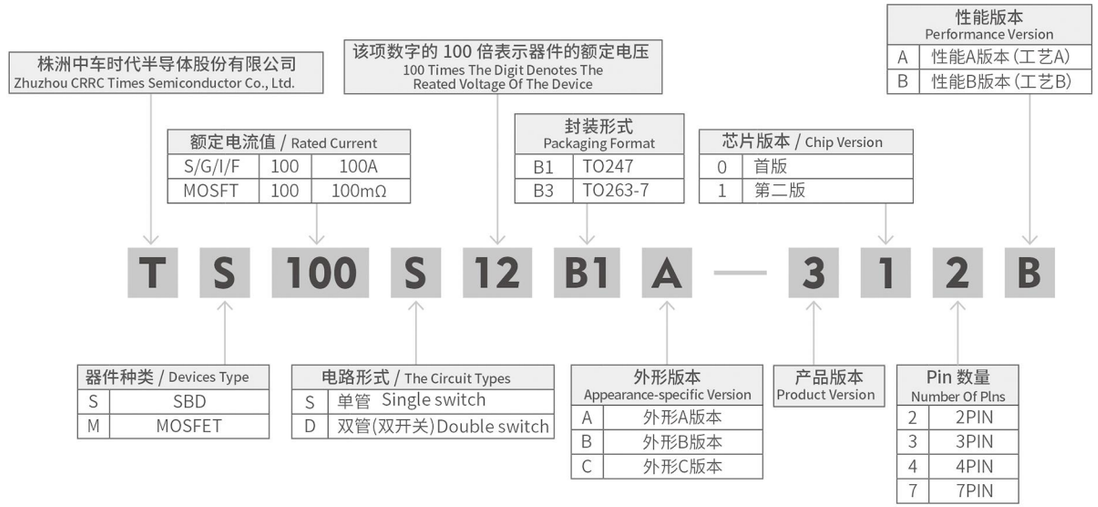
型号说明
NOMENCLATURE

SiC 模块 SiC MODULES



型号说明
NOMENCLATURE

TO SiC 器件 TO SiC SBD/MOSFET DEVICES



符号说明
SYMBOLS

肖特基二极管 SiC SBDS

符号 Symbols	参数名称	Parameters
V_{RRM}	反向重复峰值电压	Repetitive Peak Reverse Voltage
V_{DC}	直流阻断电压	DC Peak Reverse Voltage
$IF_{(avg)}$	正向电流	Continuous Forward Current
V_F	正向压降	Forward Voltage
I_R	反向电流	Reverse Current

金属 - 氧化物 - 半导体场效应晶体管 SiC MOSFETS

符号 Symbols	参数名称	Characteristics
$V_{(BR)DSS}$	击穿电压	Drain-Source Breakdown Voltage
I_D	正向电流	Continuous Forward Current
$R_{DS(on)}$	通态电阻	Drain-Source On-State Resistance
$V_{GS(th)}$	阈值电压	Gate Threshold Voltage
$T_{J, Tstg}$	运行结温及存储温度	Operating Junction Temperature Range / Storage Temperature Range
I_{DSS}	漏极截止电流	Zero Gate Voltage Drain Current

符号说明
SYMBOLS

混合 SiC 模块 HYBRID SiC MODULES

符号	参数名称	Characteristics
V_{CES}	集电极 - 发射极电压	Collector-emitter voltage
V_{GES}	栅极 - 发射极电压	Gate-emitter voltage
I_C	集电极直流电流	DC collector current
I_{CRM}	集电极重复峰值电流	Peak collector current
P_{tot}	总耗散功率	Total power dissipation
V_{isol}	绝缘电压	Isolation voltage
Q_{PD}	局部放电	Partial discharge
$R_{thJC\ IGBT}$	IGBT 结壳热阻	IGBT thermal resistance junction to case
$R_{thJC\ Diode}$	二极管结壳热阻	Diode thermal resistance junction to case
R_{thCH}	接触热阻	IGBT thermal resistance case to heatsink
T_{VJM}	最高 (等效) 结温	Max. (Virtual) junction temperature
T_{stg}	存储温度	Storage temperature
M	安装力矩	Mounting torque
I_{CES}	集电极截止电流	Collector cut-off current
I_{GES}	栅极漏电流	Gate leakage current
$V_{GE(TH)}$	栅极 - 发射极阈值电压	Gate-Emitter threshold voltage
$V_{CE(sat)}$	集电极 - 发射极饱和电压	Collector-Emitter saturation voltage
I_F	二极管正向直流电流	Diode DC forward current
I_{FRM}	二极管正向重复峰值电流	Diode Peak forward current
V_F	二极管正向电压	Diode Forward voltage
C_{ies}	输入电容	Input capacitance
Q_g	栅极电荷	Gate charge
C_{res}	反向传输电容	Reverse transfer capacitance
I_{SC}	短路电流	Short circuit current
$t_{d(off)}$	关断延迟时间	Turn-off delay time
t_f	下降时间	Fall time
E_{OFF}	关断损耗	Turn-off switching energy
$t_{d(on)}$	开通延迟时间	Turn-on delay time
t_r	上升时间	Rise time
E_{ON}	开通损耗	Turn-on switching energy
Q_{rr}	二极管反向恢复电荷	Diode Reverse recovery charge
I_{rr}	二极管反向恢复电流	Diode Reverse recovery current
E_{rec}	二极管反向恢复损耗	Diode Reverse recovery energy
E_{sw}	IGBT 模块总开关损耗	IGBT module ‘s total switching energy (E_{on}+E_{off} +E_{rec})

全 SiC 模块 FULL SiC MODULES

符号	参数名称	Characteristics
V_{DSS}	漏极 - 源极电压	Drain-Source voltage
V_{GSS}	栅极 - 源极电压	Gate-Source voltage
I_D	漏极直流电流	DC drain current
I_{DRM}	漏极重复峰值电流	Peak drain current
P_{tot}	总耗散功率	Total power dissipation
V_{isol}	绝缘电压	Isolation voltage
Q_{PD}	局部放电	Partial discharge
$R_{thJC\ MOSFET}$	MOSFET 结壳热阻	MOSFET thermal resistance junction to case
$R_{thJC\ Diode}$	二极管结壳热阻	Diode thermal resistance junction to case
R_{thCH}	接触热阻	MOSFET thermal resistance case to heatsink
T_{VJM}	最高 (等效) 结温	Max. (Virtual) junction temperature
T_{stg}	存储温度	Storage temperature
M	安装力矩	Mounting torque
I_{DSS}	漏极截止电流	Drain cut-off current
I_{GSS}	栅极漏电流	Gate leakage current
$V_{GS(TH)}$	栅极 - 源极阈值电压	Gate-Source threshold voltage
$V_{DS(on)}$	漏极 - 源极通态电压	Drain-Source saturation voltage
I_F	二极管正向直流电流	Diode DC forward current
I_{FRM}	二极管正向重复峰值电流	Diode Peak forward current
V_F	二极管正向电压	Diode Forward voltage
C_{iss}	输入电容	Input capacitance
Q_g	栅极电荷	Gate charge
C_{rss}	反向传输电容	Reverse transfer capacitance
I_{SC}	短路电流	Short circuit current
$t_{d(off)}$	关断延迟时间	Turn-off delay time
t_f	下降时间	Fall time
E_{OFF}	关断损耗	Turn-off switching energy
$t_{d(on)}$	开通延迟时间	Turn-on delay time
t_r	上升时间	Rise time
E_{ON}	开通损耗	Turn-on switching energy
Q_{rr}	二极管反向恢复电荷	Diode Reverse recovery charge
I_{rr}	二极管反向恢复电流	Diode Reverse recovery current
E_{rec}	二极管反向恢复损耗	Diode Reverse recovery energy
E_{sw}	MOSFET 总开关损耗	MOSFET total switching energy

04

第四章
CHAPTER FOUR

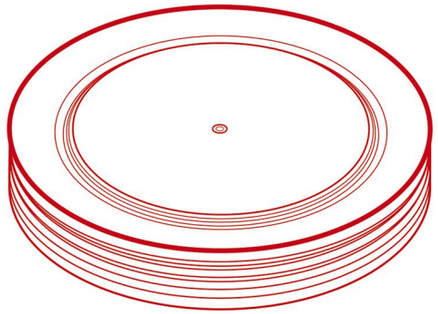
整流管及晶闸管

DIODES &
THYRISTORS

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

DIODES &
THYRISTORS

整流管及晶闸管



整流管 RECTIFIER DIODES

整流管及晶闸管 DIODES AND THYRISTORS

产品介绍 PRODUCT INTRODUCTION

产品涵盖6英寸及以下、电压8.5kV及以下烧结型和压接型器件,包含普通整流管、普通晶闸管、快速晶闸管、双向晶闸管、快恢复二极管等器件。具有大功率容量、低损耗、双面散热等特点。产品已成功用于直流电力机车、直流内燃机车牵引与传动系统。在高压直流输电、高压无功率补偿、工业变流器、软启动等领域也得到了批量应用。

Products cover sintered and press-fit devices (≤6-inch, ≤8.5kV), including rectifiers, thyristors (ordinary, fast, bidirectional), fast recovery diodes, etc. Featuring high power capacity, low loss, and double-sided heat dissipation, they are successfully applied to DC electric locomotives, traction & transmission systems of DC diesel locomotives, and mass-used in HVDC transmission, high-voltage reactive power compensation, industrial converters, soft starters, etc.

产品特点 CHARACTERISTIC

平板压装双面冷却	Double-Side Cooling
大功率容量	High Power Capability
低损耗	Low Loss

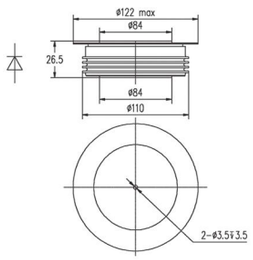
全压接型整流管 FREE FLOATING RECTIFIER DIODES

型号 TYPE -**=V_{RSM}/100	$I_{F(AV)}$		V_{RSM}	V_{RRM}	I_{FSM} @T_{VJM} &10ms	V_{FM} @I_{FM} &T_C=T_{VJM}		V_{FO} @T_{VJM}	r_F @T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	F ±10%	外形 Outline
	A	@T_C °C	V	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN	
电压至 2200V(Up to 2200V)														
ZP_C 7500-**	7570	90	1600-2200	1600-2200	94.0	6000	1.03	0.82	0.035	160	0.0057	0.0015	90	ZH_C
电压至 3400V(Up to 3400V)														
ZP_B 4800-**	4830	90	2400-3400	2400-3400	64.2	6000	1.29	0.80	0.082	175	0.009	0.002	70	ZH_B
ZP_B 5600-**	5660	90	2400-3400	2400-3400	64.2	6000	1.29	0.80	0.082	175	0.007	0.002	70	ZP_B
ZP_C 6200-**	6200	90	2400-3400	2400-3400	84.4	6000	1.17	0.75	0.070	160	0.0057	0.0015	90	ZH_C
ZP_C 6600-**	6680	90	2400-3400	2400-3400	84.4	6000	1.17	0.75	0.070	160	0.005	0.0015	90	ZP_C
ZP_D 9000-**	9000	85	2400-3400	2400-3400	118.0	6000	1.06	0.72	0.057	160	0.004	0.0008	120	ZH_D
电压至 4500V(Up to 4500V)														
ZP_B 3900-**	3910	90	3600-4500	3600-4500	59.4	6000	1.50	0.98	0.086	160	0.009	0.002	70	ZH_B
ZP_B 4600-**	4630	90	3600-4500	3600-4500	59.4	6000	1.50	0.98	0.086	160	0.007	0.002	70	ZP_B
ZP_C 5600-**	5600	90	3600-4500	3600-4500	79.0	6000	1.32	0.80	0.086	160	0.0057	0.0015	90	ZH_C
ZP_C 6000-**	6080	90	3600-4500	3600-4500	79.0	6000	1.32	0.80	0.086	160	0.005	0.0015	90	ZP_C
电压至 5500V(Up to 5500V)														
ZP_B 3600-**	3600	90	4600-5500	4600-5500	53.9	3000	1.26	0.90	0.120	160	0.009	0.002	70	ZH_B
ZP_B 4200-**	4220	90	4600-5500	4600-5500	53.9	3000	1.26	0.90	0.120	160	0.007	0.002	70	ZP_B
ZP_C 4700-**	4710	100	4600-5500	4600-5500	74.0	6000	1.44	0.82	0.104	160	0.0057	0.0015	90	ZH_C
ZP_C 5100-**	5110	100	4600-5500	4600-5500	74.0	6000	1.44	0.82	0.104	160	0.005	0.0015	90	ZP_C
ZP_D 6100-**	6140	100	4600-5500	4600-5500	96.9	6000	1.21	0.79	0.070	150	0.004	0.0008	120	ZH_D
电压至 6500V(Up to 6500V)														
ZP_B 2600-**	2670	100	5600-6500	4900-6000	51.0	3000	1.35	0.90	0.150	150	0.009	0.002	70	ZH_B
ZP_B 3100-**	3150	100	5600-6500	4900-6000	51.0	3000	1.35	0.90	0.150	150	0.007	0.002	70	ZP_B
ZP_D 5500-**	5520	100	5600-6500	4900-6000	88.4	6000	1.37	0.83	0.090	150	0.004	0.0008	120	ZH_D
ZP_D 6000-**	6000	100	5600-6500	4900-6000	88.4	6000	1.37	0.83	0.090	150	0.0035	0.0008	120	ZP_D
电压至 8500V(Up to 8500V)														
ZP_B 2200-**	2260	100	7400-8500	6900-8000	42.5	3000	1.70	1.07	0.210	150	0.009	0.002	70	ZH_B
ZP_E 6500-**	6510	100	7400-8500	6900-8000	112.0	6000	1.59	1.05	0.090	150	0.0028	0.0005	180	ZH_E

产品图示
PRODUCT DIAGRAM

全压接型整流管 FREE FLOATING RECTIFIER DIODES

ZP_B



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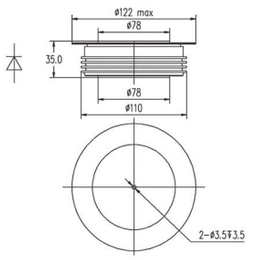

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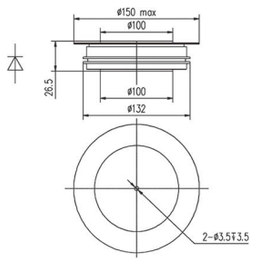

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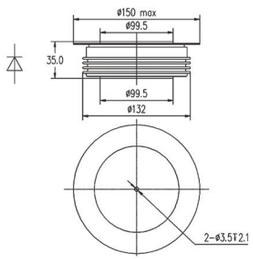

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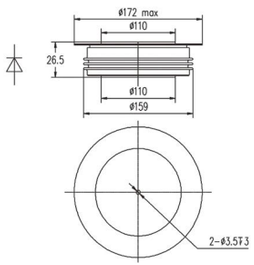
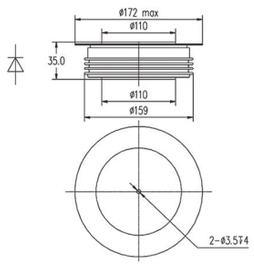


ZH_D



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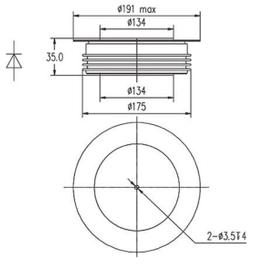


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

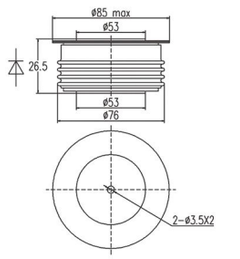
烧结型整流管 ALLOYING RECTIFIER DIODES

型号 TYPE -**= V_{RRM}/100	$I_{F(AV)}$ @T_C=100°C	V_{RRM}	I_{FSM} @T_{VJM} &10ms	V_{FM} @I_{FM} &T_C=25°C		V_{FO} @T_{VJM}	r_F @T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	F ±10%	外形 Outline
	A	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN	
电压至 1400V(Up to 1400V)												
ZP_9 2700-**	2770	600-1400	31.0	1500	1.05	0.78	0.092	190	0.02	0.005	22	ZP_9
ZP_A 4600-**	4650	600-1400	45.0	3000	1.05	0.76	0.051	190	0.0125	0.004	45	ZP_A
ZP_X 6000-**	6080	600-1400	60.0	3000	1.05	0.76	0.035	190	0.01	0.003	56	ZP_X
电压至 2200V(Up to 2200V)												
ZP_7 900-**	990	1600-2200	12.5	1500	1.60	0.82	0.433	175	0.035	0.010	10	ZP_7
ZP_8 1100-**	1100	1600-2200	13.9	1500	1.45	0.82	0.318	175	0.035	0.008	15	ZP_8
ZP_9 2000-**	2030	1600-2200	25.7	1500	1.20	0.82	0.156	175	0.02	0.005	22	ZP_9
ZP_4 2300-**	2360	1600-2200	29.8	3000	1.35	0.81	0.125	175	0.018	0.005	30	ZP_4
ZP_A 3400-**	3430	1600-2200	42.2	3000	1.20	0.79	0.086	175	0.0125	0.004	45	ZP_A
ZP_X 4400-**	4460	1600-2200	56.4	3000	1.15	0.81	0.059	175	0.01	0.003	56	ZP_X
ZP_C 8300-**	8380	1600-2200	73.0	6000	1.15	0.73	0.05	175	0.005	0.0015	90	ZP_C
电压至 3400V(Up to 3400V)												
ZP_7 800-**	850	2400-3400	10.8	1500	1.95	0.88	0.613	175	0.035	0.010	10	ZP_7
ZP_8 900-**	960	2400-3400	12.0	1500	1.70	0.88	0.450	175	0.035	0.008	15	ZP_8
ZP_9 1800-**	1830	2400-3400	23.0	1500	1.35	0.88	0.200	175	0.02	0.005	22	ZP_9
ZP_A 2900-**	2980	2400-3400	36.5	3000	1.35	0.82	0.128	175	0.0125	0.004	45	ZP_A
ZP_X 3900-**	3920	2400-3400	49.5	3000	1.25	0.85	0.084	175	0.01	0.003	56	ZP_X
电压至 4500V(Up to 4500V)												
ZP_8 600-**	640	3600-4500	10.6	1500	1.80	0.96	0.604	150	0.035	0.008	15	ZP_8
ZP_9 1200-**	1200	3600-4500	19.6	1500	1.55	0.96	0.296	150	0.02	0.005	22	ZP_9
ZP_A 1900-**	1980	3600-4500	32.0	3000	1.60	0.96	0.162	150	0.0125	0.004	45	ZP_A
ZP_X 2600-**	2680	3600-4500	42.6	3000	1.35	0.80	0.135	150	0.01	0.003	56	ZP_X
电压至 6500V(Up to 6500V)												
ZP_8 600-**	600	5000-6500	9.5	1500	1.90	0.95	0.800	150	0.035	0.008	15	ZP_8 /ZH_8
ZP_X 1900-**	1950	5400-6500	30.0	3000	1.80	1.21	0.230	150	0.01	0.003	56	ZP_X
ZP_X 2100-**	2140	4600-5200	35.0	3000	1.60	1.00	0.195	150	0.01	0.003	56	ZP_X
电压至 8500V(Up to 8500V)												
ZP_8 400-**	420	7500-8500	7.0	1500	2.65	1.15	0.900	150	0.035	0.008	15	ZH_8
ZP_9 900-**	910	7500-8500	11.0	1500	2.10	1.25	0.550	150	0.02	0.005	22	ZH_9

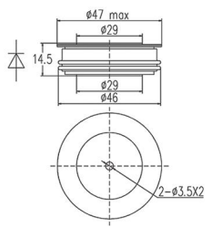
产品图示
PRODUCT DIAGRAM

烧结型整流管 ALLOYING RECTIFIER DIODES

ZP_4



ZP_7



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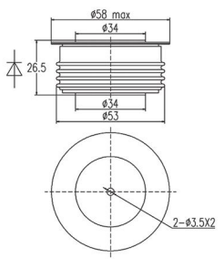

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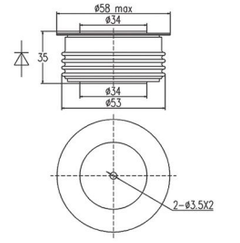

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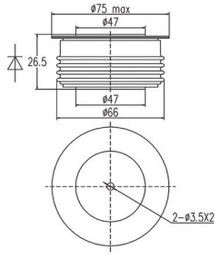

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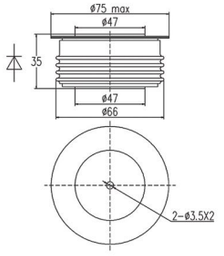

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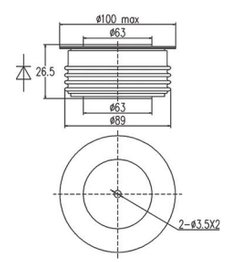

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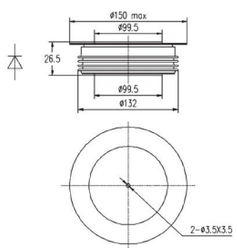

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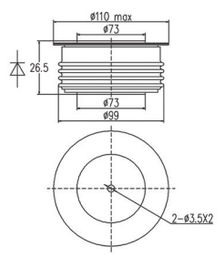


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

晶闸管 THYRISTORS

全压接型晶闸管 FREE-FLOATING THYRISTORS

型号 TYPE -**= V_{DSM}/100	$I_{T(AV)}$ A	$I_{T(AV)}$ @T_C °C	V_{DSM}/V_{RSM} V	V_{DRM}/V_{RRM} V	I_{TSM} @T_{VJM} &10ms kA	V_{TM} @I_{TM} &T_C=T_{VJM} A	V_{TM} V	V_{TO} @T_{VJM} V	r_T @T_{VJM} mΩ	T_{VJM} °C	R_{thJC} K/W	R_{thCH} K/W	F ±10% kN	外形 Outline
电压至 2200V(Up to 2200V)														
KP_B 3900-**	3980	70	1800-2200	1800-2200	64.5	3000	1.15	0.86	0.095	125	0.007	0.002	70	KP_B
KP_C 5200-**	5270	70	1800-2200	1800-2200	80.0	3000	1.05	0.87	0.061	125	0.0057	0.0015	90	KH_C
KP_C 5700-**	5750	70	1800-2200	1800-2200	80.0	3000	1.05	0.87	0.061	125	0.005	0.0015	90	KP_C
KP_C 6000-**	6020	70	1400-1800	1400-1800	94.0	3000	1.00	0.83	0.056	125	0.005	0.0015	90	KP_C
电压至 2800V(Up to 2800V)														
KP_B 3300-**	3300	70	2400-2800	2400-2800	60.0	3000	1.40	0.95	0.150	125	0.007	0.002	70	KP_B
KP_C 4700-**	4760	70	2400-2800	2400-2800	75.0	3000	1.14	0.90	0.080	125	0.0057	0.0015	90	KH_C
KP_C 5100-**	5190	70	2400-2800	2400-2800	75.0	3000	1.14	0.90	0.080	125	0.005	0.0015	90	KP_C
KP_D 6800-**	6810	70	2400-2800	2400-2800	105.0	3000	1.04	0.88	0.052	125	0.004	0.0008	120	KH_D
KP_D 7600-**	7670	70	2400-2800	2400-2800	105.0	3000	1.04	0.88	0.052	125	0.0035	0.0008	120	KP_D
电压至 3400V(Up to 3400V)														
KP_B 2700-**	2780	70	3000-3400	3000-3400	54.0	3000	1.41	0.95	0.153	125	0.009	0.002	70	KH_B
KP_B 3200-**	3270	70	3000-3400	3000-3400	54.0	3000	1.41	0.95	0.153	125	0.007	0.002	70	KP_B
KP_C 4200-**	4240	70	3000-3400	3000-3400	69.0	3000	1.21	0.86	0.115	125	0.0057	0.0015	90	KH_C
KP_C 4600-**	4610	70	3000-3400	3000-3400	69.0	3000	1.21	0.86	0.115	125	0.005	0.0015	90	KP_C
电压至 4200V(Up to 4200V)														
KP_9 1000-**	1090	70	3600-4200	3600-4200	18.0	1000	1.65	1.05	0.600	125	0.017	0.005	22	KP_9
KP_X 1900-**	1910	70	3600-4200	3600-4200	32.0	1500	1.41	0.96	0.300	125	0.011	0.003	50	KH_X
KP_X 2000-**	2030	70	3600-4200	3600-4200	32.0	1500	1.41	0.96	0.300	125	0.01	0.003	50	KL_X
KP_B 2500-**	2530	70	3600-4200	3600-4200	52.0	3000	1.55	0.95	0.200	125	0.009	0.002	70	KH_B
KP_B 3000-**	3000	70	3600-4200	3600-4200	52.0	3000	1.55	0.95	0.200	125	0.007	0.002	70	KP_B
KP_C 3900-**	3970	70	3600-4200	3600-4200	60.0	3000	1.35	0.97	0.126	125	0.0057	0.0015	90	KH_C
KP_C 4300-**	4320	70	3600-4200	3600-4200	60.0	3000	1.35	0.97	0.126	125	0.005	0.0015	90	KP_C
电压至 5200V(Up to 5200V)														
KP_A 1300-**	1300	70	4600-5200	4200-4600	20.0	1500	1.73	1.10	0.420	125	0.015	0.004	40	KH_A
KP_A 1400-**	1470	70	4600-5200	4200-4600	20.0	1500	1.73	1.10	0.420	125	0.013	0.004	40	KP_A
KP_B 2300-**	2360	70	4600-5200	4200-4600	54.5	3000	1.70	1.01	0.230	125	0.009	0.002	70	KH_B
KP_B 2700-**	2770	70	4600-5200	4200-4600	54.5	3000	1.70	1.01	0.230	125	0.007	0.002	70	KP_B
KP_C 3400-**	3460	70	4600-5200	4200-4600	60.0	3000	1.54	1.00	0.180	125	0.0057	0.0015	90	KH_C
KP_C 3700-**	3750	70	4600-5200	4200-4600	60.0	3000	1.54	1.00	0.180	125	0.005	0.0015	90	KP_C
KP_D 5000-**	5000	70	4600-5200	4200-4600	85.2	3000	1.38	1.00	0.125	125	0.004	0.0008	120	KH_D
KP_D 5300-**	5380	70	4600-5200	4200-4600	85.2	3000	1.38	1.00	0.125	125	0.0035	0.0008	120	KH_P

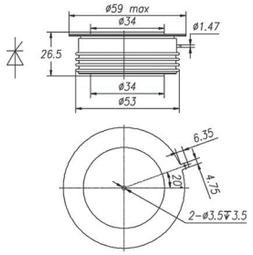
全压接型晶闸管 FREE-FLOATING THYRISTORS

型号 TYPE -**= V_{DSM}/100	$I_{T(AV)}$		V_{DSM}/V_{RSM}	V_{DRM}/V_{RRM}	I_{TSM}	V_{TM}		V_{TO}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F	外形 Outline
					@T_{VJM}	@I_{TM}		@T_{VJM}	@T_{VJM}				±10%	
	A	@T_C			&10ms	&T_C= T_{VJM}								
		°C	V	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN	
电压至 6500V (Up to 6500V)														
KP_8 300-**	350	70	5400-6500	4500-5600	4.5	1000	3.50	1.20	2.300	125	0.045	0.008	15	KH_8
KP_8 400-**	420	70	5400-6500	4500-5600	4.5	1000	3.50	1.20	2.300	125	0.035	0.008	15	KP_8
KP_9 700-**	730	70	5400-6500	4500-5600	16.1	1000	2.25	1.20	1.050	125	0.022	0.005	22	KH_9
KP_9 800-**	850	70	5400-6500	4500-5600	16.1	1000	2.25	1.20	1.050	125	0.017	0.005	22	KP_9
KP_A 1000-**	1010	70	5400-6500	4500-5600	21.5	1500	2.37	1.20	0.780	125	0.015	0.004	40	KH_A
KP_A 1100-**	1140	70	5400-6500	4500-5600	21.5	1500	2.37	1.20	0.780	125	0.013	0.004	40	KP_A
KP_X 1300-**	1360	70	5400-6500	4500-5600	32.5	1500	2.12	1.15	0.645	125	0.011	0.003	50	KH_X
KP_X 1400-**	1450	70	5400-6500	4500-5600	32.5	1500	2.12	1.15	0.645	125	0.01	0.003	50	KL_X
KP_B 1800-**	1800	70	5400-6500	4500-5600	50.0	3000	2.49	1.25	0.412	125	0.009	0.002	70	KH_B
KP_B 2100-**	2100	70	5400-6500	4500-5600	50.0	3000	2.49	1.25	0.412	125	0.007	0.002	70	KP_B
KP_C 2800-**	2800	70	5400-6500	4500-5600	64.8	3000	2.00	1.18	0.274	125	0.0057	0.0015	90	KH_C
KP_C 3000-**	3070	70	5400-6500	4500-5600	64.8	3000	2.00	1.18	0.274	125	0.005	0.0015	90	KP_C
KP_D 4200-**	4250	70	5400-6500	4500-5600	79.5	3000	1.69	1.13	0.185	125	0.004	0.0008	120	KH_D
KP_D 4500-**	4500	70	5400-6500	4500-5600	79.5	3000	1.69	1.13	0.185	125	0.0035	0.0008	120	KP_D
电压至 7200V(Up to 7200V)														
KP_B 1600-**	1790	70	6800-7200	6300-6700	32.0	3000	2.50	1.25	0.420	125	0.009	0.002	70	KH_B
KP_C 2600-**	2660	70	6800-7200	6300-6700	42.0	3000	2.15	1.19	0.320	125	0.0057	0.0015	90	KH_{C2}
电压至 8000V(Up to 8000V)														
KP_8 300-**	300	70	7500-8000	7000-7500	4.0	500	2.90	1.45	2.900	125	0.045	0.008	15	KH_8
KP_9 600-**	600	70	7500-8000	7000-7500	12.1	1000	2.90	1.35	1.550	125	0.022	0.005	22	KH_9
电压至 8500V(Up to 8500V)														
KP_8 300-**	300	70	8100-8500	7600-8000	4.0	500	2.95	1.47	2.950	125	0.045	0.008	15	KH_8
KP_9 500-**	540	70	8100-8500	7600-8000	12.1	1000	2.90	1.35	1.550	115	0.022	0.005	22	KH_9
KP_C 2500-**	2580	70	8100-8500	7600-8000	56.0	1500	1.73	1.22	0.340	125	0.0057	0.0015	90	KH_{C2}

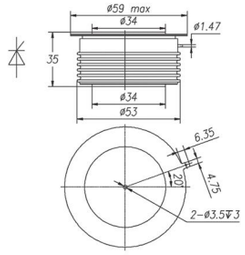
产品图示
PRODUCT DIAGRAM

全压接型晶闸管 FREE-FLOATING THYRISTORS

KP_8



KH_8



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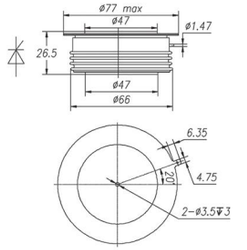

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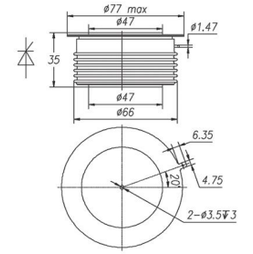
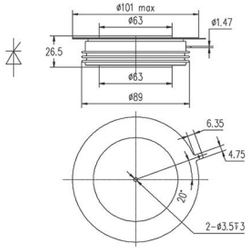


KP_A



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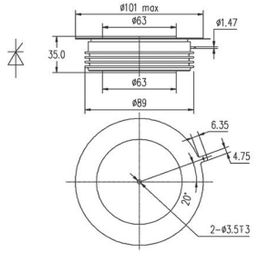
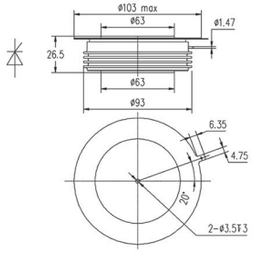
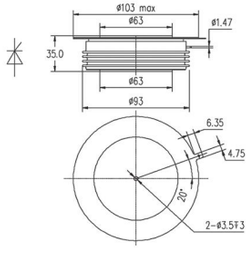


KL_X



KH_X

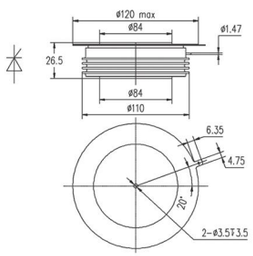


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

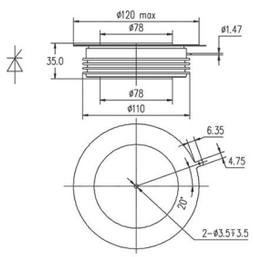
产品图示
PRODUCT DIAGRAM

全压接型晶闸管 FREE-FLOATING THYRISTORS

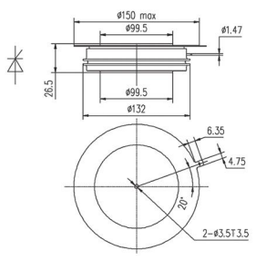
KP_B



KH_B



KP_C



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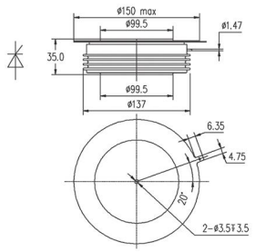
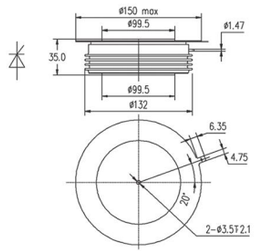
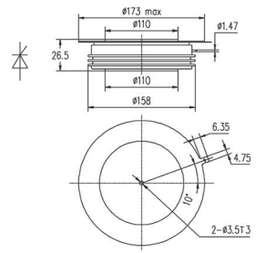


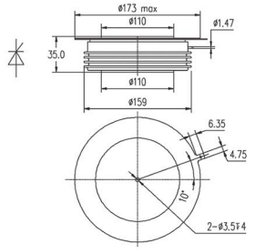
KH_{C2}



KP_D



KH_D



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

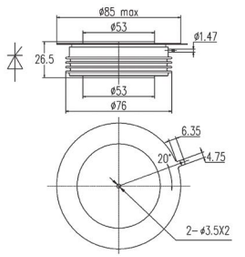
烧结型晶闸管 ALLOYING THYRISTORS

型号 TYPE -**= $V_{DRM}/100$	$I_{T(AV)}$ @T_C=70°C	V_{DRM}/V_{RRM}	I_{TSM} @T_{VJM} &10ms	V_{TM} @I_{TM} &T_C=25°C		V_{TO} @T_{VJM}	r_T @T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	F ±10%	外形 Outline
	A	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN	
电压至 1400V(Up to 1400V)												
KP_5 700-**	700	600-1400	9.1	1500	1.75	0.95	0.530	125	0.041	0.01	5	KP_5
KP_7 800-**	850	600-1400	12.8	1500	1.60	0.87	0.382	125	0.035	0.01	10	KP_7
KP_8 900-**	900	600-1400	15.0	1500	1.35	0.85	0.330	125	0.035	0.008	15	KP_8
KP_9 1700-**	1700	600-1400	26.0	1500	1.20	0.86	0.160	125	0.02	0.005	22	KP_9
KP_A 2600-**	2640	600-1400	47.0	3000	1.30	0.87	0.098	125	0.0125	0.004	45	KP_A
KP_X 3300-**	3310	600-1400	60.0	3000	1.15	0.83	0.092	125	0.01	0.003	56	KP_X
电压至 1800V(Up to 1800V)												
KP_6 300-**	320	1600-1800	5.0	600	1.80	0.93	1.150	125	0.08	0.02	5	KP_6
KP_5 600-**	640	1600-1800	8.3	1500	1.90	1.09	0.587	125	0.041	0.01	5	KP_5
KP_7 700-**	770	1600-1800	11.5	1500	1.80	0.90	0.500	125	0.035	0.01	10	KP_7
KP_8 800-**	850	1600-1800	14.0	1500	1.60	0.91	0.360	125	0.035	0.008	15	KP_8
KP_9 1500-**	1520	1600-1800	25.0	1500	1.35	0.88	0.200	125	0.02	0.005	22	KP_9
KP_4 1700-**	1710	1600-1800	28.0	3000	1.50	0.88	0.160	125	0.018	0.005	30	KP_4
KP_A 2500-**	2520	1600-1800	45.0	3000	1.45	0.91	0.120	125	0.0125	0.004	45	KP_A
KP_X 3000-**	3030	1600-1800	60.0	3000	1.35	0.90	0.110	125	0.01	0.003	56	KP_X
电压至 2400V(Up to 2400V)												
KP_7 600-**	670	1800-2400	10.0	1500	2.15	0.92	0.720	125	0.035	0.01	10	KP_7
KP_8 750-**	750	2000-2600	11.0	1500	1.85	0.95	0.500	125	0.035	0.008	15	KP_8
KP_9 1400-**	1400	2000-2600	24.0	1500	1.50	0.89	0.270	125	0.02	0.005	22	KP_9
KP_4 1400-**	1470	2000-2400	23.0	3000	1.80	0.96	0.230	125	0.018	0.005	30	KP_4
KP_A 2100-**	2110	2000-2400	35.0	3000	1.65	0.96	0.179	125	0.0125	0.004	45	KP_A
KP_X 2700-**	2730	2000-2400	45.0	3000	1.45	0.90	0.137	125	0.01	0.003	56	KP_X
电压至 3400V(Up to 3400V)												
KP_7 500-**	530	3000-3400	8.0	1500	2.65	0.98	1.200	125	0.035	0.01	10	KP_7
KP_8 500-**	580	3000-3400	8.4	1500	2.40	1.03	0.970	125	0.035	0.008	15	KP_8
KP_8 700-**	700	2600-2800	10.5	1500	1.90	1.00	0.600	125	0.035	0.008	15	KP_8
KP_9 1000-**	1010	3000-3400	17.0	1500	2.05	1.08	0.560	125	0.02	0.005	22	KP_9
KP_9 1300-**	1300	2600-2800	23.0	1500	1.55	0.95	0.300	125	0.02	0.005	22	KP_9
KP_4 1200-**	1240	2600-3400	19.2	3000	2.25	1.06	0.350	125	0.018	0.005	30	KP_4
KP_A 1700-**	1770	3000-3400	30.0	3000	2.10	1.05	0.298	125	0.0125	0.004	45	KP_A/KH_A
KP_A 1800-**	1850	2600-2800	30.0	3000	1.90	1.02	0.250	125	0.0125	0.004	45	KP_A
KP_X 2100-**	2190	3000-3400	33.0	3000	1.85	1.00	0.235	125	0.01	0.003	56	KP_X/KH_X
KP_X 2400-**	2470	2600-2800	43.0	3000	1.65	0.98	0.170	125	0.01	0.003	56	KP_X
电压至 5200V(Up to 5200V)												
KP_8 400-**	480	3600-4200	7.0	1500	3.25	1.15	1.470	125	0.035	0.008	15	KP_8/KH_8
KP_9 800-**	870	3600-4200	15.0	1500	2.50	1.15	0.799	125	0.02	0.005	22	KP_9/KH_9
KP_A 1400-**	1440	3600-4200	25.0	3000	2.45	1.15	0.452	125	0.0125	0.004	45	KP_A/KH_A
KP_X 1400-**	1470	4600-5200	23.5	3000	2.80	1.18	0.525	125	0.01	0.003	56	KP_X/KH_X
KP_X 1800-**	1880	3600-4200	25.0	3000	2.20	1.14	0.360	125	0.01	0.003	56	KP_X/KH_X

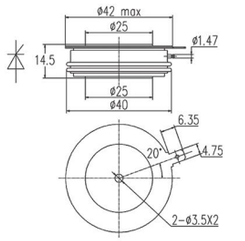
产品图示
PRODUCT DIAGRAM

烧结型晶闸管 ALLOYING THYRISTORS

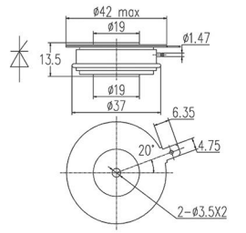
KP_4



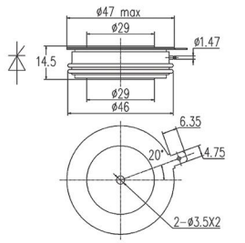
KP_5



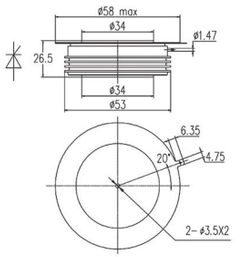
KP_6



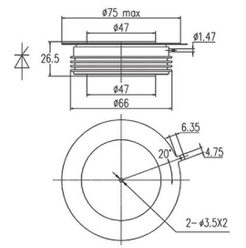
KP_7



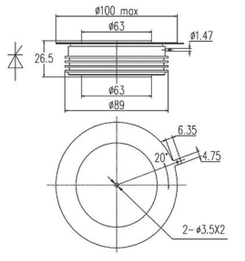
KP_8



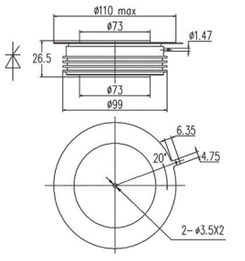
KP_9



KP_A



KP_X

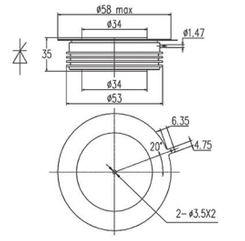


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

烧结型晶闸管 ALLOYING THYRISTORS

KH_8



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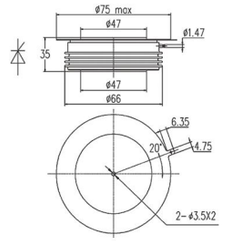
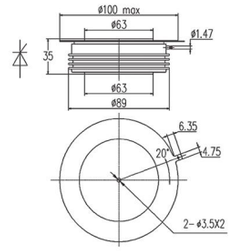
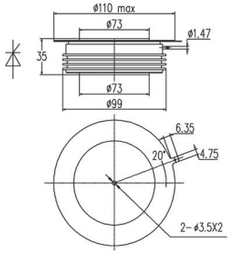
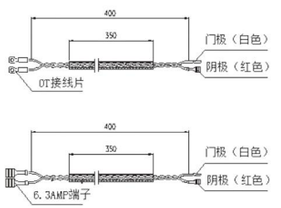


KH_A



KH_X





注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

快速晶闸管 FAST SWITCHING THYRISTORS

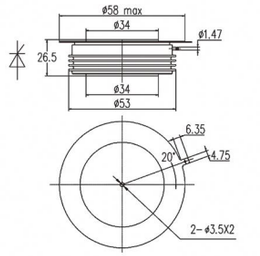
型号 TYPE -**= V_{DRM}/100	$I_{T(AV)}$ @T_C= 55°C	V_{DRM}	V_{RRM}	I_{TSM} @T_{VJM} &10ms	V_{TM} @I_{TM} &T_C= T_{VJM}		T_{VJM}	R_{thJC}	R_{thCH}	t_q @T_{VJM}	f	F ±10%	外形 Outline
	A	V	V	kA	A	V	°C	K/W	K/W	μs	Hz	kN	
电压至 2000V (Up to 2000V)													
KK_8 600-**	680	1600-2000	1600-2000	8.6	1500	2.80	125	0.035	0.008	50	1000	15	KP_8
KK_9 1200-**	1200	1600-2000	1600-2000	15.1	2000	2.15	125	0.02	0.005	50	1000	22	KP_9
KF_9 1500-**	1500	1600-1800	200	18.9	2000	1.71	125	0.02	0.005	50	1500	22	KP_9
KK_4 1500-**	1510	1600-2000	1600-2000	19.0	2000	2.00	125	0.018	0.005	50	1000	30	KP_4
KK_A 2000-**	2010	1600-2000	1600-2000	25.3	3000	2.35	125	0.0124	0.004	50	1000	45	KP_A
KK_X 2700-**	2740	1600-2000	1600-2000	28.9	4000	2.15	125	0.01	0.003	50	1000	56	KP_X
KF_X 2900-**	2910	1800-2000	200	34.8	4000	1.75	125	0.01	0.003	80	1000	56	KP_X
电压至 3000V (Up to 3000V)													
KK_A 2000-**	2000	2200-2500	2200-2500	25.2	3000	2.47	125	0.0124	0.004	65	700	45	KP_A
KK_X 2700-**	2750	2000-2200	2000-2200	28.8	4000	2.00	125	0.01	0.003	55	800	56	KP_X
电压至 3500V (Up to 3500V)													
KK_X 2000-**	2020	3200-3500	3200-3500	21.3	3000	2.95	125	0.01	0.003	120	250	56	KP_X
KK_B 2500-**	2520	3200-3500	3200-3500	27.0	4000	3.20	125	0.007	0.002	120	250	70	KP_B
电压至 4500V (Up to 4500V)													
KF_C 3600-**	3650	4200-4500	300	41.5	4000	2.10	125	0.0057	0.002	200	250	90	KH_{C2}

说明 Remarks:
1.f 为对应关断时间 t_q 下的推荐最大工作频率。
1.f is the recommended maximum operating frequency at the corresponding off time t_q.

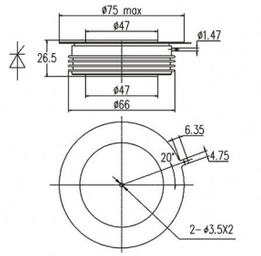
产品图示
PRODUCT DIAGRAM

快速晶闸管 FAST SWITCHING THYRISTORS

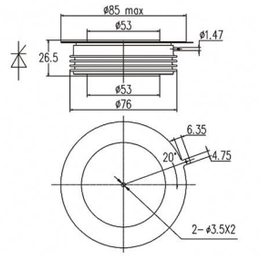
KP_8



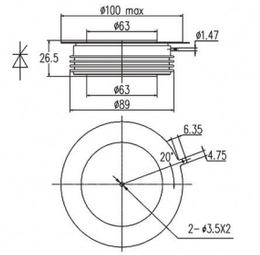
KP_9



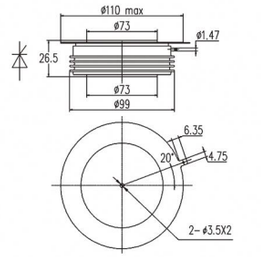
KP_4



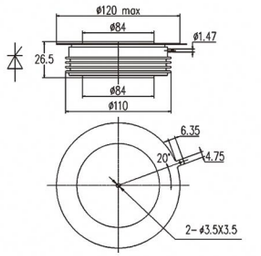
KP_A



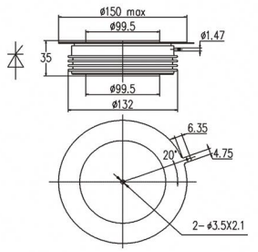
KP_X

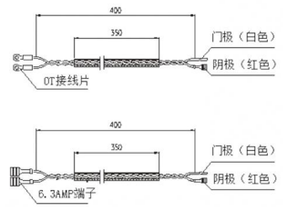


KP_B



KH_{C2}





注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

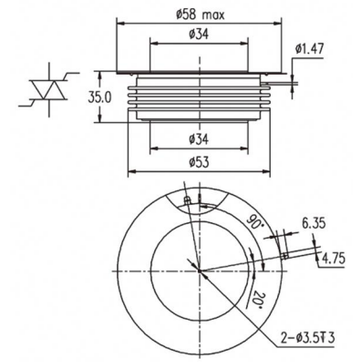
双向晶闸管 BIDIRECTIONAL THYRISTORS

型号 TYPE -**= V_{DSM}/100	$I_{T(AV)}$	$I_{T(RMS)F}$	V_{DSM}/V_{RSM}	V_{DRM}/V_{RRM}	I_{TSM}	V_{TM}		V_{TO}	r_T	T_{VJM}	R_{thJC}	R_{thCH}	F	外形 Outline
	@T_C=70°C				@T_{VJM} &10ms	@I_{TM} &T_C=T_{VJM}		@T_{VJM}	@T_{VJM}				±10%	
	A	°C	V	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN	
电压至 2800V(Up to 2800V)														
KB_C 5500-**	2520	2520	2200-2800	2200-2800	38.0	3000	1.47	0.99	0.16	125	0.01	0.003	90	KB_{C2}
电压至 6500V(Up to 6500V)														
KB_8 400-**	180	400	5400-6500	4500-5600	2.8	500	3.5	1.24	4.3	125	0.09	0.008	15	KB_8
KB_9 700-**	350	770	5400-6500	4500-5600	4.5	1000	3.50	1.20	2.300	125	0.045	0.008	22	KB_9

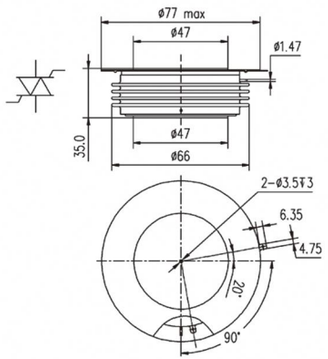
产品图示 PRODUCT DIAGRAM

双向晶闸管 BIDIRECTIONAL THYRISTORS

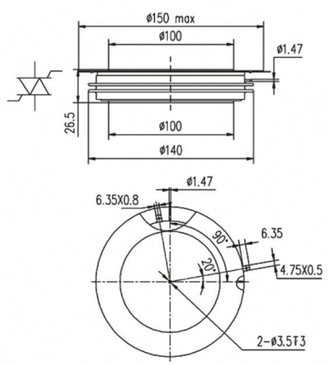
KB_8



KB_9



KB_{C2}



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

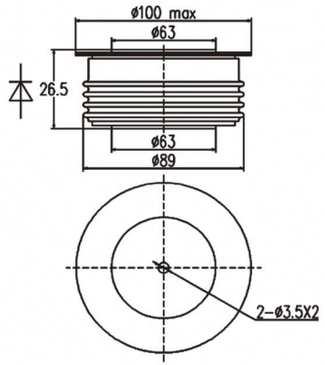
快速二极管 FAST DIODES

型号 TYPE -**= V_{DRR}/100	$I_{T(AV)}$	V_{RRM}	I_{FSM}	V_{FM}		T_{VJM}	R_{thJC}	R_{thCH}	t_{rr}	F	外形 Outline
	@T_C= 70°C		@T_{VJM} &10ms	@I_{FM} &T_C=T_{VJM}					@T_{VJM}	±10%	
	A	V	kA	A	V	°C	K/W	K/W	µs	kN	
电压至 2200V(Up to 2200V)											
ZK_A 2000-**	2082	1800-2200	27.5	3000	2.30	150	0.0124	0.004	6.5	45	ZP_A
ZK_X 2500-**	2598	1800-2200	34.3	4000	2.30	150	0.01	0.003	6.5	56	ZP_X
电压至 4500V(Up to 4500V)											
ZK_X 2000-**	2032	4000-4500	26.8	4000	3.20	150	0.01	0.003	7.5	56	ZP_X

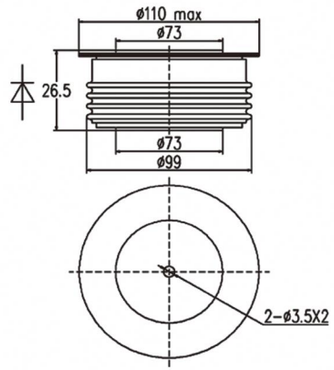
产品图示 PRODUCT DIAGRAM

快速二极管 FAST DIODES

ZP_A



ZP_X

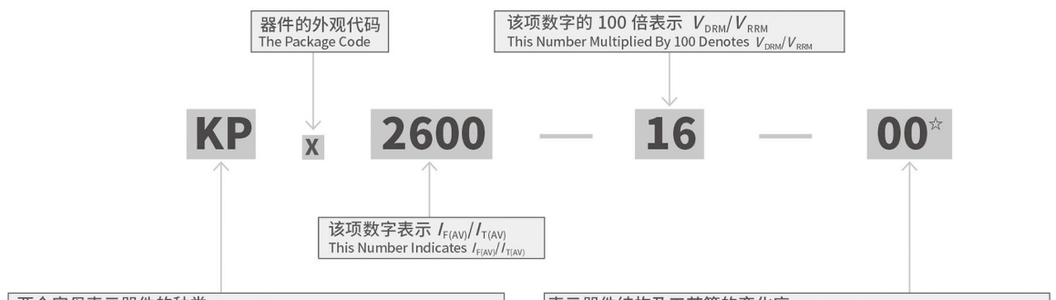


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

型号说明

NOMENCLATURE

整流管及晶闸管 DIODES AND THYRISTORS



两个字母表示器件的种类 Two Characters Denote The Device Category	
符号 Symbols	器件种类 Device Types
ZP	普通整流管 Rectifier diodes
ZK	快速二极管 Fast Diode
KP	普通晶闸管 Thyristor
KF	非对称晶闸管 Asymmetric Thyristor
KK	快速晶闸管 Fast switching thyristors
KB	双向晶闸管 Bi-directional control thyristors

表示器件结构及工艺等的变化序 Denotes The Variation Sequence Of Device Structure And Process	
设计序号 Design number	具体含义 Specific meaning
00	原型设计 Original design
01	第一次修订 / 增补 The first revision
02	第二次修订 / 增补 The second revision
☆	新产品 New products

符号说明

SYMBOLS

符号 Symbols	参数名称	Description
F	紧固力	Mounting Force
$I_{F(AV)}$	正向平均电流	Mean Forward Current
I_{FM}	正向峰值电流	Peak Forward Current
I_{FSM}	浪涌电流	Surge Forward Current
$I_{T(AV)}$	通态平均电流	Mean On-state Current
$I_{F(RMS)}$	通态方均根电流	RMS On-state Current
I_{TM}	通态峰值电流	Peak On-state Current
I_{TSM}	通态浪涌电流	Surge (Non-repetitive) Current
R_{thCH}	接触热阻	Thermal Resistance, Case to Heatsink
R_{thJC}	结壳热阻	Thermal Resistance, Junction to Case
t_q	电路换向关断时间	Circuit commutated turn-off time
T_C	壳温	Case Temperature
T_{VJM}	最高(等效)结温	Max.Virtual Junction Temperature
V_{DSM}	断态不重复峰值电压	Non-repetitive Peak Off-state Voltage
V_{RSM}	反向不重复峰值电压	Non-repetitive Peak Reverse Voltage
V_{DRM}	断态重复峰值电压	Repetitive Peak Off-state Voltage
V_{RRM}	反向重复峰值电压	Repetitive Peak Reverse Voltage
V_{FM}	正向峰值电压	Peak Forward Voltage
V_{TM}	通态峰值电压	Peak On-state Voltage
V_{TO}	通态门槛电压	On-state Threshold Voltage
r_T	通态斜率电阻	On-state Slope Resistance
V_{FO}	正向门槛电压	Forward Threshold Voltage
r_F	正向斜率电阻	Forward Slope Resistance
Q_{rr}	反向恢复电荷	Reverse Recovery Charge

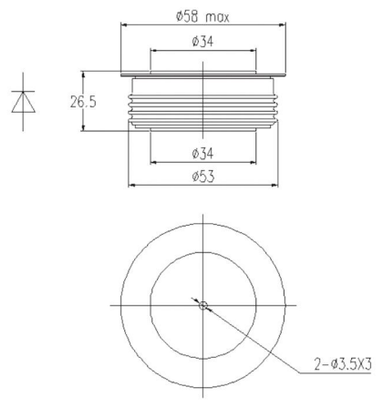
FRD 产品 FRD PRODUCTS

型号 TYPE -**= V_{RRM} /100	$I_{F(AV)}$ @T_C=70°C or 55°C	V_{RRM}	I_{FSM} @T_{VJM} &10ms	V_{FM} @I_{FM} &T_C= T_{VJM}		V_{F0} @T_{VJM}	r_F @T_{VJM}	T_{VJM}	R_{thJC}	R_{thCH}	I_{rr}	Q_{rr}	F ±10%	外形 Outline
	A	V	kA	A	V	V	mΩ	°C	K/W	K/W	A	μC	kN	
电压至 2500V (Up to 2500V)														
$FY_9$1100-**	1150	2500	18	4500	2.80	1.05	0.39	125	0.020	0.005	1200	2600	22	ZP_9
电压至 4500V (Up to 4500V)														
FD_D 5000-**	5000	4500	80	2500	2.00	1.35	0.26	140	0.0033	0.001	3600	9000	50-130	ZS_{D1}
FD_B 2700-**	2700	4500	48	2500	2.60	1.50	0.44	140	0.0056	0.0025	3000	7200	50-100	ZS_{B1}
FD_B 2000-**	1823	4500	40	2500	2.50	1.25	0.50	140	0.0075	0.0025	3000	7200	36-52	ZS_{B1}
FD_B 1300-**	1350	4500	28	2500	4.00	1.93	0.83	140	0.0075	0.0025	2500	4200	36-52	ZS_{B1}
FY_9 600-**	630	4500	16	2000	3.80	1.30	1.25	125	0.020	0.005	800	2500	22	ZP_9
FY_8 400-**	400	4500	4	1000	3.20	1.70	1.50	125	0.035	0.008	360	650	15	ZP_8
电压至 6500V (Up to 6500V)														
FY_9 400-**	460	6500	10	900	4.00	1.50	2.80	125	0.020	0.005	650	1300	22	ZP_9

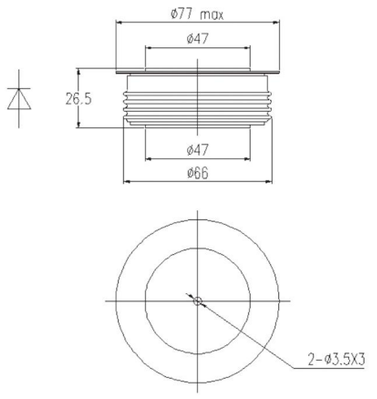
产品图示
PRODUCT DIAGRAM

FRD 产品 FRD PRODUCTS

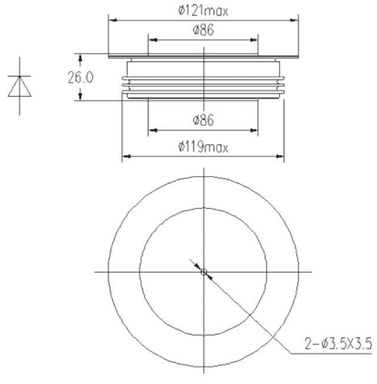
ZP_8



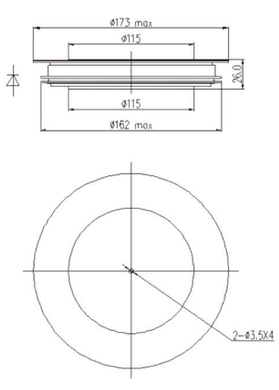
ZP_9



ZS_{B1}



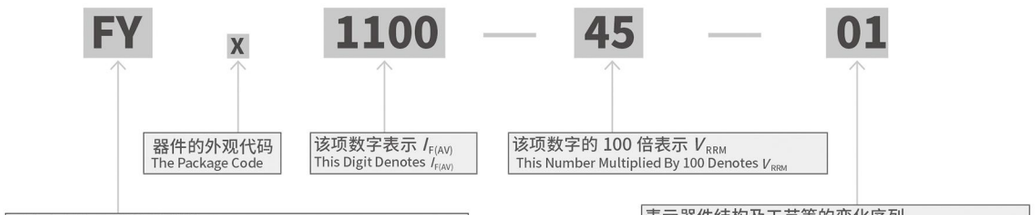
ZS_{D1}



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

型号说明
NOMENCLATURE

FRD 产品 FRD PRODUCTS



两个字母表示器件的种类
Two Character Denote The Device Category

符号 Symbols	器件种类 Device Types
FY	全压接型FRD Free floating type FRD
FD	低温焊接型FRD Low temperature bonding type FRD

表示器件结构及工艺等的变化序列
this Numbers Or Letters Represent Ordinal Numeral
For Varieties Of Divice Structure And Process

设计序号 Design number	具体含义 Specific meaning
00	标准型 Standard typ
01	低频型 Low-frequency type

符号说明
SYMBOLS

FRD 产品 FRD PRODUCTS

符号 Symbols	参数名称	Description
F	紧固力	Mounting Force
$I_{F(AV)}$	正向平均电流	Mean Forward Current
I_{FM}	正向峰值电流	Peak Forward Current
I_{FSM}	浪涌电流	Surge (Non-repetitive) Current
I_{rr}	反向恢复电流	Reverse Recovery Current
R_{thCH}	接触热阻	Thermal Resistance, Case to Heatsink
R_{thJC}	结壳热阻	Thermal Resistance, Junction to Case
Q_{rr}	反向恢复电荷	Reverse Recovery Charge
T_C	壳温	Case Temperature
T_{VJM}	最高(等效)结温	Max.VirtualJunction Temperature
V_{FM}	正向峰值电压	Peak Forward Voltage
V_{RRM}	反向重复峰值电压	Repetitive Peak Reverse Voltage

05

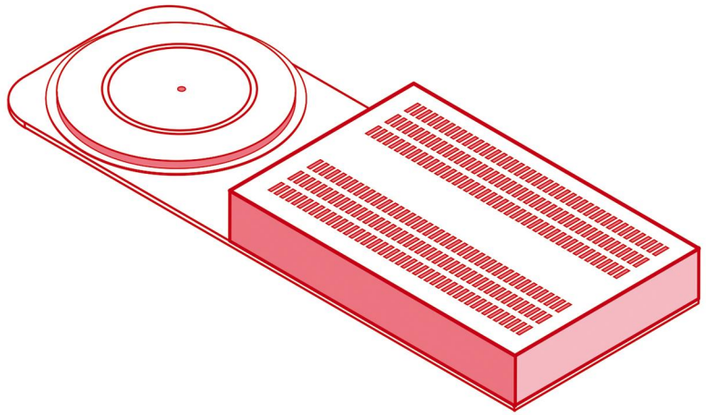
第五章
CHAPTER FIVE

集成门极换流晶闸管

IGCT

IGCT

集成门极换流晶闸管



集成门极换流晶闸管 IGCT

产品介绍
PRODUCT INTRODUCTION

集成门极换流晶闸管采用了缓冲层、透明阳极、门极硬驱动等新技术，是一种适用于5MVA 以上电能转换装置的中高压开关器件，广泛应用于电机驱动、节能环保、风力发电、船舶驱动、电能质量控制等功率装置中，促进电力电子成套装置在功率、可靠性、效率、成本、体积和重量等方面都取得了巨大进展。

The integrated gate commutated thyristor adopts new technologies such as buffer layer, transparent anode and gate hard drive. It is a medium and high voltage switching device suitable for power conversion equipments above 5MVA. It is widely used in power devices like motor drives, energy conservation and environmental protection, wind power generation, marine drives, and power quality control, promoting significant progress in power electronic complete sets of equipment in terms of power, reliability, efficiency, cost, volume, and weight.

产品特点
CHARACTERISTIC

集成门极驱动	Integrated Gate Driver
功率等级高	High Power Grade
通态损耗小	Low On-State Loss
浪涌电流大	High Surge Current
长期短路失效模式	Long-term Short-Circuit Failure Mode
电磁兼容能力强	Strong EMC Performance

非对称型号 A_S TYPE	I_{TGQM} T_{VJM}	$I_{T(AV)}$ T_C=85°C	V_{DRM} T_{VJM}	V_{RRM} T_{VJM}	I_{TSM} T_{VJM} 10ms	$V_{TM}@I_{TM}$ T_{VJM}		T_{VJM}	R_{thJC}	R_{thCS}	V_{TO} T_{VJM}	r_T T_{VJM}	F ±10%	外形 Outline
	A	A	V	V	kA	V	A	°C	K/W		V	mΩ	kN	
CA_C 4000-45	4000	1700	4500	17	32	2.7	4000	125	0.0085	0.003	1.40	0.325	40	CA_C
CA_C 4000-45-02	4000	2150	4500	17	35	1.9	4000	125	0.0085	0.003	1.05	0.213	40	CA_C
CA_C 5000-45	5000	1870	4500	17	33	2.35	4000	125	0.0085	0.003	1.22	0.280	40	CA_{2C}
CA_C 5000-45 Plus	5000	3000*	4500	17	35	2.61	5000	125	0.0085	0.003	1.22	0.280	40	CA_{3C}
CA_C 6500-45 ★	6500	2450	4500	17	40	1.98	4000	125	0.0068	0.0022	1.19	0.187	55	CA_{2C}
CA_C 4000-65	4000	2000*	6500	17	26	4.1	4000	125	0.0085	0.003	1.88	0.560	40	CA_{2C}
CA_E 8000-45	8000	3670	4500	17	64	2.30	8000	125	0.0046	0.0013	1.54	0.097	108	CA_E
CA_E 8000-65	8000	2740	6500	17	48	2.74	6000	125	0.0046	0.0013	1.24	0.250	108	CA_E

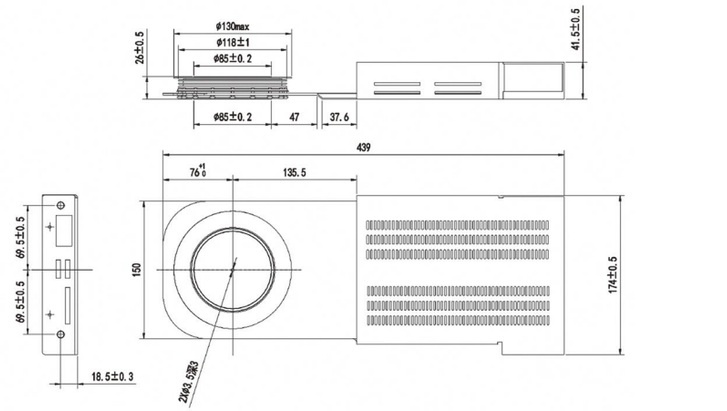
集成门极换流晶闸管 IGCT

逆阻型号 R_B TYPE	I_{TGQM} T_{VJM}	$I_{T(AV)}$ T_C=60°C	V_{DRM} T_{VJM}	V_{RRM} T_{VJM}	I_{TSM} T_{VJM} 10ms	$V_{TM}@I_{TM}$ T_{VJM}		T_{VJM}	R_{thJC}	R_{thCS}	V_{TO} T_{VJM}	r_T T_{VJM}	F ±10%	外形 Outline
	A	A	V	V	kA	V	A	°C	K/W		V	mΩ	kN	
CS_C 6000-25	6000	2620	2500	2500	42.2	1.04	1000	100	0.0085	0.003	0.87	0.18	40	CA_{2C}
CS_C 5000-33	5000	1930	3300	3300	34.5	1.61	2000	100	0.0085	0.003	1.11	0.261	40	CA_{2C}
CS_E 6000-45 ★	6000	3490	4500	4500	57.6	2.00	6000	90	0.0046	0.0013	1.13	0.134	108	CA_E
CS_E 10000-65 ★	10000	5000	6500	6500	50	2.20	5000	110	0.0032	0.0012	1.15	0.21	120	CS_E
CS_E 5500-80	5500	3290	8000	8000	40	2.58	5000	90	0.0036	0.0012	1.26	0.26	120	CS_E

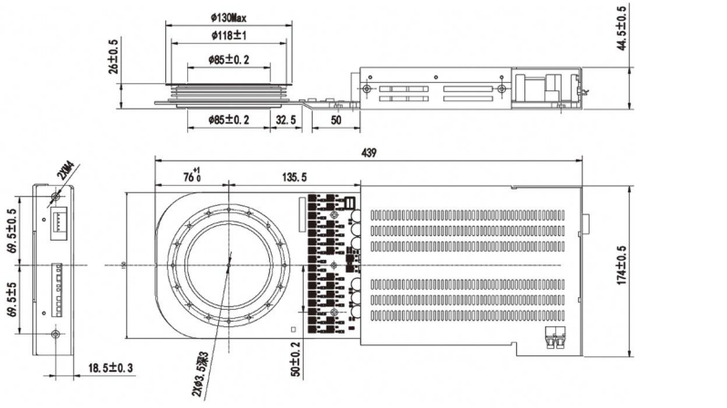
注：1、* 直流连续电流；2、★预研产品
Remark：1、*DC continuous current；2、★ Developing products

产品图示
PRODUCT DIAGRAM

CA_C



CA_{2C}

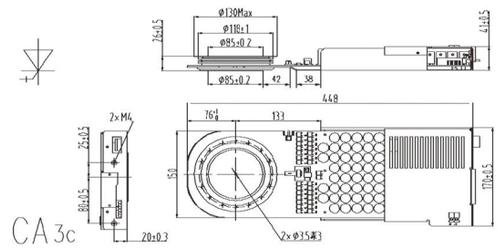


注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

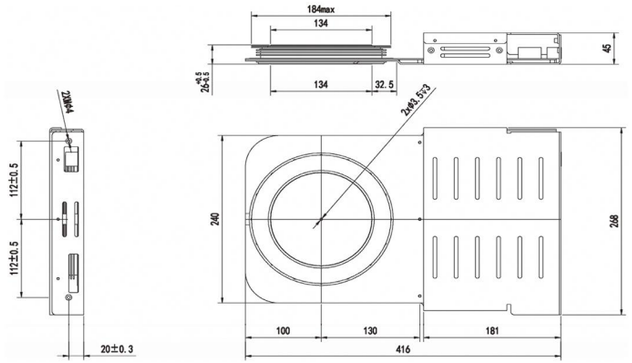
产品图示
PRODUCT DIAGRAM

集成门极换流晶闸管 IGCT

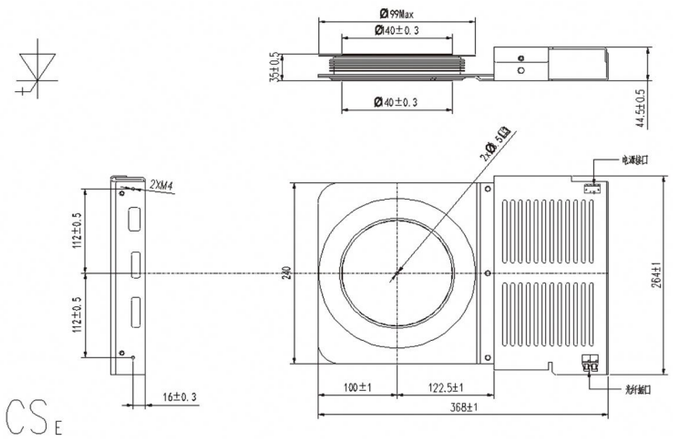
CA_{3C}



CA_E



CS_E



注:未标注数量单位的统一为毫米(mm)
Remarks: All dimensions shown in mm unless stated otherwise

型号说明
NOMENCLATURE

集成门极换流晶闸管 IGCT

CA — **C** — **4000** — **45** — **00**

- **CA**：两个字母表示器件的种类 Two Characters Denote The Device Category

符号 Symbols	器件种类 Device Types
CA	非对称型 IGCTs Asymmetric IGCTs
CR	逆导型 IGCTs Reverse Conducting IGCTs
CS	逆阻型 IGCTs Symmetric IGCTs

- **C**：一个数字或字母表示器件的芯片直径 One Digit Or Letter Denotes The Chip Diameter
- **4000**：该项数字表示 I_{TGQM} This Digit Denotes I_{TGQM}
- **45**：该项数字的 100 倍表示 V_{RRM} This Number Multiplied By 100 Denotes V_{RRM}
- **00**：表示器件结构及工艺等的变化序列 Denotes The Variation Sequence Of Device Structure And Process

设计序号 Design number	具体含义 Specific meaning
缺省 Vacancy	标准型 Standard type
01	高频型 High-frequency type
02	低频型 Low-frequency type

符号说明
SYMBOLS

集成门极换流晶闸管 IGCT

符号 Symbols	参数名称	Characteristics
F	紧固力	Mounting Force
I_{DRM}	断态重复峰值电流	Repetitive Peak Off-state Current
$I_{T(AV)}$	GCT 通态平均电流	Average On-state Current
I_{TGQM}	可关断通态峰值电流	Maximum Controllable Peak On-state Current
I_{TM}	GCT 通态峰值电流	Peak On-state Current
I_{TSM}	GCT 通态不重复浪涌电流	Surge (Non-repetitive) On-state Current
r_T	GCT 斜率电阻	Slope Resistance for GCT
T_C	壳温	Case Temperature
T_{VJM}	最高(等效)结温	Max.Junction Operating Temperature
V_{DRM}	断态重复峰值电压	Repetitive Peak Off-state Voltage
V_{RRM}	反向重复峰值电压	Repetitive Peak Reverse Voltage
V_{TM}	通态峰值电压	Peak On-state Voltage at I_{TM}
V_{TO}	GCT 门槛电压	Threshold Voltage for GCT
CS	命令信号	Command Signal
SF	反馈信号	Transmitter for Status Feedback

06

第六章
CHAPTER SIX

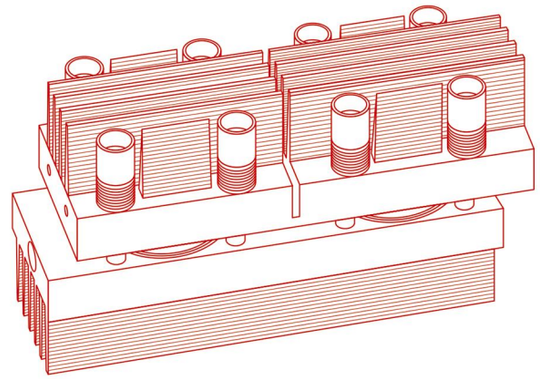
功率组件

POWER ASSEMBLIES

株洲中车时代半导体股份有限公司
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

POWER ASSEMBLIES

功率组件



双极功率组件 BIPOLAR POWER ASSEMBLIES

功率组件 POWER ASSEMBLIES

产品介绍 PRODUCT INTRODUCTION

功率组件是集成了散热装置和用户使用端口(控制和电源连接)的功率半导体,我们拥有丰富的双极型半导体功率组件产品系列,同时也可以为客户量身定制可靠的功率组件,并为此提供优质的技术服务。

为提高组件产品性能和竞争力,中车时代半导体公司已开发出多款具备可靠性能和优良组装性的平台式组件。在此基础上,我们可以在很短的时间内,开发扩展出各种不同的组件形式,达到最佳的使用效果。系列化的组件比按照客户特殊要求生产的组件更有优势,它能很快的提供给用户并保证备件供应。因此,建议您尽可能采用现成的平台式组件。

Power modules are power semiconductors integrated with heat dissipation devices and user ports (control and power connections). We offer a comprehensive range of bipolar semiconductor power modules, and can also provide customers with customized reliable power modules along with high-quality technical services.

To enhance the performance and competitiveness of module products, CRRC Times Semiconductor has developed a variety of platform-based modules with reliable performance and excellent assemblability. On this basis, we can develop and expand various module forms in a short time to achieve optimal application results. Serialized modules have advantages over those produced according to specific customer requirements: they can be delivered to users quickly and ensure spare parts supply. Therefore, we recommend that you use existing platform-based modules as much as possible.

产品特点 CHARACTERISTIC

集成压装、散热、驱动	Integrated Press-fitting, Cooling, Gate driver
高可靠性	High Reliability
国标通用	National Standard
定制研发	Customized Development

风冷双极功率组件 AIR-COOLING POWER ASSEMBLIES

国标风冷组件 GB AIR-COOLING ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	元件数量 The Number of Devices	适应最大元件 Applicable Devices	冷却方式 Cooling Method	风速 Air Speed	热阻 Rsa Thermal Resistance	重量(单个散热器) Weight (Heatsink)	散热器材质 Heatsink Material	外形图 Outline
					m/s	K/W	kG		
tPower-SA. KP(ZP)*****F	Sf12(国标)	1	KP_8、ZP_8	风冷 Air-cooling	6	≤ 0.090	2.6	铝型材 Aluminium Heatsink	Fig.1
	Sf13(国标)	1	KP_9、ZP_9	风冷 Air-cooling	6	≤ 0.071	3.5	铝型材 Aluminium Heatsink	Fig.2
	Sf14(国标)	1	KP_9、ZP_9	风冷 Air-cooling	6	≤ 0.056	4.9	铝型材 Aluminium Heatsink	Fig.3
	Sf15(国标)	1	KP_9、ZP_9	风冷 Air-cooling	6	≤ 0.048	6	铝型材 Aluminium Heatsink	Fig.4
	Sf16(国标)	1	KP_X、ZP_X	风冷 Air-cooling	6	≤ 0.037	9.5	铝型材 Aluminium Heatsink	Fig.5
	Sf17(国标)	1	KP_B、ZP_B	风冷 Air-cooling	6	≤ 0.030	13.5	铝型材 Aluminium Heatsink	Fig.6

产品图示 PRODUCT DIAGRAM

FIG.1

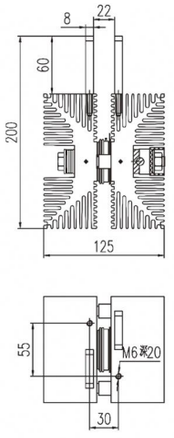
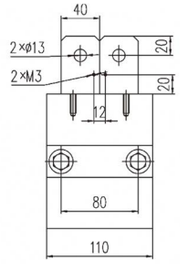
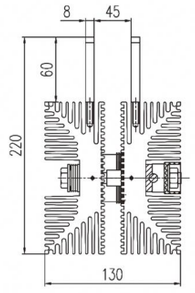
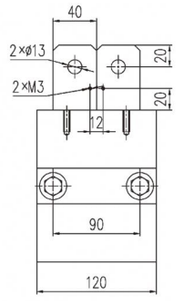
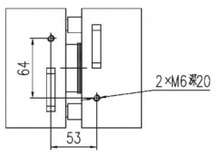


FIG.2









注:未标注数量单位的统一为毫米(mm)
Remarks: All dimensions shown in mm unless stated otherwise

产品图示
PRODUCT DIAGRAM

国标风冷组件 GB AIR-COOLING ASSEMBLIES

FIG.3

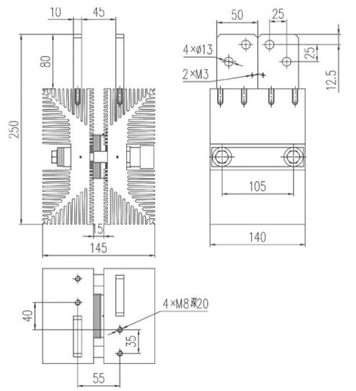


FIG.4

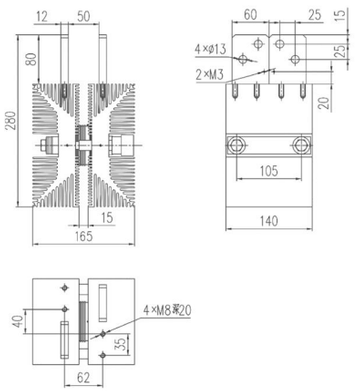


FIG.5

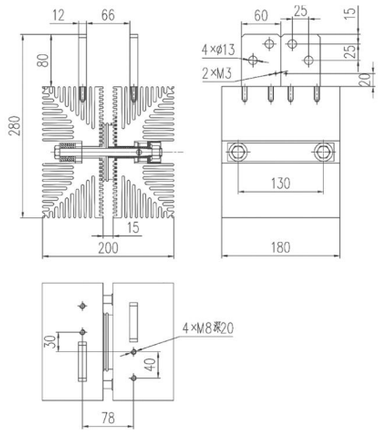
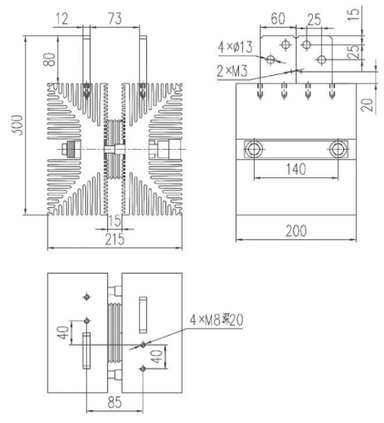


FIG.6



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

常用型材风冷组件 EXTRUDED ALUMINUM AIR-COOLING ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	元件数量 The Number of Devices	适应最大元件 Applicable Devices	冷却方式 Cooling Method	风速 Air Speed	热阻曲线 Rsa Thermal Resistance Curve	散热器重量 Weight (Heatsink)	散热器材质 Heatsink Material	外形图 Outline
					m/s	K/W	kG/M		
tPower-SA. KP(ZP)*****F	ZB16	≤3	KP_7、ZP_7	风冷 Air-cooling	6	-	5.13	铝型材 Aluminium Heatsink	Fig.6
	ZB17	≤3	KP_8、ZP_8	风冷 Air-cooling	6	-	5.13	铝型材 Aluminium Heatsink	Fig.7
	ZB18	≤3	KP_9、ZP_9	风冷 Air-cooling	6	Fig.1	6.62	铝型材 Aluminium Heatsink	Fig.8
	XF12	≤3	KP_9、ZP_9	风冷 Air-cooling	6	Fig.2	8.4	铝型材 Aluminium Heatsink	Fig.9
	XF15	≤3	KP_X、ZP_X	风冷 Air-cooling	6	Fig.3	23.8	铝型材 Aluminium Heatsink	Fig.10
	DXC615	≤3	KP_C、ZP_C	风冷 Air-cooling	6	Fig.4	28.7	铝型材 Aluminium Heatsink	Fig.11
	XSF19	≤3	KP_D、ZP_D	风冷 Air-cooling	6	Fig.5	37	铝型材 Aluminium Heatsink	Fig.12

热阻曲线
RSA THERMAL RESISTANCE CURVE

FIG.1

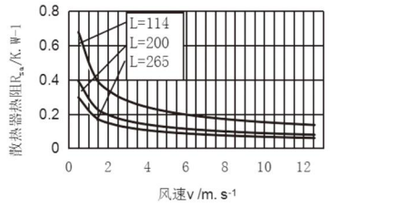


FIG.1

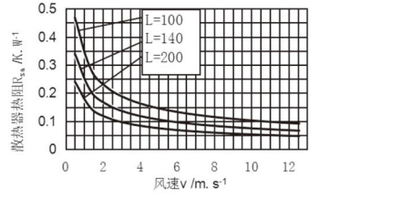


FIG.3

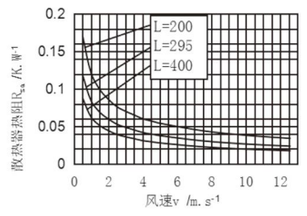


FIG.4

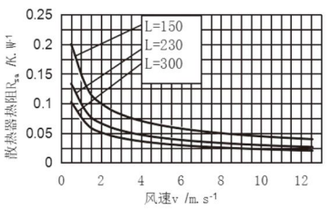
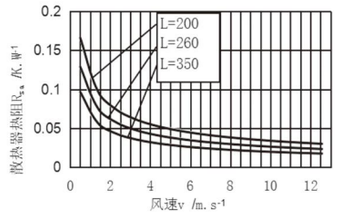


FIG.5



产品图示
PRODUCT DIAGRAM

常用型材风冷组件 EXTRUDED ALUMINUM AIR-COOLING ASSEMBLIES

FIG.6

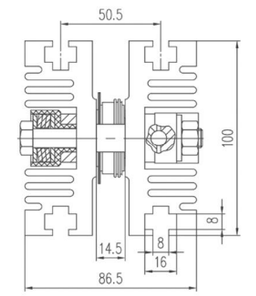


FIG.7

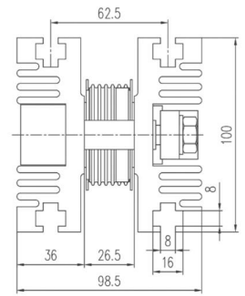


FIG.8

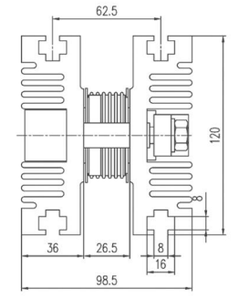


FIG.9

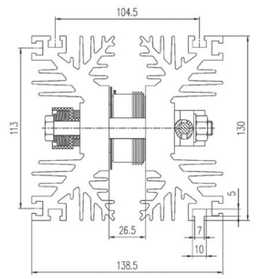


FIG.10

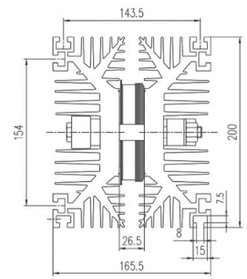


FIG.11

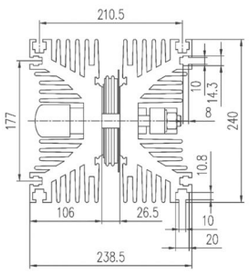
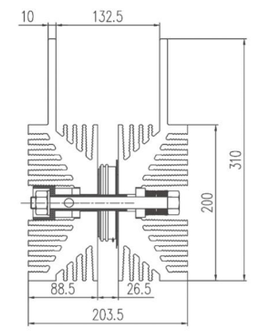


FIG.12



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

特殊风冷组件 SPECIAL AIR-COOLING ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	元件数量 The Number of Devices	适应最大元件 Applicable Devices	冷却方式 Cooling Method	风速 Air Speed	热阻 Rsa Thermal Resistance	重量（单个散热器）Weight (Heatsink)	散热器材质 Heatsink Material	外形图 Outline
					m/s	K/W	kG		
tPower-SA. KP(ZP)*****F	LSP6	1	KP_7、ZP_7	自冷 Nature-cooling	—	⩽ 0.8	2.2	铝型材 Aluminium Heatsink	Fig.1
	LSF8	1	KP_8、ZP_8	风冷 Air-cooling	6	⩽ 0.09	4.5	铝型材 Aluminium Heatsink	Fig.2
	LSFA	1	KP_A、ZP_A	风冷 Air-cooling	6	⩽ 0.045	8.5	铝型材 Aluminium Heatsink	Fig.3
	TSFA-1	1	KP_A、ZP_A	风冷 Air-cooling	6	⩽ 0.05	12	铜 Copper	Fig.4
	TSFA-3	1	KP_A、ZP_A	风冷 Air-cooling	6	⩽ 0.044	13	铜 Copper	Fig.5
	ZS331	1	KP_X、ZP_X	风冷 Air-cooling	6	⩽ 0.026	18	铜 Copper	Fig.6

产品图示
PRODUCT DIAGRAM

FIG.1

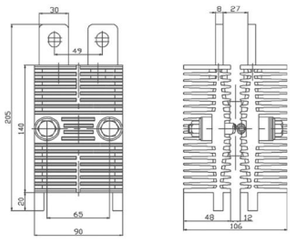


FIG.2

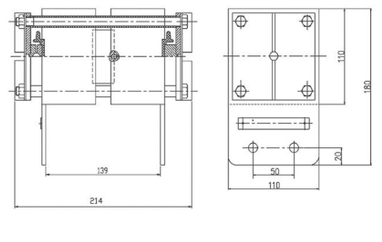


FIG.3

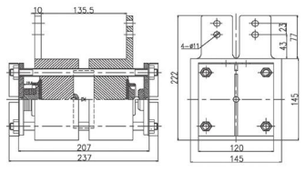


FIG.4

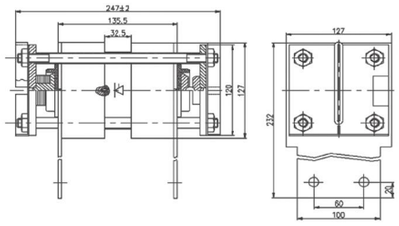


FIG.5

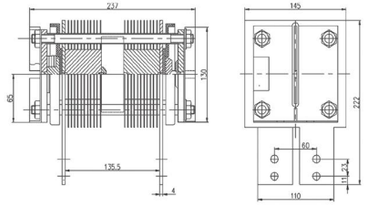
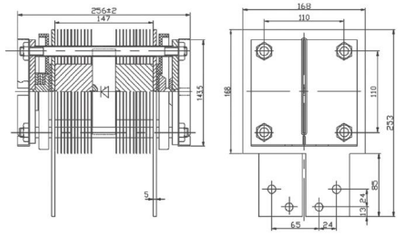


FIG.6



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

液冷双极功率组件 LIQUID-COOLING POWER ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	元件数量 The Number of Devices	适应最大元件 Applicable Devices	冷却方式 Cooling Method	流量 Flow L/min	热阻 RsaThermal Resistance K/W	重量 Weight kG	外形图 Outline
tPower-SA. KP(ZP)*****S	SS12	1	KP8、ZP8	液冷 Liquid-cooling	4	⩽ 0.018	1.1	Fig.1
	SS13	1	KP9、ZP9	液冷 Liquid-cooling	4	⩽ 0.015	1.6	Fig.2
	SS14	1	KPX、ZPX	液冷 Liquid-cooling	4	⩽ 0.013	2.2	
	SS15	1	KPB、ZPB	液冷 Liquid-cooling	4	⩽ 0.010	4.4	Fig.3
	SS16	1	KPC、ZPC	液冷 Liquid-cooling	4	⩽ 0.008	5	
	SS12 串联	2	KP8、ZP8	液冷 Liquid-cooling	4	⩽ 0.018	1.9	Fig.4
	SS13 串联	2	KP9、ZP9	液冷 Liquid-cooling	4	⩽ 0.015	2.9	Fig.5
	SS14 串联	2	KPX、ZPX	液冷 Liquid-cooling	4	⩽ 0.013	4.1	
	SS15 串联	2	KPB、ZPB	液冷 Liquid-cooling	4	⩽ 0.010	8	Fig.6

型号 Type	尺寸 Dimension																
	H	H2	H3	H4	H5	H6	H7	D	D1	D2	D3	L	L1	L2	d1	d2	d3	d4
tPower-SA. KP(ZP)*****S	152	110	65	5	145	24.5	-	160	140	40	-	190	20	-	ϕ13	M3	ϕ13	ϕ11X14
	157	108	64	6	150	25	-	160	140	50	20	190	15	20	ϕ13	M4	ϕ13	ϕ11X14
	198	125	64	6	170	25	-	195	161	54	20	220	20	20	ϕ13	M4	ϕ13	ϕ11 开口
	230	158	80	8	220	35	-	260	220	80	40	263	20	40	ϕ13	M4	ϕ16	ϕ11 开口
	230	158	80	8	220	35	-	260	220	80	40	290	20	40	ϕ13	M4	ϕ16	ϕ11 开口
	240	180	65	5	230	24.5	44	160	140	40	-	190	20	-	ϕ13	M3	ϕ13	ϕ11X14
	240	178	64	6	230	25	44	160	140	50	20	190	15	20	ϕ13	M4	ϕ13	ϕ11X14
	250	188	64	6	240	25	44	195	161	54	20	220	20	20	ϕ13	M4	ϕ13	ϕ11 开口
	320	248	80	8	310	35	62	260	220	80	40	263	20	40	ϕ13	M4	ϕ16	ϕ11 开口

产品图示 PRODUCT DIAGRAM

液冷双极功率组件 LIQUID-COOLING POWER ASSEMBLIES

FIG.1

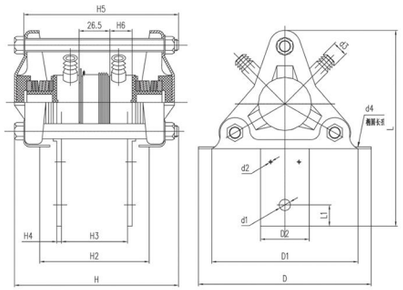
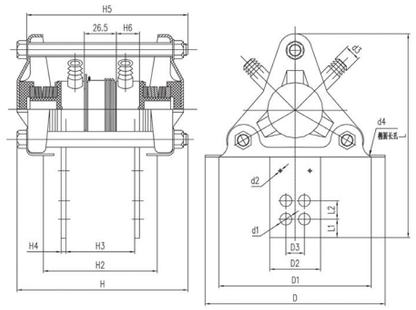


FIG.2



产品图示 PRODUCT DIAGRAM

液冷双极功率组件 LIQUID-COOLING POWER ASSEMBLIES

FIG.3

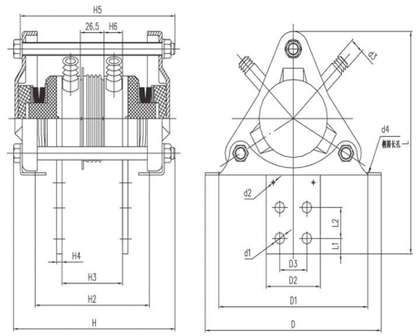


FIG.4

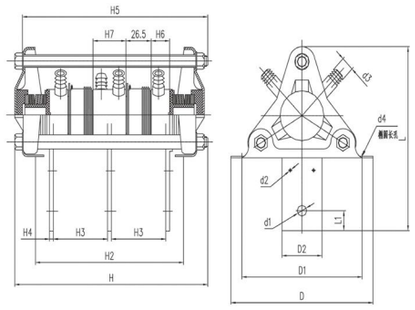


FIG.5

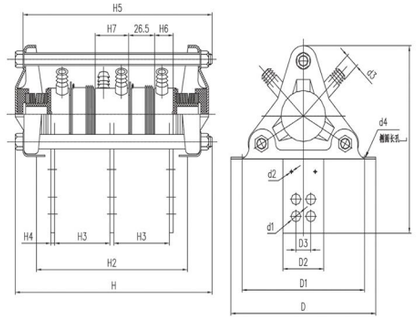
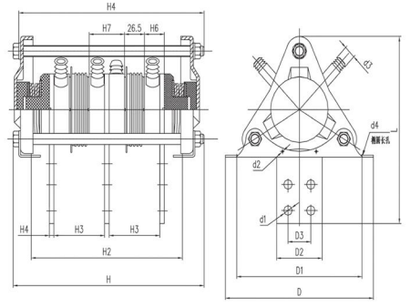


FIG.6



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

液冷双极功率组件 LIQUID-COOLING POWER ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	元件数量 The Number of Devices	适应最大元件 Applicable Devices	冷却方式 Cooling Method	流量 Flow	热阻 RsaThermal Resistance	外形图 Outline
					L/min	K/W	
tPower-SA. KP(ZP)*****S	SS16-1245G4C	4	KP_C、ZP_C	液冷 Liquid-cooling	4	⩽ 0.016	Fig.1
	SS15-886G6X	6	KP_X ZP_X	液冷 Liquid-cooling	4	⩽ 0.020	Fig.2

产品图示 PRODUCT DIAGRAM

FIG.1

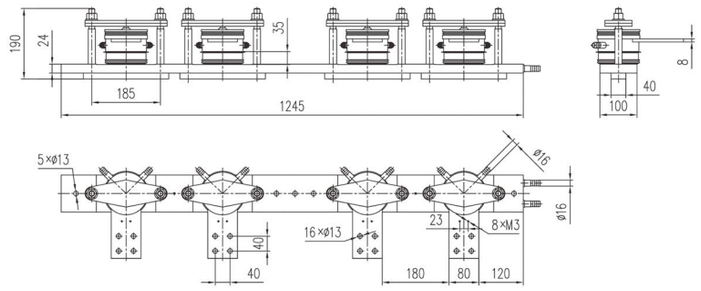
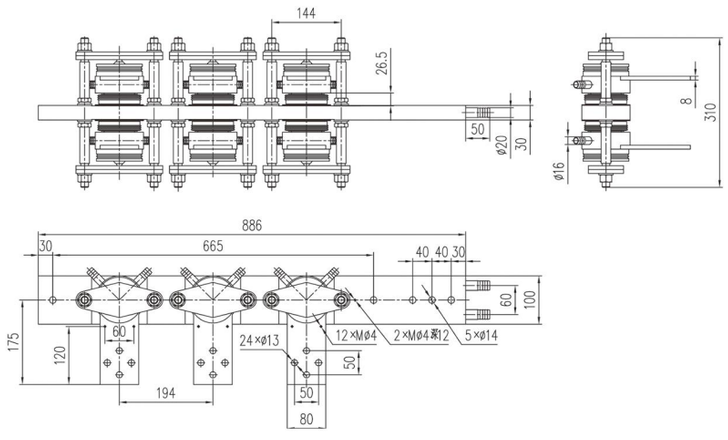


FIG.2



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

定制式双极功率组件 CUSTOMIZED POWER ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	元件数量 The Number of Devices	适用元件 Applicable Devices	冷却方式 Cooling Method	输出电流 Irms	V_{DRM}/V_{RRM}	触发接口 Trigger Interface	频率 Frequency	示意图 Sketch
					A	kV		Hz	
tPower-SA. KP(ZP)*****F	定制 Commission	⩽6	相控晶闸管及整流管 PCT&Rectifier Diodes	风冷 Air-cooling	⩽ 3000	⩽ 25	—	⩽ 100	Fig.1
tPower-SA. KK(KP)*****S	定制 Commission	⩽8	相控晶闸管及整流管 PCT&Rectifier Diodes	液冷 Liquid-cooling	—	⩽ 35	光纤 Optical fiber	⩽ 100	Fig.2
tPower-SA. KP*****N	定制 Commission	⩽ 12	相控晶闸管及整流管 PCT&Rectifier Diodes	自冷 Self-cooling	—	⩽ 50	光纤 Optical fiber	⩽ 100	Fig.3
	定制 Commission	⩽ 14	相控晶闸管及整流管 PCT&Rectifier Diodes	自冷 Self-cooling	—	⩽ 50	光纤 Optical fiber	⩽ 100	Fig.4

产品图示 PRODUCT DIAGRAM

FIG.1

FIG.2

FIG.3

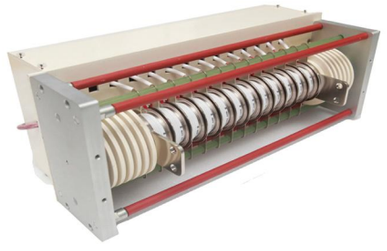


FIG.4

IGCT 功率组件 IGCT POWER ASSEMBLIES

型号 Type	散热器型号 Heatsink Type	拓扑结构 Topological Structure	冷却方式 Cooling Method	功率等级 Power	输出电流 I	V_{DC}	触发接口 Trigger Interface	频率 Frequency	示意图 Sketch
				MVA	A	kV		Hz	
tPower-SA.C***ML**S	定制 Commission	3L-NPC	液冷 Liquid-cooling	⩽ 14	⩽ 2500	⩽7	光纤 Optical fiber	⩽ 1000	Fig.1
tPower-SA.C***B**S	定制 Commission	半桥 Half bridge	液冷 Liquid-cooling	⩽5	⩽ 1500	⩽ 3.6	光纤 Optical fiber	⩽ 1000	Fig.2
tPower-SA.C***H**F	定制 Commission	H桥 H bridge	定制 Commission	—	⩽ 5000	⩽ 10	光纤 Optical fiber	—	Fig.3
tPower-SA.C***H**F	定制 Commission	断路器	定制 Commission	—	⩽ 3000	⩽ 10	光纤 Optical fiber	—	Fig.4

产品图示 PRODUCT DIAGRAM

FIG.1

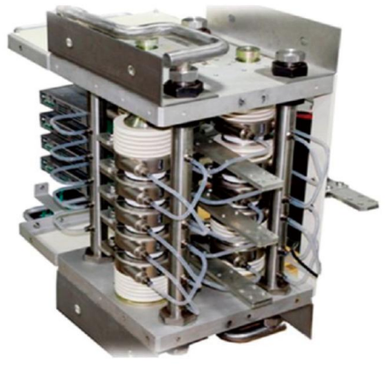


FIG.2

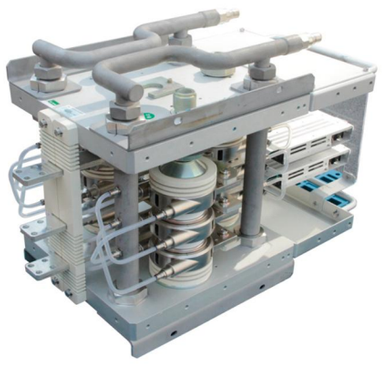
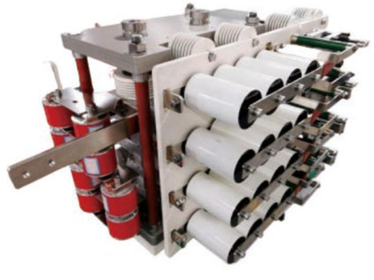


FIG.3

FIG.4



双极模块 BIPOLAR MODULES

软启动模块 SOFT STARTER MODULES

型号 Type	$I_{overload}$(21s)	V_{DRM}/ V_{RRM}	I_{TSM} @ T_{vj}=125°C ,10ms	I^2t @T_{vjmax}	V_{TO}@ T_{vj} = 125°C	r_T@ T_{vj} = 125°C	T_{vjmax}	重量 Weight	外形图 Outline
	A	V	kA	A^2s	V	mΩ	°C	kG	
tPower-SA.KP12X14FJ	1200	1400	12.8	81.9×10^4	0.87	0.382	150	1.4	Fig.1
tPower-SA.KP15X14FJ	1500	1400	15	113×10^4	0.85	0.33	150	1.4	Fig.1
tPower-SA.KP12X18FJ	1200	1800	10	50×10^4	0.9	0.46	150	1.4	Fig.1
tPower-SA.KP15X18FJ	1500	1800	14	98×10^4	0.85	0.37	150	1.4	Fig.1
tPower-SA.KP15X14FJ1	1680	1400	15	113×10^4	0.85	0.33	150	1.85	Fig.2
tPower-SA.KP15X18FJ1	1560	1800	14	98×10^4	0.85	0.38	150	1.85	Fig.2
tPower-SA.KP30X14FJ	3120	1400	26	338×10^4	0.86	0.16	150	3.4	Fig.3
tPower-SA.KP30X18FJ	3060	1800	25	313×10^4	0.88	0.2	150	3.4	Fig.3

产品图示 PRODUCT DIAGRAM

FIG.1

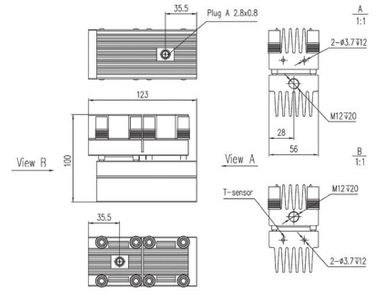


FIG.2

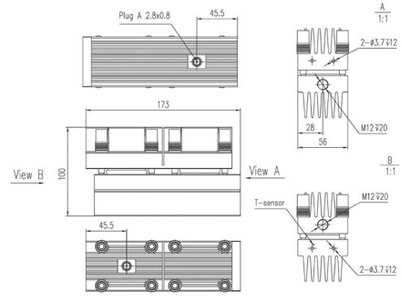


FIG.3

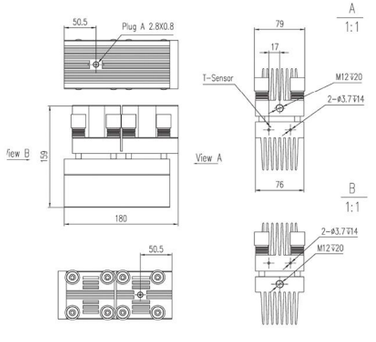


FIG.1

FIG.3

FIG.3

注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

压接型晶闸管模块 PRESS-CONNECT THYRISTOR MODULES

型号 Type	V_{DRM}/V_{RRM}	I_{TAV}	I_{TSM} @T_{vjM}&10ms	V_{To} @ T_{vjM}	r_T @T_{vjm}	T_{vj} Max	R_{thJC} Per Chip	R_{thCH} Per Chip	外形图 Outline
	V	A	kA	V	mΩ	℃	K/W	K/W	
TMTO 600-xx	1200-1800	600	20	0.88	0.27	130	0.065	0.02	Fig.1
TMTO 320-xx	3000-3600	325	7	1.03	0.97	125	0.068	0.02	Fig.1
TMTO 260-xx	3600-4200	274	6.5	1.15	1.47	125	0.068	0.02	Fig.1
TMTO 185-xx	5800-6500	185	2.3	1.45	2.9	125	0.078	0.02	Fig.1
TMTC 570-xx	1200-1800	570	4.5	0.93	1.15	130	0.2	0.06	Fig.2
TMTC 275-xx	3600-4200	277	6.8	1.15	1.47	125	0.068	0.02	Fig.2
TMTO 800-xx	1200-1800	800	32	0.91	0.158	125	0.042	0.01	Fig.3
TMTO 400-xx	4500-5600	398	16	1.2	1.05	125	0.045	0.01	Fig.3
TMTC 330-xx	1200-1800	330	10.5	0.87	0.45	130	0.11	0.02	Fig.4
TMTC 220-xx	2400-3600	222	7.5	0.98	1.2	125	0.11	0.02	Fig.4
TMTC 1000-xx	800-1400	1000	29	0.86	0.13	130	0.05	0.016	Fig.5
TMTC 160-xx	1200-1800	160	20	0.85	0.27	130	0.065	0.02	Fig.6

产品图示 PRODUCT DIAGRAM

FIG.1

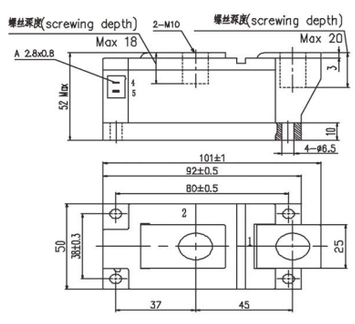


FIG.2

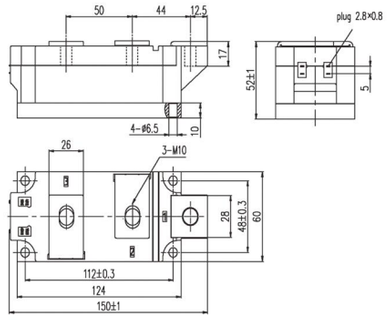


FIG.3

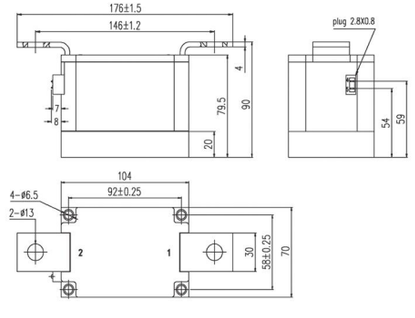
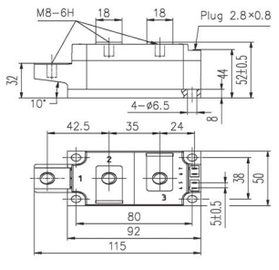


FIG.4



产品图示 PRODUCT DIAGRAM

FIG.5

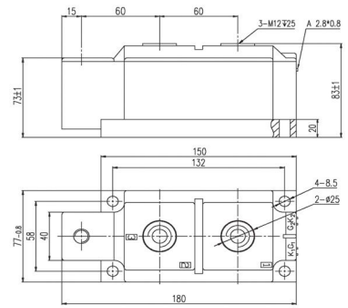
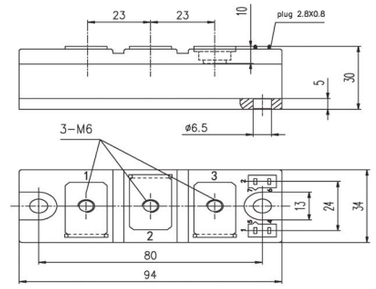
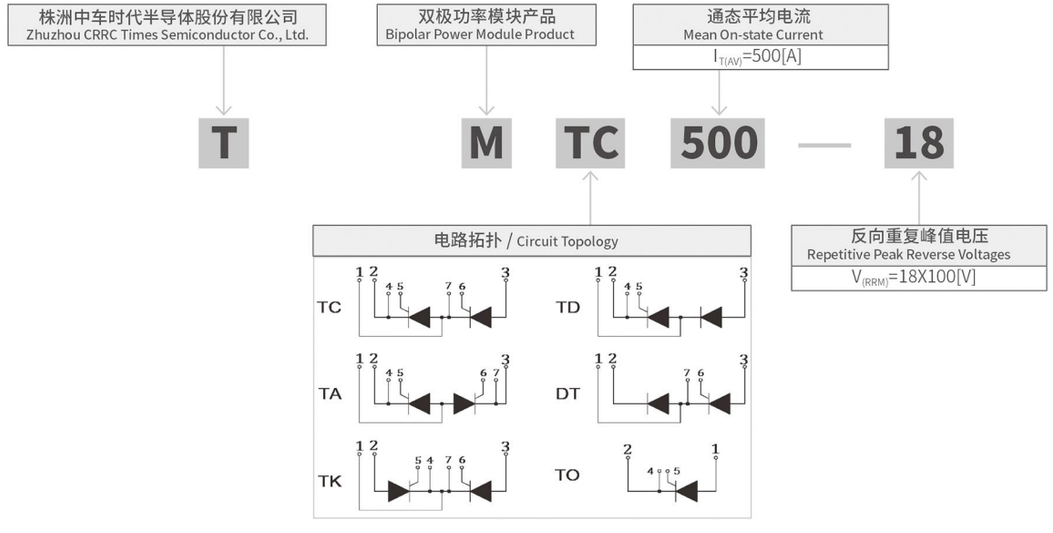


FIG.6



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

型号说明 NOMENCLATURE 晶闸管模块 THYRISTOR MODULE'S TYPES



压接型二极管模块 PRESS-CONNECT RECTIFIER DIODE MODULE

型号 Type	V_{RRM}	I_{FAV}	I_{FSM} @T_{vjM}&10ms	V_{Fo} @ T_{vjM}	r_T @ T_{vjm}	T_{vj} Max	R_{thJC} Per Chip	R_{thCH} Per Chip	外形图 Outline
	V	A	kA	V	mΩ	℃	K/W	K/W	
TMDD 280-xx	5600-6500	282	9	0.98	1.05	140	0.085	0.02	Fig.1
TMDD 700-xx	1800-2200	700	21	0.8	0.17	150	0.065	0.02	Fig.2
TMDD 500-xx	2400-3400	500	13	0.88	0.46	150	0.068	0.02	Fig.2
TMDD 430-xx	3400-4200	438	13	0.94	0.68	150	0.068	0.02	Fig.2
TMDO 700-xx	1800-2200	700	21	0.92	0.17	150	0.056	0.02	Fig.3
TMDD 430-xx	3600-4500	430	12	0.96	0.7	150	0.07	0.02	Fig.3
TMDO 300-xx	5600-6500	315	7.5	0.9	0.8	140	0.07	0.02	Fig.3
TMDO 1200-xx	1800-2200	1200	35	0.81	0.125	160	0.042	0.01	Fig.4
TMDO 950-xx	3600-4400	946	29	0.96	0.235	160	0.045	0.01	Fig.4
TMDD 600-xx	3600-4500	634	20	0.95	0.4	150	0.05	0.02	Fig.5
TMDD 360-xx	1800-2200	360	11	0.82	0.433	150	0.11	0.02	Fig.6
TMDD 320-xx	2800-3400	320	10	0.9	0.65	150	0.11	0.02	Fig.6
TMDD 200-xx	1800-2200	200	5.2	0.95	0.65	150	0.2	0.06	Fig.7
TMDD 1000-28	2800	1000	32	0.8	0.18	150	0.05	0.008	Fig.8

产品图示
PRODUCT DIAGRAM

FIG.1

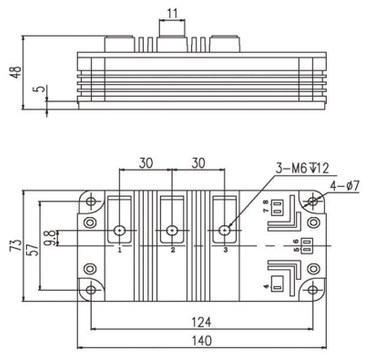
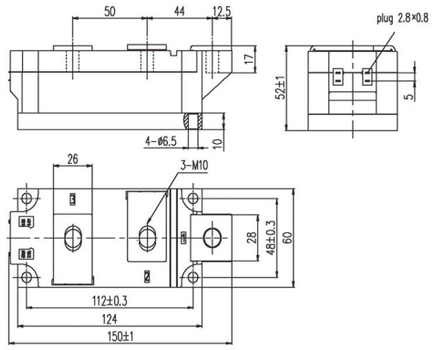


FIG.2



产品图示
PRODUCT DIAGRAM

FIG.3

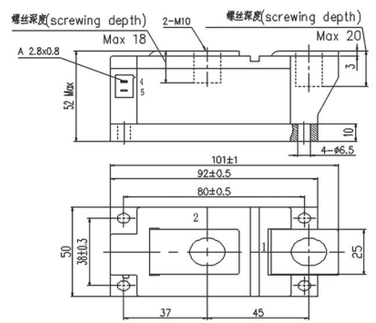


FIG.4

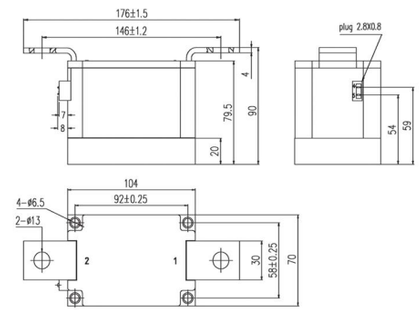


FIG.5

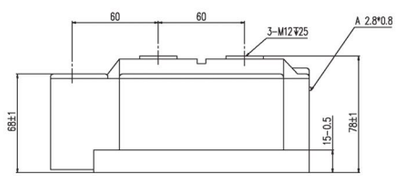


FIG.6

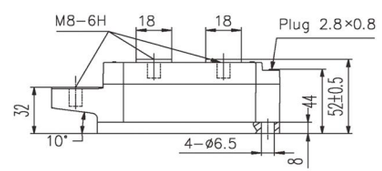


FIG.7

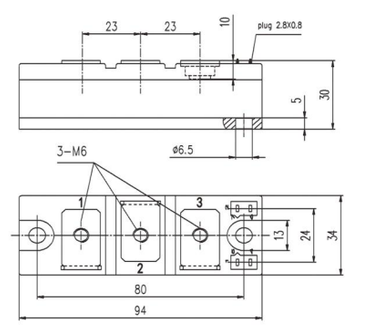
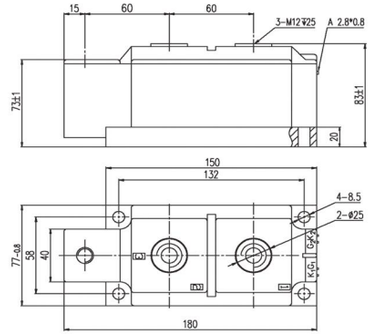


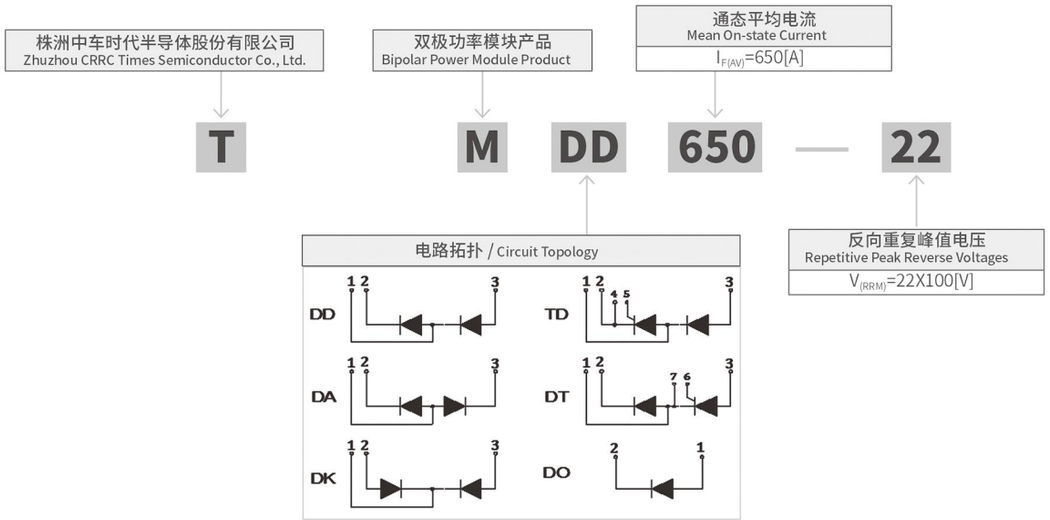
FIG.8



注：未标注数量单位的统一为毫米（mm）
Remarks: All dimensions shown in mm unless stated otherwise

型号说明
NOMENCLATURE

二极管模块 DIODE MODULE'S TYPES



符号说明
SYMBOLS

双极功率模块 BIPOLAR POWER MODULE

符号 Symbols	参数名称	Characteristics
I_{TAV}	通态平均电流	Mean on-state current
I_{TSM}	通态浪涌电流	Surge on-state current
V_{TO}	通态门槛电压	On-state threshold voltage
r_T	通态斜率电阻	On-state slope resistance
T_{vjmax}	最高结温	Max.junction temperature
R_{thJC}	结壳热阻	Thermal resistance,junction to case
R_{thCH}	接触热阻	Thermal resistance,case to heatsink
I_{FAV}	正向平均电流	Mean forward current
I_{FSM}	正向浪涌电流	Surge forward current
V_{FO}	正向门槛电压	Forward threshold voltage
r_F	正向斜率电阻	Forward slope resistance
V_{RRM}	反向重复峰值电压	Repetitive peak off revese voltage
V_{DRM}	断态重复峰值电压	Repetitive peak off-state voltage

质量体系与保障
QUALITY SYSTEM & INSURANCE

ISO9001
证书


Bureau Veritas Certification

ZHUZHOU CRRC TIMES ELECTRIC CO., LTD.

Bureau Veritas Certification (Beijing) Co., Ltd. certifies that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standards detailed below

GB/T 19001-2016/ISO 9001:2015

The above site is part of the Management System of the below organisation:

ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

TIANXIN HIGH-TECH PARK, SHIFENG DISTRICT, 412001 ZHUZHOU CITY, HUNAN PROVINCE, CHINA
Unified social credit code: 91430200MA4QBF90X6

Design and development, manufacturing, sales and service of Power Semiconductor and related products

Certificate No.: **CN040873-003**
Version: **No.1**, Issue date: **07-12-2023**

The validity of this certificate depends on the validity of the main certificate, which expires on: **28-12-2026**

CNAS 中国认可 管理体系 MANAGEMENT SYSTEM CNAS C150-M

Signed on behalf of Bureau Veritas Certification (Beijing) Co., Ltd.

Certification body address: Room 02, 9 / F, West Office Building 1, Oriental Economic and Trade City, Oriental Plaza, No.1 East Chang'an Street, Dongcheng District, Beijing, China. 100738

Further clarifications regarding the scope and validity of this certificate, and the applicability of the management system requirements, please call: +86 10 59683888
Certified organisation has to accept and pass regular surveillance audits, then this certificate can be continuously valid.
Information of this certificate may be obtained by visiting CNCA website (www.cnca.gov.cn).

Page 1 of 1

TS22163
证书


Bureau Veritas Certification

IRIS Certification

CERTIFICATE

awarded to

Zhuzhou CRRC Times semiconductor Co.,LTD
Tianxin High-Tech Park, Shifeng District
412001, Zhuzhou city,Hunan Province
China

BUREAU VERITAS CERTIFICATION

confirms, as an IRIS Certification® approved certification body, that the Management System of the above organization has been assessed and found to be in accordance with the

IRIS Certification® Conformity assessment:2020
and based on
ISO/TS 22163:2017

for the activities of Design and Development and Manufacturing
for the scopes of certification: 04 (Power system, drive unit), 19 (Single railway components)
Design and development, manufacturing and service of Power Semiconductor and related products

Certificate valid from: 30/09/2023 Certificate valid until: 29/09/2026*

Current date: 27/09/2023
Certificate-Register-No: CHN-IR - 000 1824

* Providing that the subsequent surveillance audits are successful before the validity date of the previous audit.
Certification body address: TOUR ALTO 1 PLACE ZAHA HADID CS 40381, 92062 Paris la Defense Cedex, France

1/1

质量体系与保障 QUALITY SYSTEM & INSURANCE

IATF16949
证书

Bureau Veritas Certification

Certificate of Approval

AWARDED TO

Zhuzhou CRRC Times Semiconductor Co., Ltd.

No.29 Boya Road, Shifeng District, Zhuzhou City, Hunan Province, 412001, China

IATF USI: YRE256

Bureau Veritas Certification certify that the Quality Management System of the above organisation has been audited and found to be in accordance with the requirements of

IATF 16949 - FIRST EDITION

and the applicable customer specific requirements

SCOPE

Design and manufacturing

PERMITTED EXCLUSION(S)

None

PRODUCT(S) DELIVERED

Power Semiconductor Devices

Date Of Certification: 13-09-2023

Date Of Expiration: 12-09-2026

IATF Certificate N°: 0483275

Bureau Veritas Certification Certificate No: CN046093-1 - IATF **Revision: 1**

For Bureau Veritas Certification Holding, Tour ALTO, 4 place des saisons, 92400 COURBEVOIE - France
(The official document is in English. Any translations of this document shall be used for reference only.)

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Bureau Veritas Certification

Appendix to the Certificate of Approval

AWARDED TO

Zhuzhou CRRC Times Semiconductor Co., Ltd.

No.29 Boya Road, Shifeng District, Zhuzhou City, Hunan Province, 412001, China

IATF USI: YRE256

REMOTE SUPPORT FUNCTION(S)

NAME	ADDRESS	SCOPE
Zhuzhou CRRC Times Semiconductor Co., Ltd Line 3 plant	Building B3,Industrial Park, Shidai Road, Shifeng District, Zhuzhou City, Hunan Province, 412001, China	Contract Review, Customer Service, Supplier Management, Purchasing, Human Resource, Policy Making, Sales, Quality System Management, Internal Audit Management, Management Review, Finance, Marketing, Strategic Planning
Zhuzhou CRRC Times Semiconductor Co., Ltd Line 5 plant	Building B1, Tianxin High-Tech Park, Shifeng District, Zhuzhou City, Hunan Province, 412001, China	Laboratory

Date Of Certification: 13-09-2023

Date Of Expiration: 12-09-2026

IATF Certificate N°: 0483275

Bureau Veritas Certification Certificate No: CN046093-1 - IATF **Revision: 1**

For Bureau Veritas Certification Holding, Tour ALTO, 4 place des saisons, 92400 COURBEVOIE - France
(The official document is in English. Any translations of this document shall be used for reference only.)

2/2

QC080000
证书

IEC QUALITY ASSESSMENT SYSTEM (IECQ)
covering Electronic Components,
Assemblies, Related Materials and Processes
For rules and details of the IECQ visit www.iecq.org

IECQ Certificate of Conformity

Hazardous Substance Process Management

IECQ Certificate No.:	IECQ-H LCIE 23.0018	Issue No.:	2	Status:	Current
Supersedes:	IECQ-H LCIE 23.0018 Issue 1	Issue Date:	2023/12/10	Org Issue:	2020/12/10
CB Reference No.:	QL795359	Expiration:	2026/12/09		

Applicable to:

- **European Directive 2011/65/EU ("RoHS – Restriction of the use Of certain Hazardous Substances") in electrical and electronic equipment. Including all published amendments**

Zhuzhou CRRC Times Semiconductor Co., Ltd.
Tianxin High-Tech Park, Shifeng District, Zhuzhou City, Hunan Province
China

The organization has developed and implemented Hazardous Substance Process Management procedures and related processes which have been assessed and found to comply with the applicable requirements for IECQ HSPM organization approval which is in accordance with the Basic Rules IECQ 01 and Rules of Procedure IECQ 03-5 "IECQ Hazardous Substances Process Management" of the IEC Quality Assessment System for Electronic Components (IECQ), and with respect to the IECQ Specification:

- **IECQ QC 080000:2017** - Hazardous Substance Process Management System Requirements

This Certificate is applicable to all electronic components, assemblies, related materials and processes for the following scope of activities:
Design and development, manufacturing, sales and service of Power Semiconductor and related products

Issued by the Certification Body: LCIE Bureau Veritas

33 avenue, du Général Leclerc
92260, Fontenay aux Roses
France

Authorized person:
Jérôme REYSSON

The validity of this certificate is maintained through on-going surveillance audits by the IECQ CB issuing this certificate.
This Certificate of Conformity may be suspended or withdrawn in accordance with the Rules of Procedure of the IECQ System and its Schemes.
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-- Attached Translation: --None --

IECQ-H Rev. 08