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# 大功率半导体器件产品目录

## Power Semiconductor Product Guide

### 2020 / 2021

**株洲中车时代半导体有限公司**  
ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD.

## 企业简介

### Company Introduction

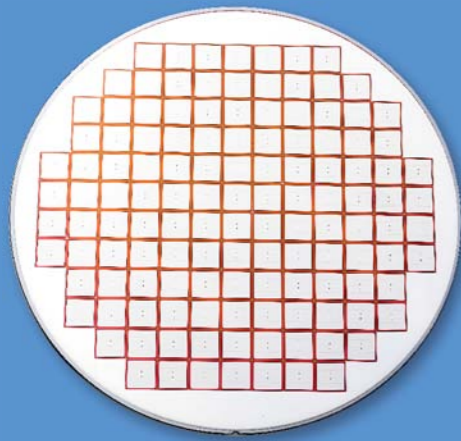
株洲中车时代半导体有限公司是株洲中车时代电气股份有限公司(HK3898)下属全资子公司,自1964年开始致力于功率半导体技术的研发与产业化,现已成为少数同时掌握IGBT、SiC、晶闸管、IGCT及其组件技术IDM(集成设计制造)模式企业代表,拥有芯片—模块—装置—系统完整产业链。公司目前在中国、英国两地设立研发中心,营销网络遍布全球。公司是新型功率半导体器件国家重点实验室、国家能源大功率电力电子器件研发中心的依托单位,中国功率半导体技术创新与产业联盟理事长单位,湖南省功率半导体创新中心的牵头共建单位。

Zhuzhou CRRC Times Semiconductor Co., Ltd. is the wholly-owned subsidiary of CRRC Times Electric Co., Ltd.( HK3898), has been contributed to the research and development and industrialization of power semiconductor technology since 1964, Now it has become the representative of a few IDM companies in the world who has the technology of IGBT、SiC、Thyristor、IGCT and their assembly simultaneously, owned complete industrial chain with wafers, modules, devices and systems. The company currently has R&D centres in China and the United Kingdom, with marketing networks all over the world. The company is a supporting unit of the State Key Laboratory of New Power Semiconductor Devices and the National Energy High-power Electronic Device R&D Centre, Chairman Unit of China Power Semiconductor Technology Innovation and Industry Alliance, Co-founder Company of Hunan Power Semiconductor Innovation Centre.

## Contents

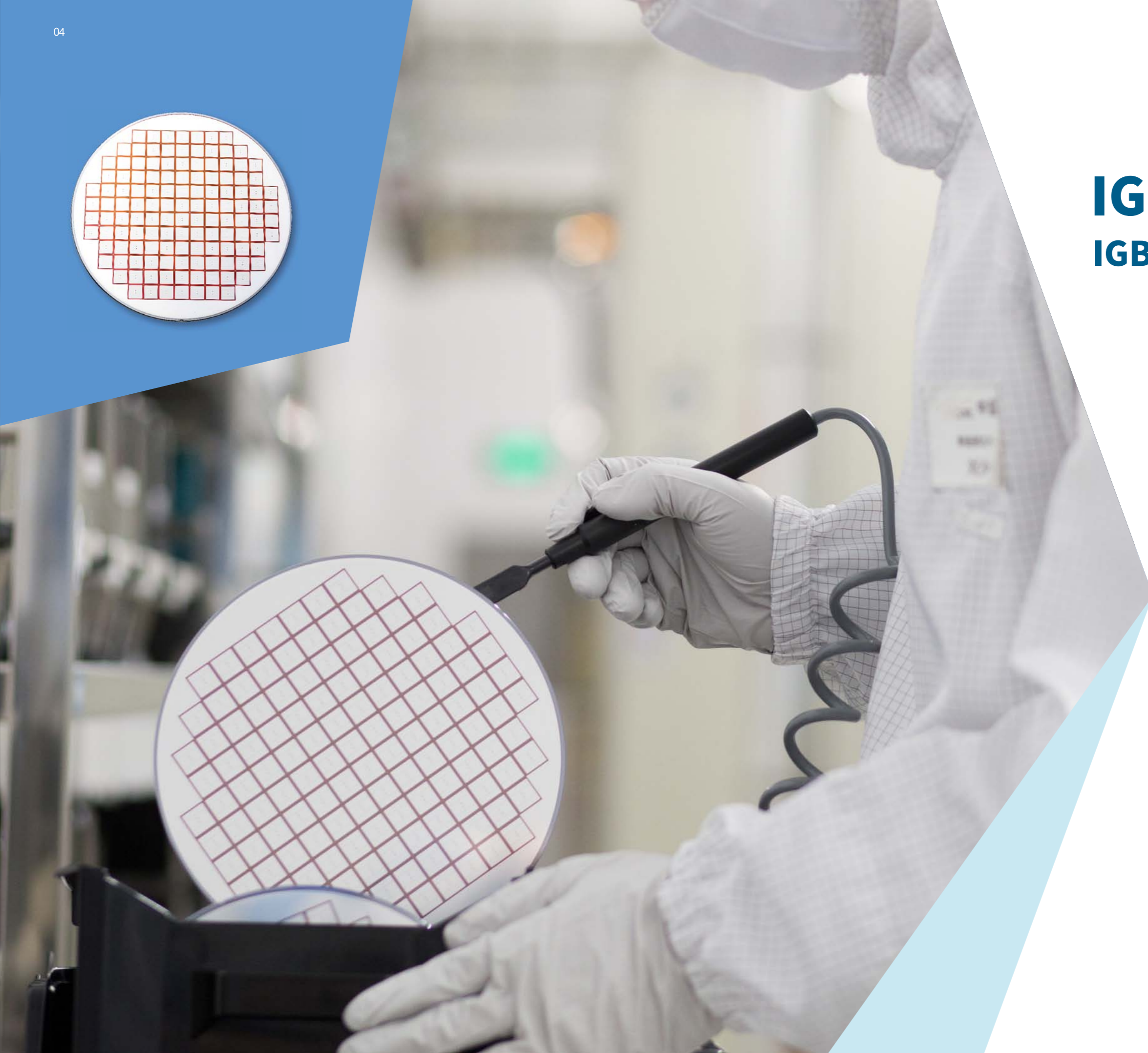
## 目录

<b>IGBT &amp; FRD Modules</b>		<b>IGBT及FRD模块</b>	
Automotive IGBT Modules	06	汽车IGBT模块	
Medium And Low-voltage IGBT Modules	08	中低压IGBT模块	
High-voltage IGBT Modules	11	高压IGBT模块	
Press-pack IGBT Modules	14	压接式IGBT模块	
FRD Modules	16	FRD模块	
<b>SiC Chip And Devices</b>		<b>SiC芯片及器件</b>	
SBD Chip And Devices	22	SBD芯片及器件	
MOSFET Chip And Devices	22	MOSFET芯片及器件	
SiC Modules	25	SiC模块	
<b>Diodes And Thyristors</b>		<b>整流管及晶闸管</b>	
Free Floating Rectifier Diodes	32	全压接型整流管	
Alloying Rectifier Diodes	34	烧结型整流管	
Free Floating Thyristors	36	全压接型晶闸管	
Alloying Thyristors	40	烧结型晶闸管	
Fast Switching Thyristors	43	快速晶闸管	
Bi-directional Thyristors	45	双向晶闸管	
Fast Diodes	48	快速二极管	
Fast Recovery Diodes	50	快恢复二极管	
<b>IGCT</b>	<b>54</b>	<b>集成门极换流晶闸管</b>	
<b>Power Assemblies</b>		<b>功率组件</b>	
Air-cooling Power Assemblies	62	风冷功率组件	
Liquid-cooling Power Assemblies	65	液冷功率组件	
Heat Pipe Power Assemblies	66	热管功率组件	
Customized Power Assemblies	69	定制型功率组件	
IGCT Bipolar Power Assemblies	70	集成门极换流晶闸管功率组件	
Soft Starter Modules	71	软启动模块	
Thyristor Modules	72	晶闸管模块	
<b>Quality System And Insurance</b>	<b>74</b>	<b>质量体系与保障</b>	
<b>Globe Landscape</b>	<b>76</b>	<b>全球布局</b>	



# IGBT及FRD模块

## IGBT And FRD Modules



# 汽车IGBT模块 Automotive IGBT Modules

采用中车第六代RTMOS精细沟槽栅芯片,具有高电流密度、低开关损耗、高短路能力等特点。采用直接水冷基板,选用高性能导热材料,具有高功率密度,满足汽车复杂应用工况需求。该系列产品涵盖400A至950A电流范围,最大可满足180kW电机需求。产品已批量应用于新能源电动汽车领域。

CRRC automotive IGBT module uses CRRC Gen6 RTMOS Fine Trench technology featuring high current density, low switching losses, high short circuit capability. With direct water-cooling baseplate design and high thermal conduction material, the power density of CRRC automotive IGBT has been further increased which can meet all kinds of complex automotive application requirements. CRRC automotive IGBT family covers current range from 400A to 950A which can meet the requirement of motor drive up to 180kW. CRRC automotive IGBT has been volume applied to various electric vehicles.

## 产品特点 Characteristic

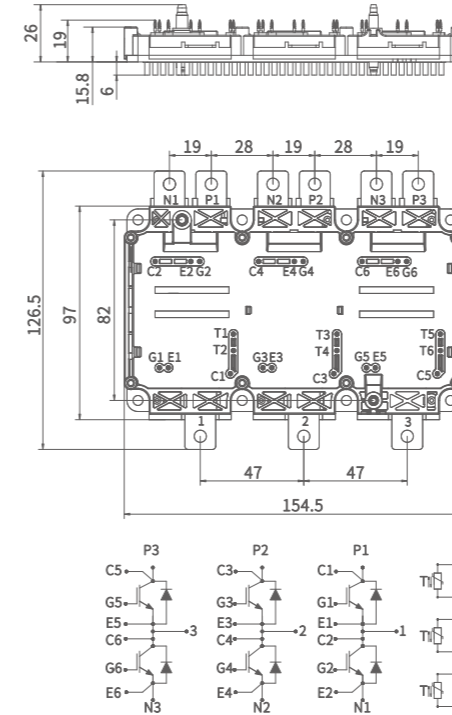
- 低导通压降 Low  $V_{CE(sat)}$
- 低开关损耗 Low Switching Losses
- 高电流密度 High Current Density
- 高短路能力 High Short Circuit Capability
- 高热循环能力 High Thermal Cycling Capability
- $T_{vj-max}=175^{\circ}C$   $T_{vj-max}=175^{\circ}C$



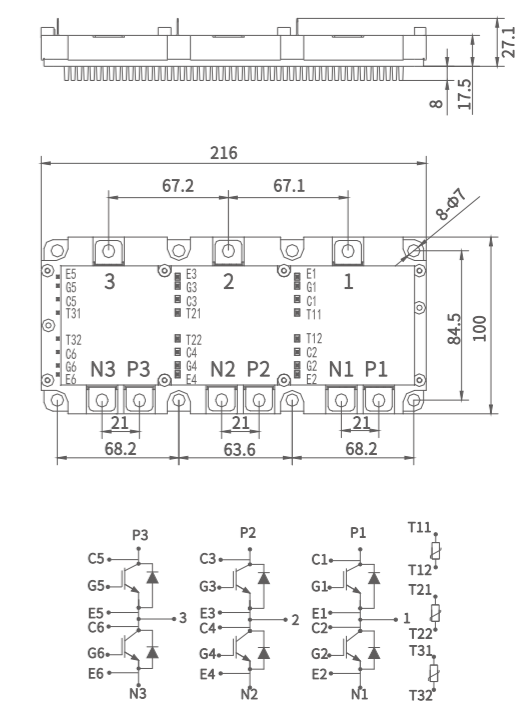
型号 Part Number	$I_c$		$V_{CES}$	$I_{CRM}$	$V_{CE(sat)}$ @ $I_c$ & $T_c=25^{\circ}C$	$E_{SW}$ @ $T_{vj-op}$	$T_{vj-op}$	$R_{th(J-C)}$	封装 Package		
	@ $T_c$	$^{\circ}C$							代码 Code	尺寸 Dimension	基板材料 Baseplate
	A	$^{\circ}C$	V	A	V	mJ	$^{\circ}C$	K/W	/	mm	/
<b>电压等级:750V Voltage:750V</b>											
TG400FF08S2-S3A00	400	65	750	800	1.7	44	150	0.12	S2	140 × 112 × 24	Cu
TG400FF08S0-S3A00	400	65	750	800	1.7	44.5	150	0.12	S0	140 × 113 × 24	Cu
TG400FF08S2-S3A01	400	65 (T <sub>F</sub> )	750	800	1.7	50.5	150	0.17 (R <sub>th(J-F)</sub> )	S2	140 × 112 × 27	Cu
TG600FF08S3-S3A01	600	65 (T <sub>F</sub> )	750	1200	1.55	70	150	0.135 (R <sub>th(J-F)</sub> )	S3	154.5 × 126.5 × 32	Cu
TG800FF08S1-S3A01	800	75 (T <sub>F</sub> )	750	1600	1.45	73.8	150	0.086 (R <sub>th(J-F)</sub> )	S1	216 × 100 × 35	Cu
TG820FF08S3-S4A01	820	80 (T <sub>F</sub> )	750	1640	1.25	66.5	175	0.135 (R <sub>th(J-F)</sub> )	S3	154.5 × 126.5 × 32	Cu
		(T <sub>F</sub> )						(R <sub>th(J-F)</sub> )			
<b>电压等级:1200V Voltage:1200V</b>											
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

# 外形图 Outlines

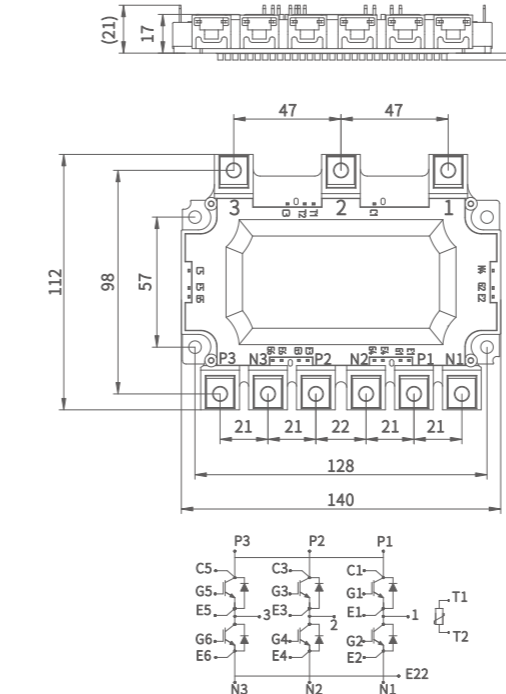
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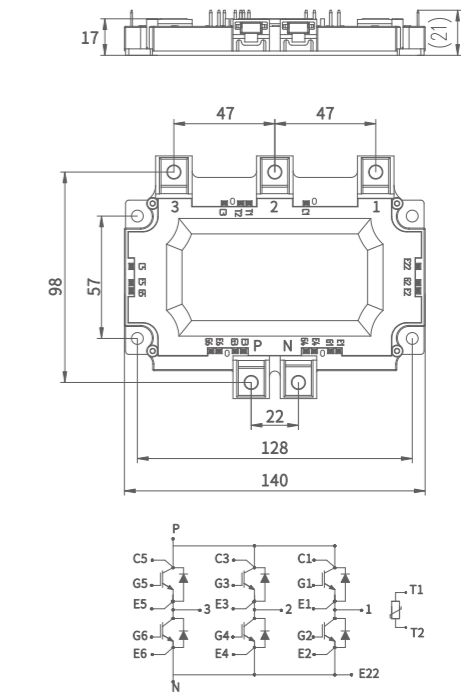
S1



S2



S0



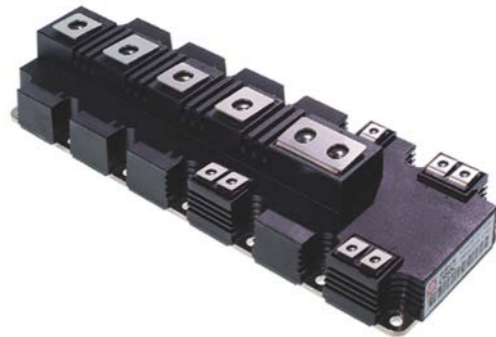
# 中低压IGBT模块 Medium And Low Voltage IGBT Modules

采用中车第五代TMOSS<sup>®</sup>芯片,具有低导通压降、低开关损耗等特点。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450A至3600A,电压1200V至1700V,产品已批量应用于新能源风电、光伏、变频器、SVG、中频感应加热等领域。

CRRC MV&LV IGBT module family uses CRRC Gen5 TMOSS<sup>®</sup> IGBT chip, with benefit of low on-state voltage drop, low switching losses. For package Cu baseplate and high thermal conduction material have been applied to further enhance thermal performance and current density and long term reliability. CRRC medium and low voltage IGBT family covers current from 450A to 3600A, voltage from 1200V to 1700V, can meet requirements of renewable energy and industry applications. CRRC MV&LV IGBT has been volume applied to applications of wind power, PV, inverter, SVG and induction heating etc.

## 产品特点 Characteristic

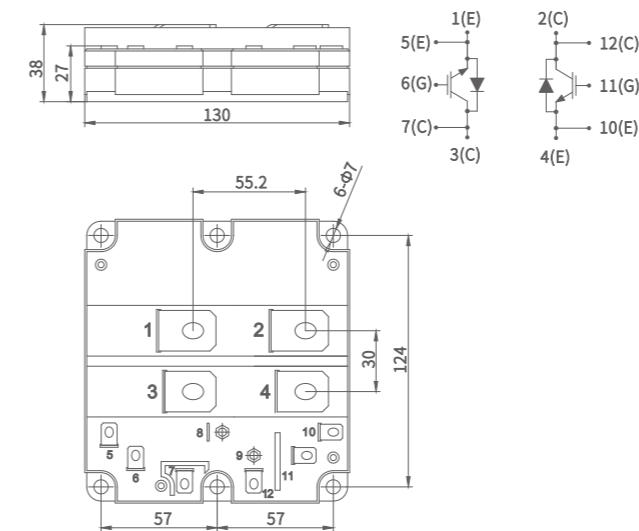
- 低导通压降 Low  $V_{CE(sat)}$
- 低开关损耗 Low Switching Losses
- 高电流密度 High Current Density
- 高短路能力 High Short Circuit Capability
- 高热循环能力 High Thermal Cycling Capability
- $T_{vj-max}=175^{\circ}C$   $T_{vj-max}=175^{\circ}C$



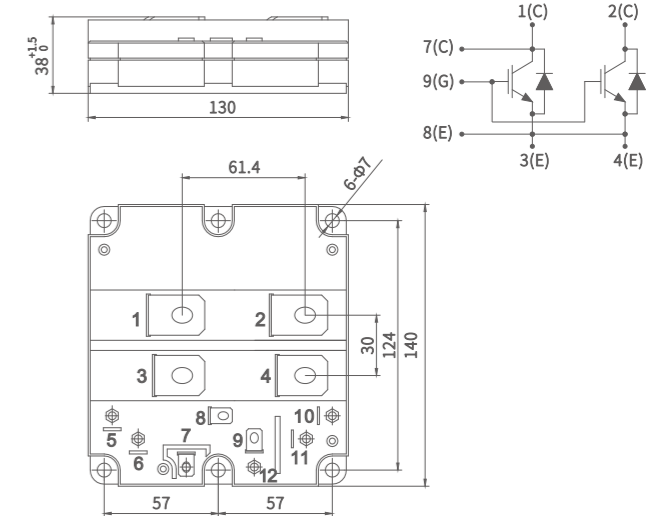
型号 Part Number	$I_c$		$V_{CES}$	$I_{CRM}$	$V_{CE(sat)}$ @ $I_c$ & $T_c=25^{\circ}C$	$E_{sw}$ @ $T_{vj-op}$	$T_{vj-op}$	$R_{th(J-C)}$	封装 Package		
	@ $T_c$								代码 Code	尺寸 Dimension	基板材料 Baseplate
	A	$^{\circ}C$									
<b>电压等级:1700V Voltage:1700V</b>											
TG450HF17M1-S300	450	100	1700	900	1.8	381	150	0.055	M1	152×62×21	Cu
TG600HF17M1-S300	600	100	1700	1200	1.85	458	150	0.044	M1	152×62×21	Cu
TG650HF17H2-S300	650	95	1700	1300	1.85	610	150	0.03	H2	172×89×38	Cu
TG1000HF17H1-S300	1000	100	1700	2000	1.85	980	150	0.02	H1	250×89×38	Cu
TIM1200DDM17-TSA000	1200	75	1700	2400	1.8	1083	150	0.022	DD	140×130×38	AlSiC
TIM1600FSM17-PSA011	1600	80	1700	3200	2.3	1800	125	0.009	FS	140×130×38	AlSiC
TIM2400NSM17-TSA000	2400	85	1700	4800	2.1	2840	150	0.01	NS	140×130×38	AlSiC
TIM2400ESM17-TSA000	2400	100	1700	4800	1.75	2840	150	0.0065	ES	190×140×38	AlSiC
TIM3600E2SM17-TSA000	3600	95	1700	7200	1.85	3810	150	0.0075	E2	190×140×38	AlSiC
<b>电压等级:1200V Voltage:1200V</b>											
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
TG900HF12H2-S300	900	90	1200	1800	1.75	369	150	0.0295	H2	172×89×38	Cu
TG1400HF12H1-S300	1400	100	1200	2800	1.8	595	150	0.02	H1	250×89×38	Cu

## 外形图 Outlines

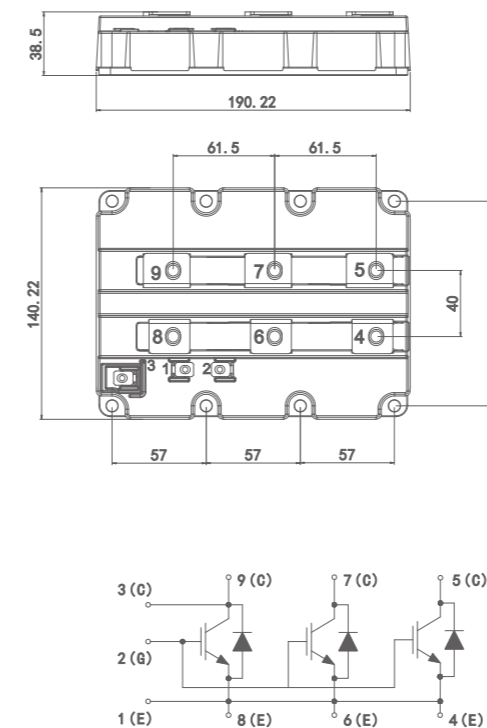
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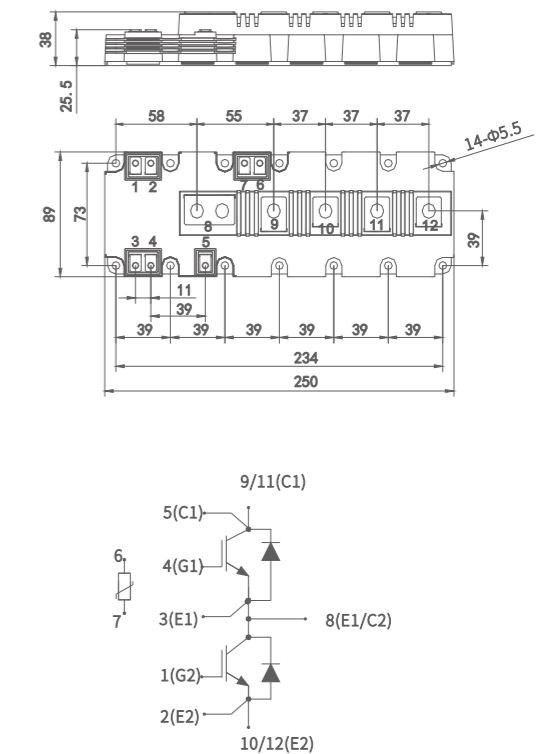
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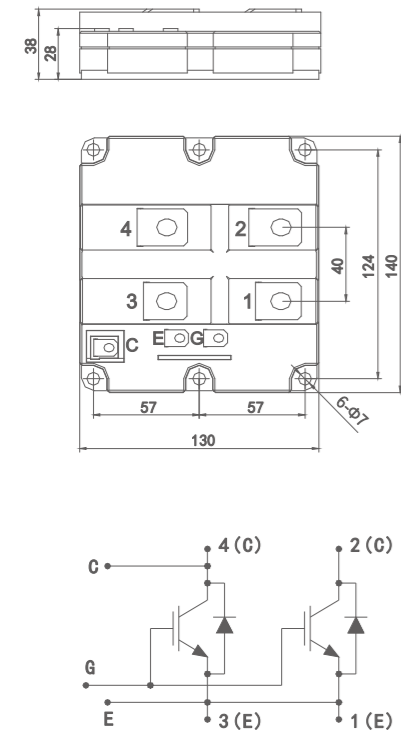
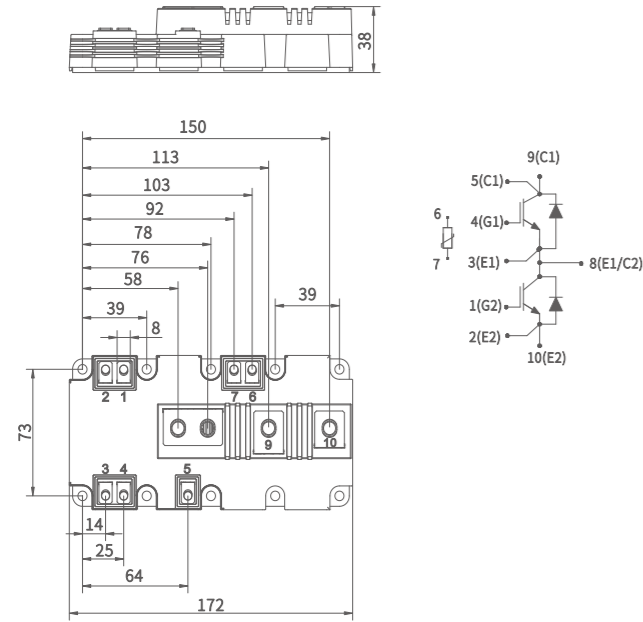


E2SM



H1





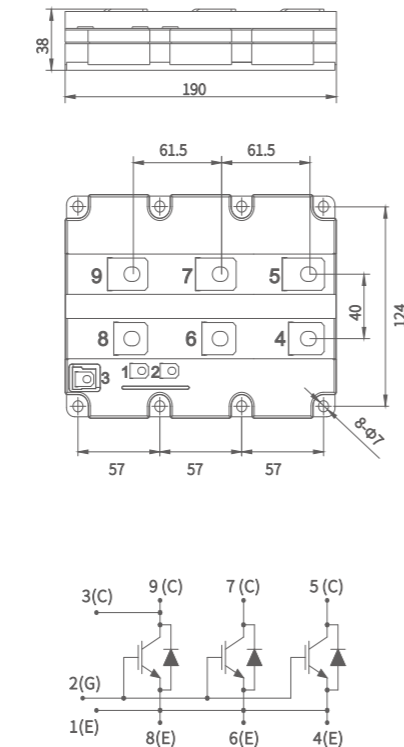
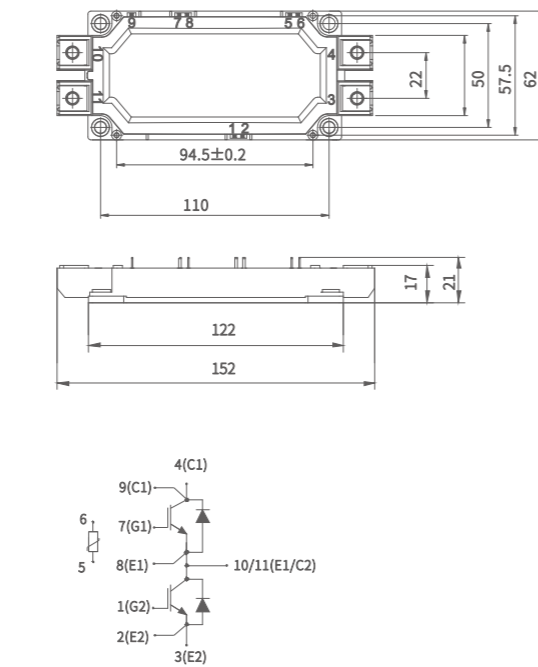
# 高压IGBT模块 High Voltage IGBT Modules

采用中车第四代DMOS<sup>+</sup>芯片,具有低导通压降、软关断特性、裕量大等特点。采用AlSiC基板、AlN衬板,具有高热循环能力、高可靠性等特点,可满足车辆频繁启停和长距离可靠性运行的要求,批量应用于电力机车、高速动车组、地铁等轨道交通领域,以及其他大功率变频器装置领域。

CRRC HV IGBT module family uses CRRC Gen4 DMOS<sup>+</sup> IGBT chip featuring low on-state voltage drop, soft turn-off and large SOA. For package AlSiC baseplate and AlN substrate have been applied with high thermal cycling capability and high reliability. CRRC HV IGBT can fully meet the railway application which includes frequent start-up and long distance reliable operation. CRRC HV IGBT has been volume applied to locomotive, high-speed train, urban rail and other high power converter applications.

## 产品特点 Characteristic

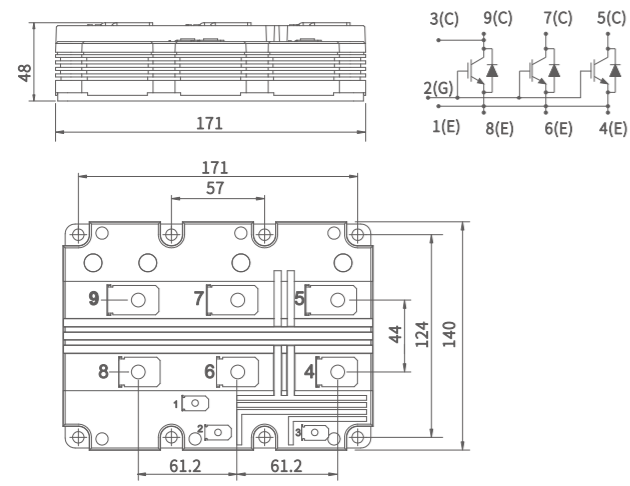
- 低导通压降 Low  $V_{CE(sat)}$
- 低开关损耗 Low Switching Losses
- 软关断特性 Soft Turn-Off
- 高热循环能力 High Thermal Cycling Capability
- 高短路能力 High Short Circuit Capability
- 高可靠性 High Reliability



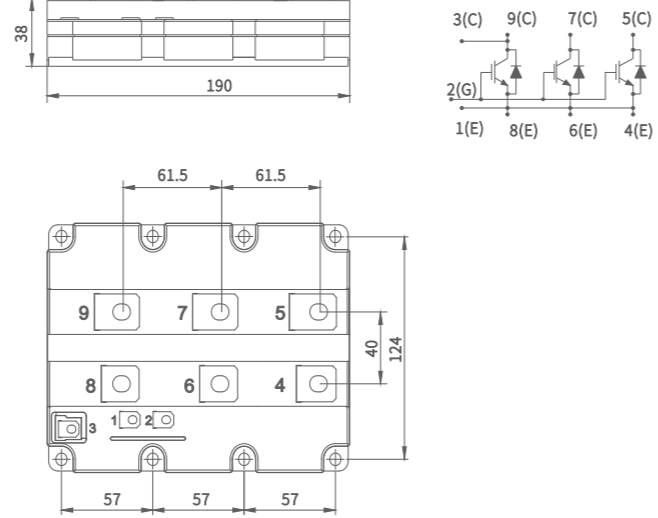
型号 Part Number	$I_c$		$V_{CES}$	$I_{CRM}$	$V_{CE(sat)}$ @ $I_c$ & $T_c=25^\circ C$	$E_{SW}$ @ $T_{vj-op}$	$T_{vj-op}$	$R_{th(J-C)}$	封装 Package		
	A	$^\circ C$							V	A	V
<b>电压等级:6500V Voltage:6500V</b>											
TIM750ASM65-PSA011	750	80	6500	1500	3.0	14280	125	0.0085	AS	190 × 140 × 48	AlSiC
<b>电压等级:4500V Voltage:4500V</b>											
TIM800XSM45-PSA011	800	95	4500	1600	2.4	9429	125	0.013	XS	140 × 130 × 48	AlSiC
TIM1200ASM45-PSA011	1200	85	4500	2400	2.3	14060	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
<b>电压等级:3300V Voltage:3300V</b>											
TIM250PHM33-PSA011	250	100	3300	500	2.5	1375	150	0.048	PH	140 × 73 × 38	AlSiC
TG450HF33X1-TSA011	450	100	3300	900	2.3	2030	150	0.028	X1	144 × 100 × 40	AlSiC
TIM500GDM33-PSA011	500	100	3300	1000	2.4	2850	150	0.024	GD	160 × 130 × 38	AlSiC
TIM1000NSM33-PSA011	1000	95	3300	2000	2.4	5770	150	0.012	NS	140 × 130 × 38	AlSiC
TIM1000ECM33-PSA011	1000	95	3300	2000	2.1	6500	150	0.012	EC	190 × 140 × 38	AlSiC
TIM1500ESM33-PSA011	1500	110	3300	3000	2.1	9300	150	0.008	ES	190 × 140 × 38	AlSiC
TIM1500E2SM33-PSA011	1500	95	3300	3000	2.5	8170	150	0.008	ES	190 × 140 × 38	AlSiC
TIM1800E2SM33-PSA011	1800	95	3300	3600	2.5	9532	150	0.008	ES	190 × 140 × 38	AlSiC

# 外形图 Outlines

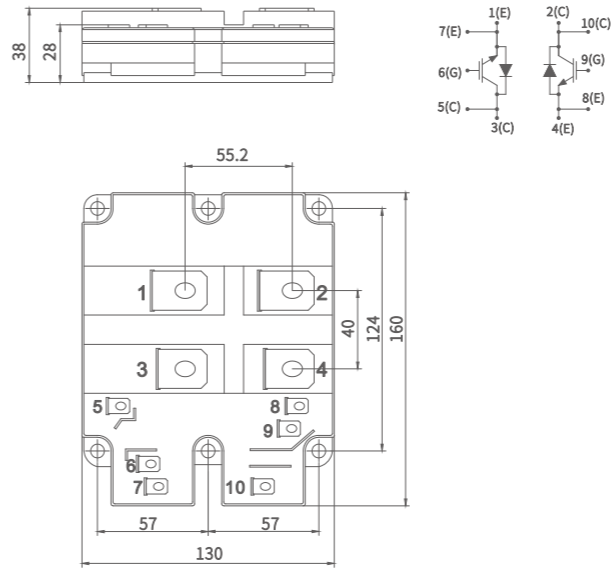
ASM



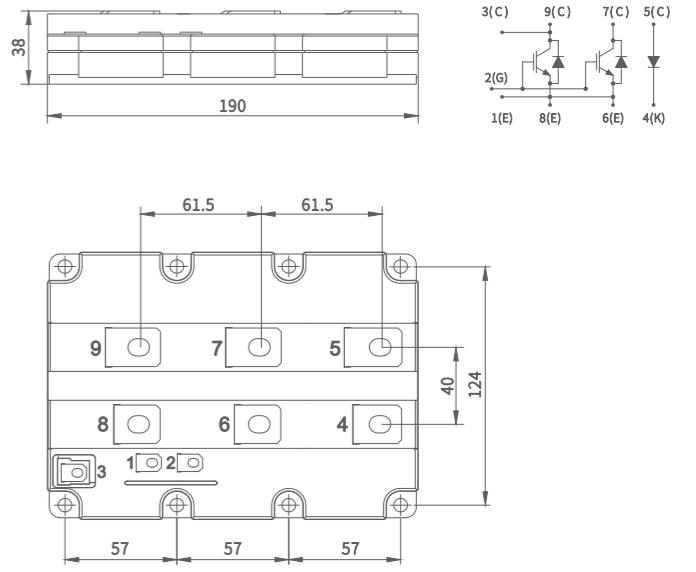
ESM



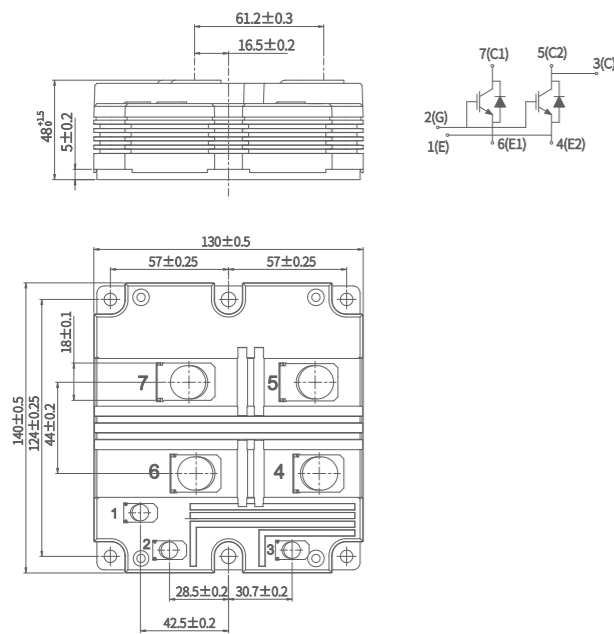
GDM



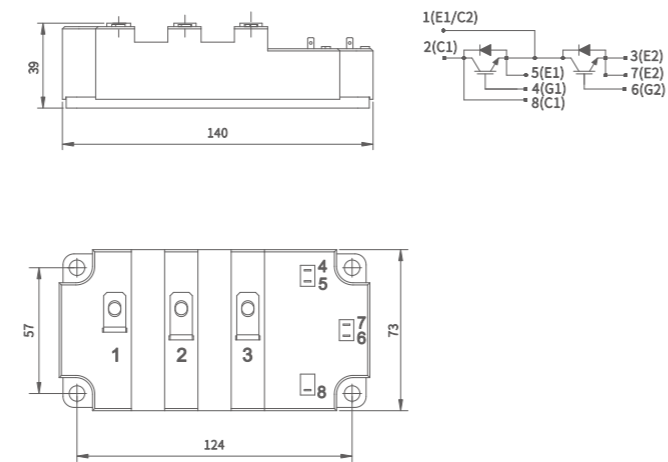
ECM



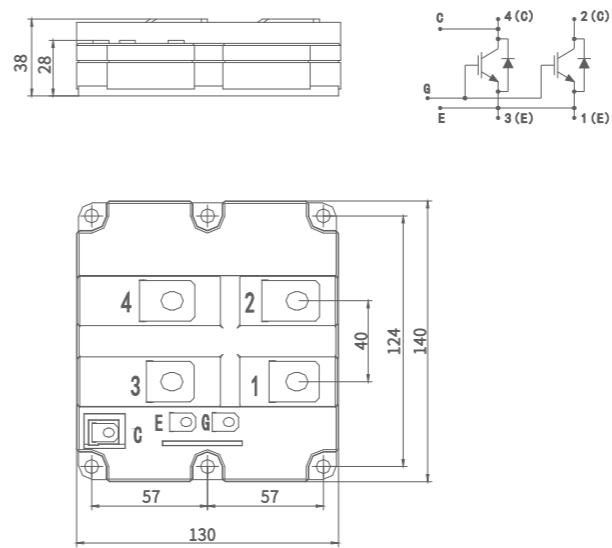
XSM



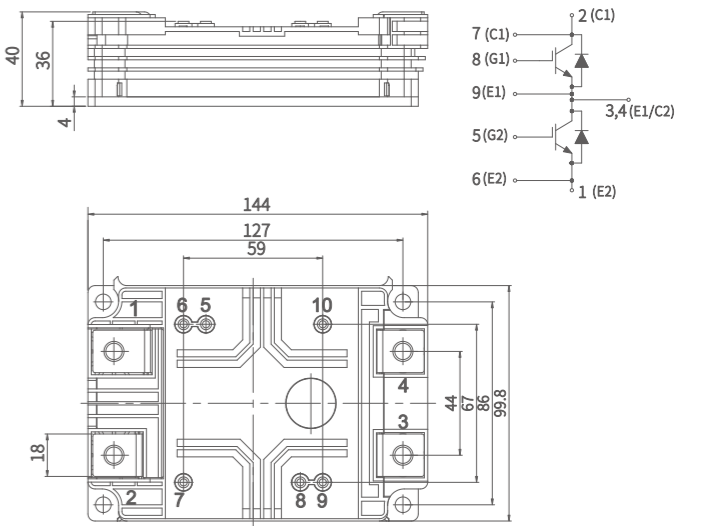
PHM



NSM



X1



# 压接式IGBT模块 Press-Pack IGBT Modules

采用中车第四代DMOS+芯片，具有低导通压降、低开关损耗、软关断特性等特点。采用银烧结及柔性压接技术，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，已批量应用于多个柔性直流输电工程。

CRRC press-pack IGBT uses CRRC Gen4 DMOS+ IGBT chip featuring low on-state voltage drop, low switching losses and soft turn-off characteristics. For the package silver sintering and flexible clamping technology have been applied with benefit of high power capacity, high reliability and high overload capability. It can meet the requirement of long-distance, high power flexible HVDC application. CRRC press-pack IGBT has been volume applied to multiple flexible HVDC projects.

## 产品特点 Characteristic

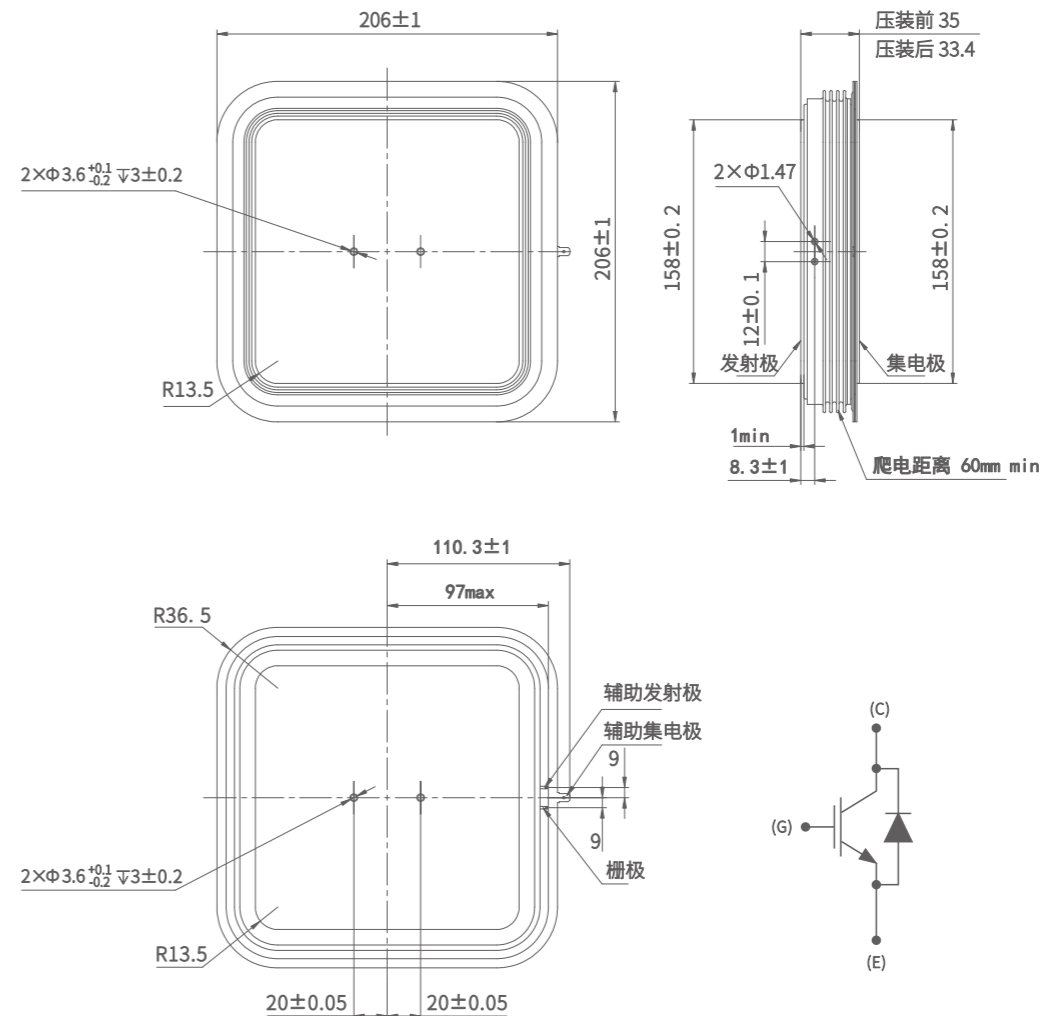
- 低导通压降 Low  $V_{CE(sat)}$
- 低开关损耗 Low Switching Losses
- 软关断特性 Soft Turn-Off
- 低杂散电感 Low Stray Inductance
- 高热循环能力 High Thermal Cycling Capability
- 高过载能力 High Overload Capability
- 双面散热 Double-side Cooling



型号 Part Number	$I_c$		$V_{CES}$	$I_{CRM}$	$V_{CE(sat)}$ @ $I_c$ & $T_C=25^\circ C$	$E_{SW}$ @ $T_{vj-op}$	$T_{vj-op}$	$R_{th(J-C)}$	封装 Package		
	@ $T_C$								代码 Code	尺寸 Dimension	基板材料 Baseplate
	A	°C									
<b>电压等级:4500V Voltage:4500V</b>											
TG2000SW45ZC-P200	2000	95	4500	4000	2.3	27900	125	0.0043	ZC	206 × 206 × 35	/
TG3000SW45ZC-P200	3000	90	4500	6000	2.3	39700	125	0.003	ZC	206 × 206 × 35	/

# 外形图 Outlines

ZC



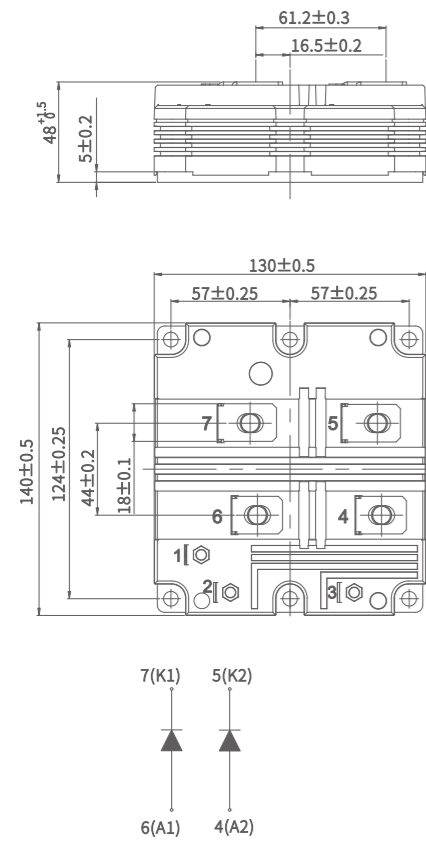


# FRD模块 FRD Modules

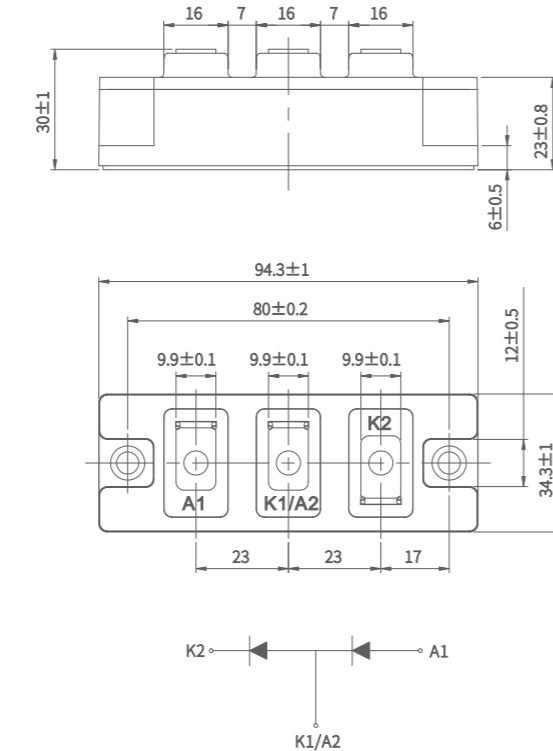
型号 Part Number	I <sub>c</sub>		V <sub>CES</sub>	I <sub>CRM</sub>	V <sub>CE(sat)</sub> @I <sub>c</sub> & T <sub>C</sub> =25°C	E <sub>SW</sub> @T <sub>Vj-op</sub>	T <sub>Vj-op</sub>	R <sub>th(J-c)</sub>	封装 Package		
	A	°C							代码 Code	尺寸 Dimension	基板材料 Baseplate
			V	A	V	mJ	°C	K/W	/	mm	/
<b>电压等级:6500V Voltage:6500V</b>											
TFM750XDM65-D200	750	80	6500	1500	2.55	4080	125	0.016	XD	140×130×48	AlSiC
<b>电压等级:4500V Voltage:4500V</b>											
TFM1200XDM45-D200	1200	85	4500	2400	2.7	3900	125	0.016	XD	140×130×48	AlSiC
<b>电压等级:3300V Voltage:3300V</b>											
TFM1500NDM33-D200	1500	95	3300	3000	2.4	2600	150	0.015	ND	140×130×38	AlSiC
TF1500K1DM33-D200	1500	90	3300	3000	2.25	2200	150	0.0145	K1	130×90×38	AlSiC
<b>电压等级:1200V Voltage:1200V</b>											
TF100HF12T1-D300	100	95	1200	200	1.6	32	150	0.28	T1	94.3×34.3×30	Cu

## 外形图 Outlines

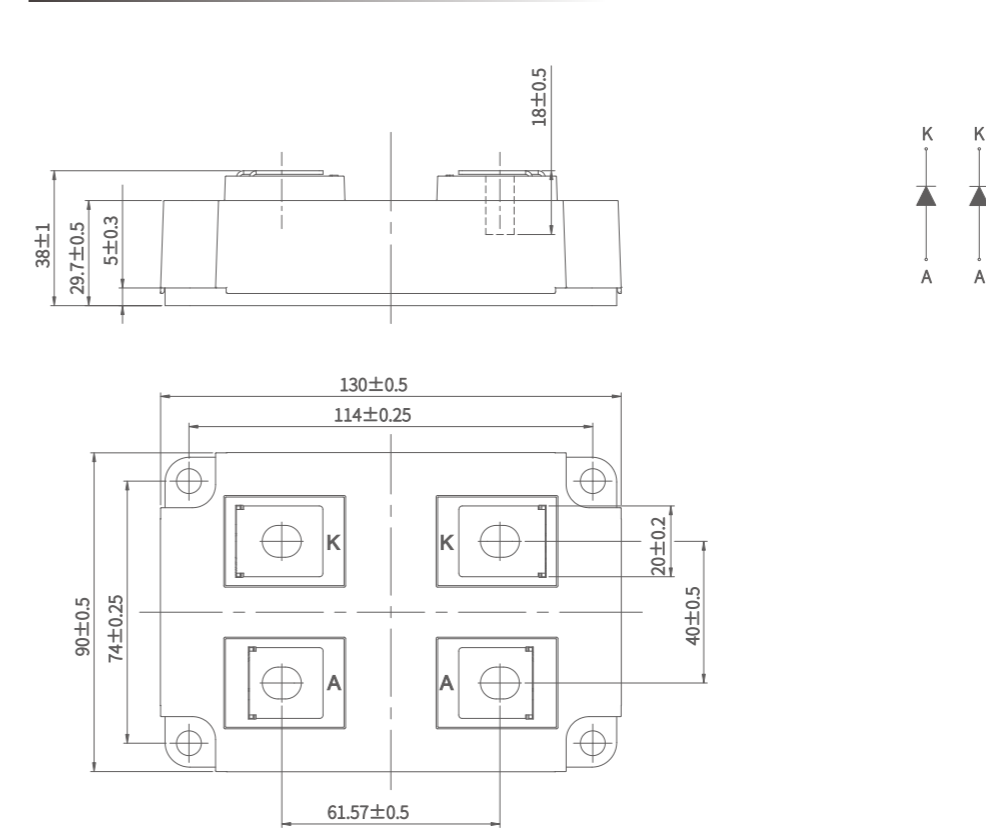
XDM



T1

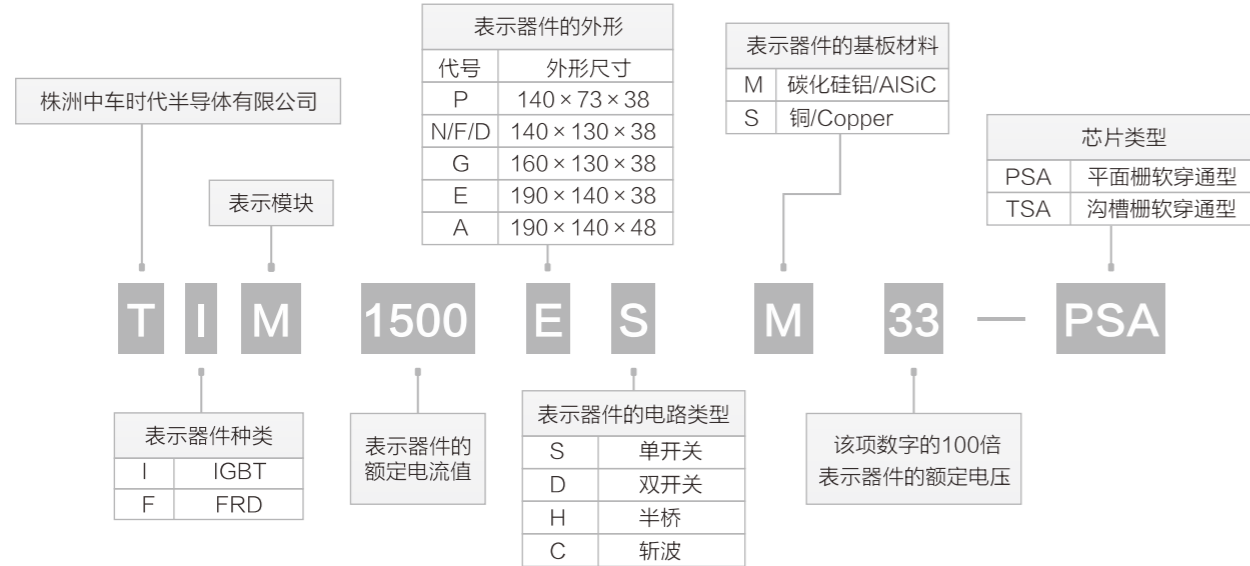


K1

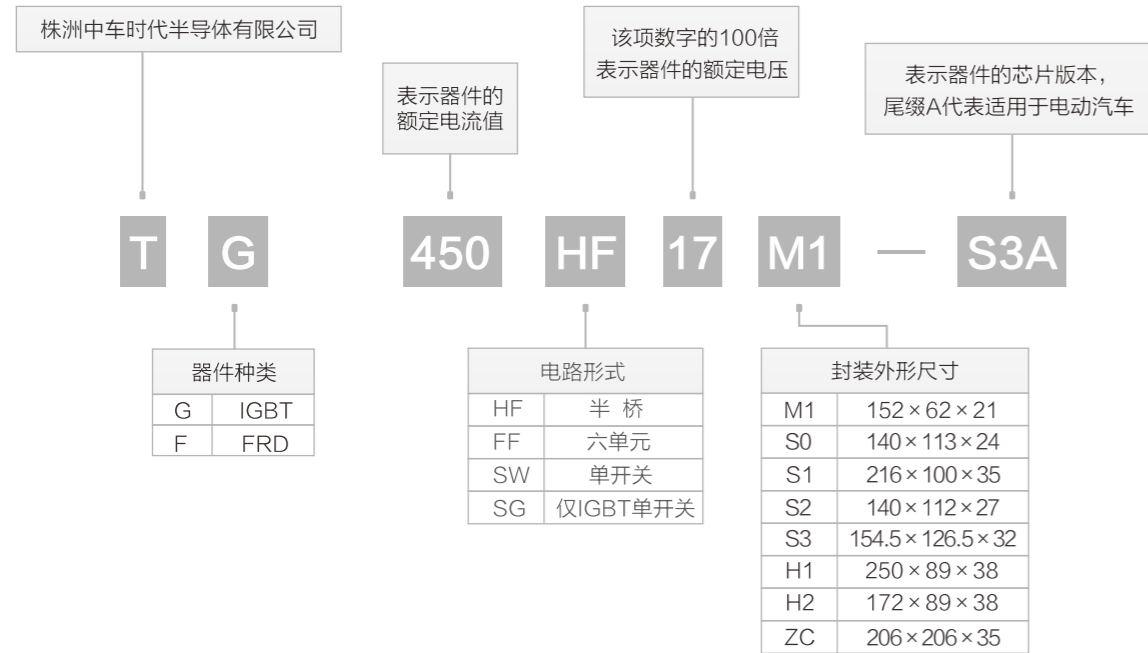


# 型号说明 Nomenclature

## 高压IGBT模块产品 High-voltage IGBT Modules



## 中低压及压接式IGBT模块产品 Medium And Low-voltage & Press-pack IGBT Modules



# 符号说明 Symbols

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
$R_{th(J-C)}$	结壳热阻	Thermal Resistance Junction To Case
$R_{th(CH)}$	接触热阻	IGBT Thermal Resistance Case To Heatsink
$T_{vj-op}$	工作结温	Operation Junction Temperature
$T_{stg}$	存储温度	Storage Temperature
$I_{CES}$	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
$I_{SC}$	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 Modules Total Switching Energy ( $E_{on}+E_{off}+E_{rec}$ )



# SiC芯片及器件

## SiC Chip And Devices



# SBD芯片及器件 SBD Chip And Devices

芯片型号 Part Number	V <sub>DC</sub> V	V <sub>RRM</sub> V	V <sub>RSM</sub> V	I <sub>F</sub> A	T <sub>vj-op</sub> °C	V <sub>F</sub> V		I <sub>R</sub> μA
						T <sub>vj-op</sub> =25°C	T <sub>vj-op</sub> =175°C	T <sub>vj-op</sub> =175°C
TS120PFS86S0D	1200	1200	1200	100	+175	1.5	2	<500
TS120PFSC8S0D	1200	1200	1200	150	+175	1.5	2	<500
TS330PLS66S0D	3300	3300	3300	32	+175	1.9	3.9	<500
TS330PLS95S0D	3300	3300	3300	36	+175	1.9	3.9	<500

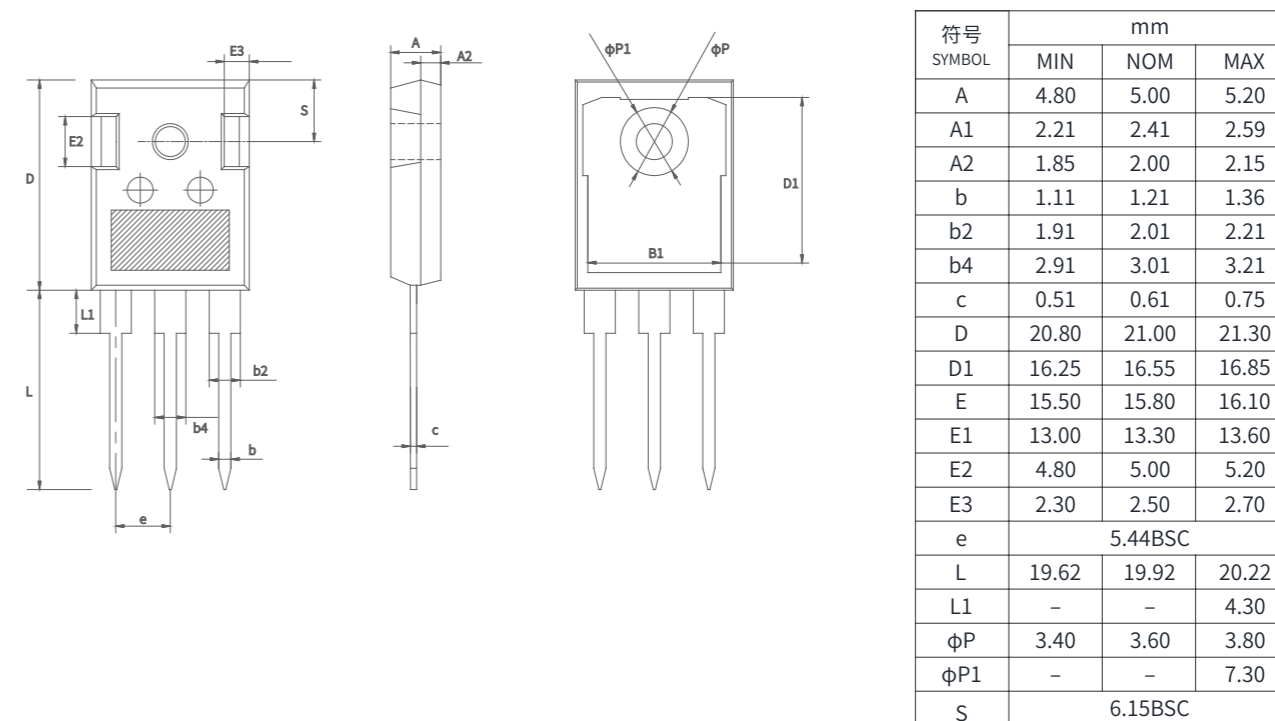
器件型号 Part Number	V <sub>DC</sub> V	V <sub>RRM</sub> V	V <sub>RSM</sub> V	I <sub>F</sub> A	T <sub>vj-op</sub> °C	V <sub>F</sub> V		I <sub>R</sub> μA	封装类型 Package
						T <sub>vj-op</sub> =25°C	T <sub>vj-op</sub> =175°C	T <sub>vj-op</sub> =175°C	
TS15SF120C2C1S	1200	1200	1200	15	+175	1.5	2.1	<1000	TO-247-3L
TS20SF120C2C1S	1200	1200	1200	20	+175	1.5	2.1	<200	TO-247-3L
TS30SF120C2C1S	1200	1200	1200	30	+175	1.5	2.1	<200	TO-247-3L
TS40SF120C2C1S	1200	1200	1200	40	+175	1.5	2.1	<200	TO-247-3L

# MOSFET芯片及器件 MOSFET Chip And Devices

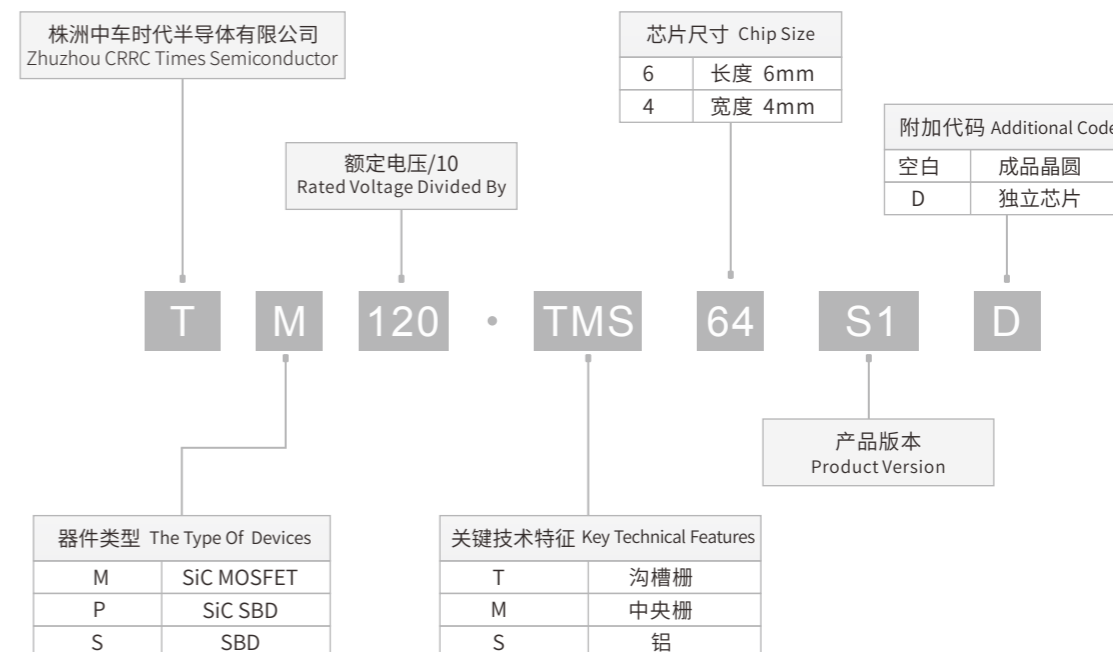
芯片型号 Part Number	V <sub>DSS</sub> V	I <sub>D</sub> A	T <sub>vj-op</sub> °C	R <sub>DS(on)</sub> @ V <sub>GS</sub> =20V mΩ		I <sub>DSS</sub> μA
				T <sub>vj-op</sub> =25°C	T <sub>vj-op</sub> =175°C	T <sub>vj-op</sub> =175°C
TM120PLS44A1D	1200V	20	+175	80	TBD	<200
TM120PLS44S0D	1200V	12	+175	130	103	<200
TM330PLSA7S0D	3300V	50	+175	35	70	<500
TM330PLS95S0D	3300V	32	+175	55	115	<500

器件型号 Part Number	V <sub>DSS</sub> V	I <sub>D</sub> A	T <sub>vj-op</sub> °C	R <sub>DS(on)</sub> @ V <sub>GS</sub> =20V mΩ		I <sub>DSS</sub> μA	封装类型 Package
				T <sub>vj-op</sub> =25°C	T <sub>vj-op</sub> =175°C	T <sub>vj-op</sub> =175°C	
TM40SG120C2C1S	1200	40	+175	40	TBD	TBD	TO-247-3L
TM80SG120C2C1S	1200	20	+175	80	TBD	<200	TO-247-3L
TM130SG120C2C1S	1200	12	+175	130	103	<200	TO-247-3L

# 器件封装尺寸 Package Dimensions



# SiC 芯片型号说明 SiC Chip Types



## 符号说明 Symbols

### SBD芯片及器件 SBD Chip And Devices

符号 Symbols	参数名称	Characteristics
$V_{RRM}$	反向重复峰值电压	Repetitive Peak Reverse Voltage
$V_{RSM}$	反向非重复峰值电压	Non-repetitive Peak Reverse Voltage
$V_{DC}$	直流阻断电压	DC Blocking Voltage
$I_F$	正向电流	Forward Current (Diode)
$I_{FRM}$	正向重复峰值电流	Forward Repetitive Current
$I_{FSM}$	正向浪涌电流	Single Cycle Surge Current
$P_{tot}$	总耗散功率	Total Power Dissipation
$T_{vj-op}$	运行结温	Operation Temperature
$T_{stg}$	存储温度	Storage Temperature
$V_F$	正向压降	Forward Voltage Drop
$I_R$	反向电流	Reverse Current
$Q_c$	总电容电荷	Total Capacitance Charge
$C$	总电容	Total Capacitance

### MOSFET芯片及器件 MOSFET Chip And Devices

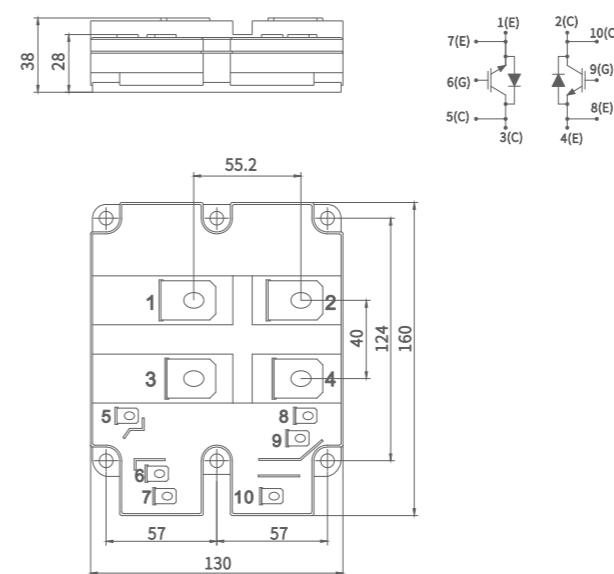
符号 Symbols	参数名称	Characteristics
$V_{(BR)DSS}$	击穿电压	Breakdown Voltage
$I_D$	正向电流	Forward Current
$R_{DS(on)}$	通态电阻	On-state Resistance
$V_{GS(th)}$	阈值电压	Gate Threshold Voltage
$P_{tot}$	总耗散功率	Total Power Dissipation
$T_{vj-op}$	运行结温	Operation Temperature
$T_{stg}$	存储温度	Storage Temperature
$I_{DSS}$	漏极截止电流	Drain Interception Current

## 混合SiC模块 Hybrid SiC Modules

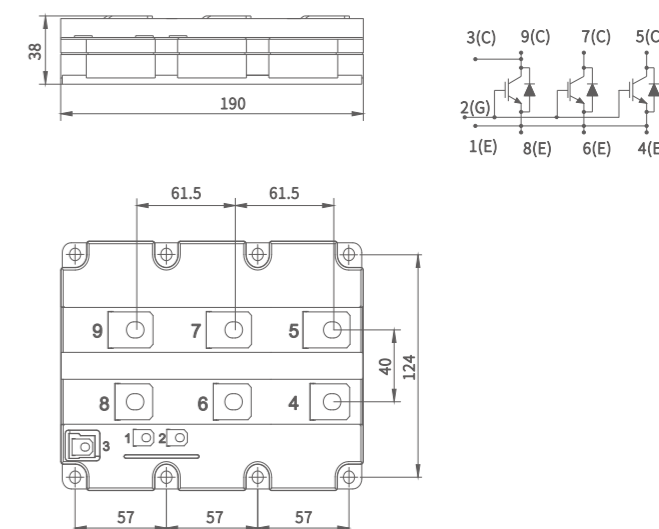
型号 Part Number	$I_c$		$V_{CES}$	$I_{CRM}$	$V_{CE(sat)}$ @ $I_c$ & $T_c=25^\circ C$	$E_{SW}$ @ $T_{vj-op}$	$T_{vj-op}$	$R_{th(J-C)}$ IGBT	封装 Package		
	A	$^\circ C$							类型 Type	尺寸 Dimension	基板材料 Baseplate
	/	/							/	mm	/
<b>电压等级:1200V Voltage:1200V</b>											
TH600HF12M1-S3A00	600	90	1200	1200	1.7	140	150	0.05	M1	152×62×21	Cu
<b>电压等级:1700V Voltage:1700V</b>											
THM1600FSM17-PSA011	1600	85	1700	3200	2.5	960	125	0.009	F	140×130×38	AlSiC
<b>电压等级:3300V Voltage:3300V</b>											
THM500GDM33-PSA011	500	85	3300	1000	2.1	1900	150	0.021	G	160×130×38	AlSiC
THM1500ESM33-PSA012	1500	95	3300	3000	2	6035	150	0.008	E1	190×140×38	AlSiC

## 外形图 Outlines

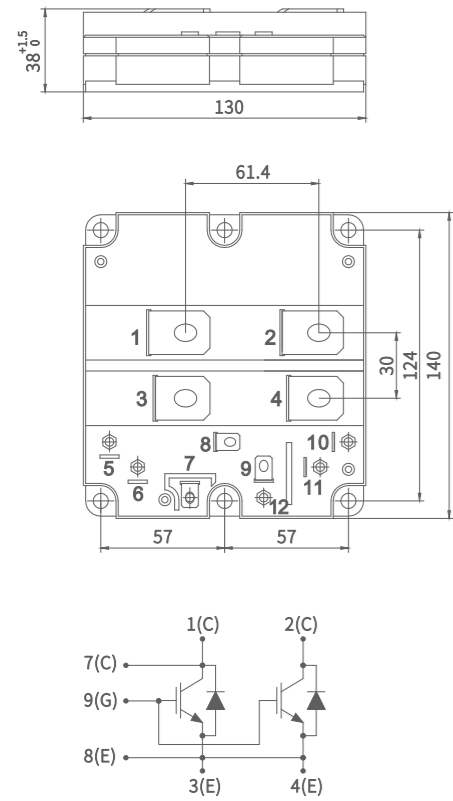
### Hybrid-SiC G



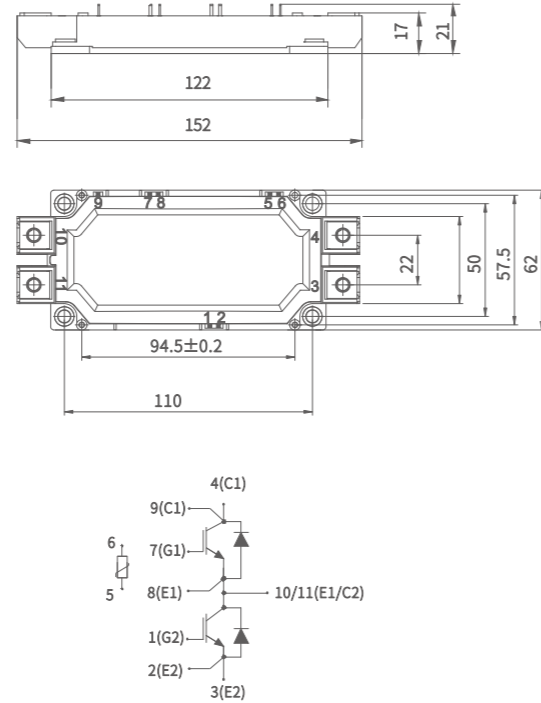
### Hybrid-SiC E1



Hybrid-SiC F



Hybrid-SiC M1

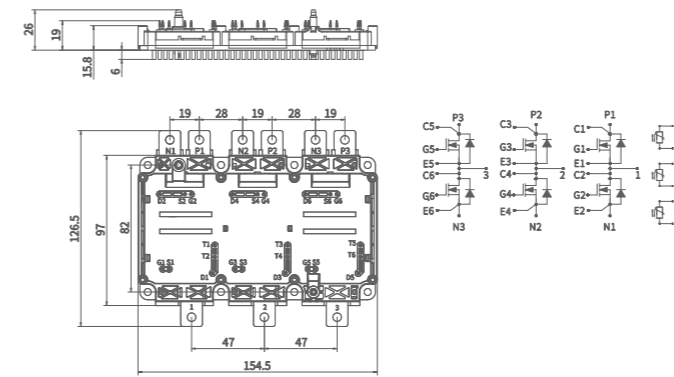


# 全SiC模块 Full SiC Modules

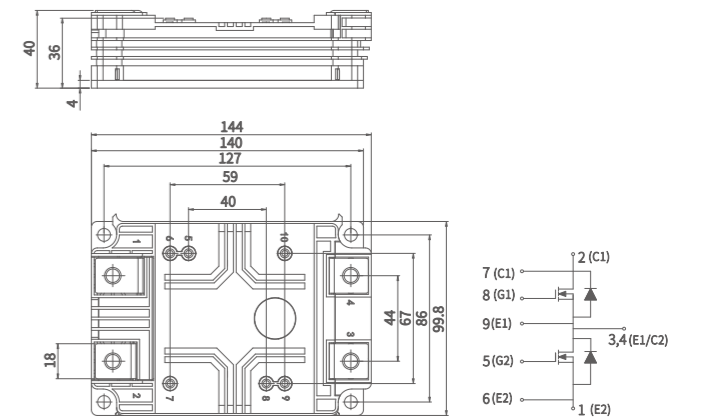
型号 Part Number	I <sub>D</sub>		V <sub>DSS</sub>	I <sub>DRM</sub>	V <sub>Ds(on)</sub> @ I <sub>D</sub> & T <sub>C</sub> =25°C	E <sub>SW</sub> @ T <sub>vj-op</sub>	T <sub>vj-op</sub>	R <sub>th(J-C)</sub> MOSFET	封装 Package		
	A	°C							类型 Type	尺寸 Dimension	基板材料 Baseplate
<b>电压等级: 1200V Voltage: 1200V</b>											
TM400FF12S3-F1A00	400	90(T <sub>F</sub> )	1200	800	0.92	50	150	0.09(R <sub>th,JF</sub> )	S3	154.5×126.5×32	Cu
<b>电压等级: 3300V Voltage: 3300V</b>											
TMM500GDM33-F100	450	90	3300	900	1.7	590	150	0.024	X1	144×100×40	AlSiC
TM450HF33X1-F100	500	90	3300	1000	1.5	800	150	0.021	G	160×130×38	AlSiC

## 外形图 Outlines

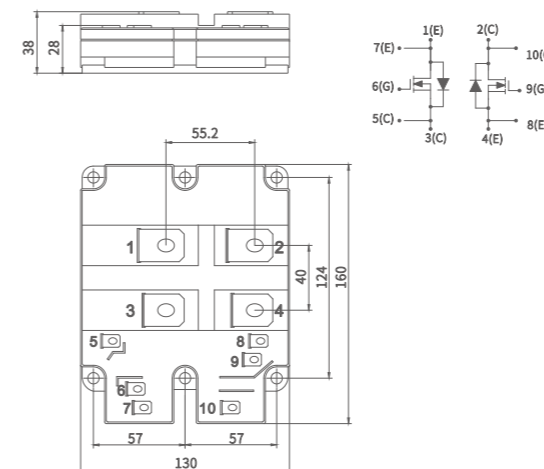
Full-SiC S3



Full-SiC X1

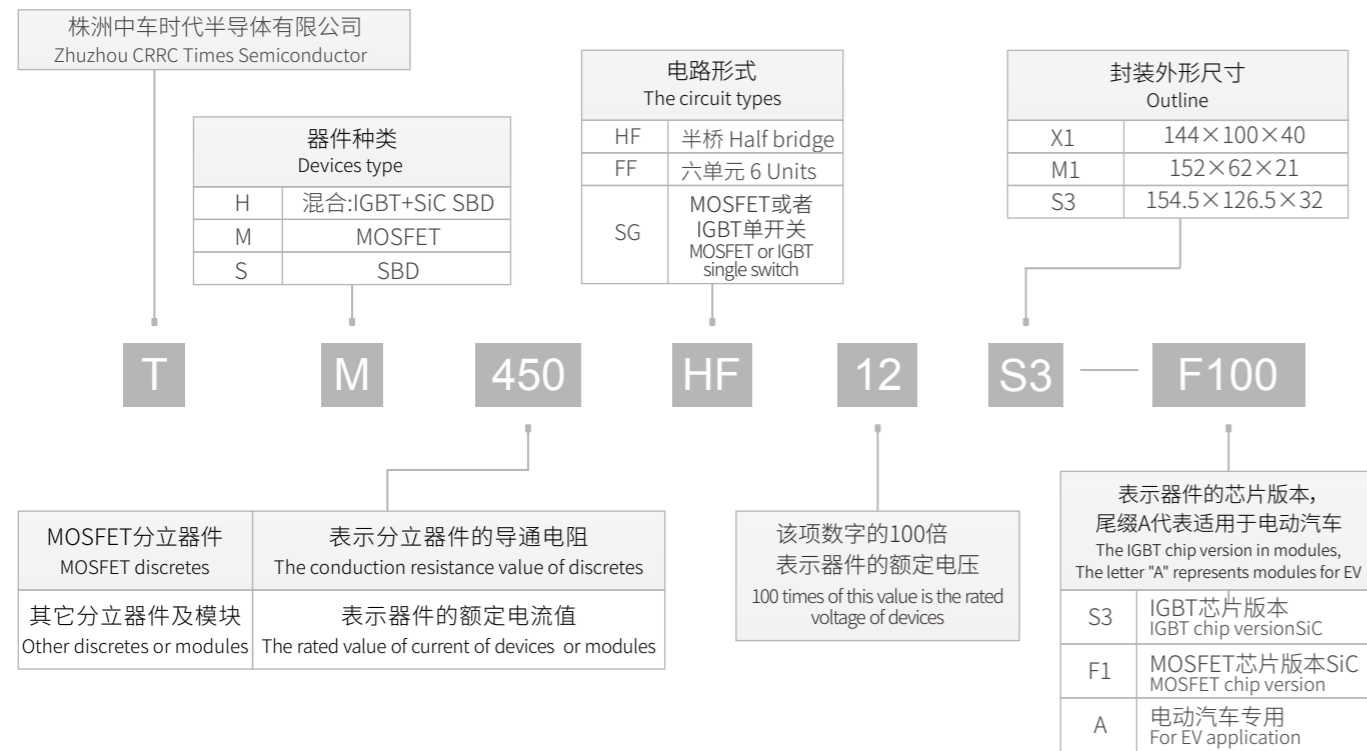


Full-SiC G

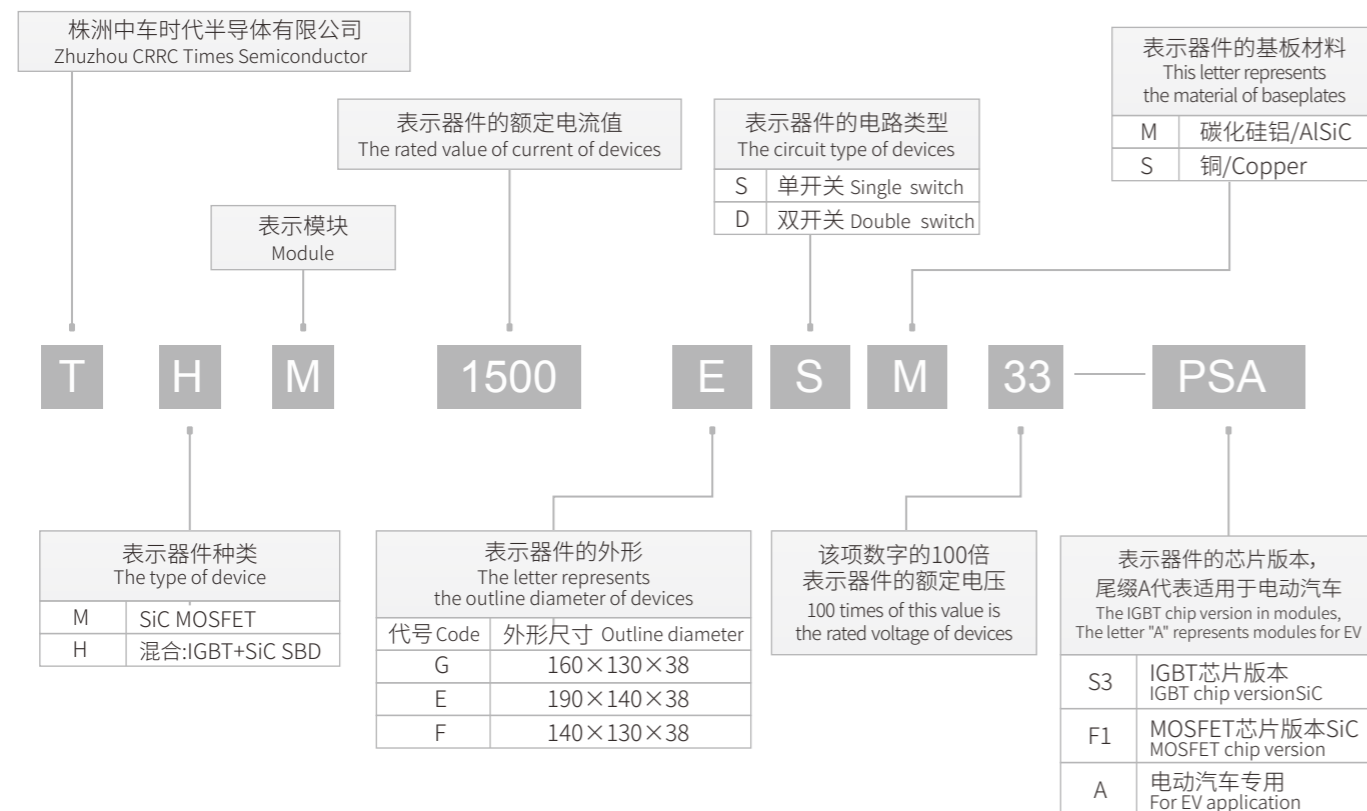


# 型号说明 Nomenclature

## 中低压及新型SiC模块产品命名规则



## 高压SiC模块产品命名规则



# 符号说明 Symbols

## 混合SiC模块 Hybrid SiC Modules

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.
$R_{th(J-C)IGBT}$	IGBT结壳热阻 IGBT Thermal Resistance Junction To Case
$R_{th(J-C)Diode}$	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
$T_{vj-op}$	工作结温 Operation Junction Temperature
$I_{CES}$	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
$I_{SC}$	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 Rising 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 Modules Total Switching energy (Eon+Eoff+Erec)

## 全SiC模块 Full SiC Modules

符号 Symbols	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.
$R_{th(J-C)IGBT}$	MOSFET结壳热阻 Mosfet Thermal Resistance Junction To Case
$R_{th(J-C)Diode}$	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
$T_{vj-op}$	工作结温 Operation Junction Temperature
$I_{DSS}$	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
$I_{SC}$	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 Rising 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



# 整流管及晶闸管 Diodes And Thyristors

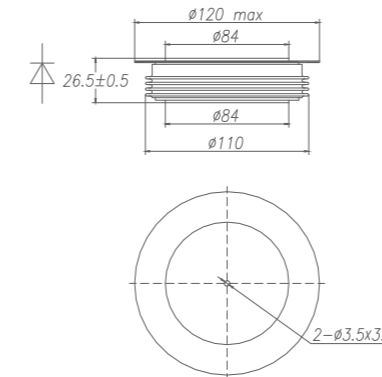
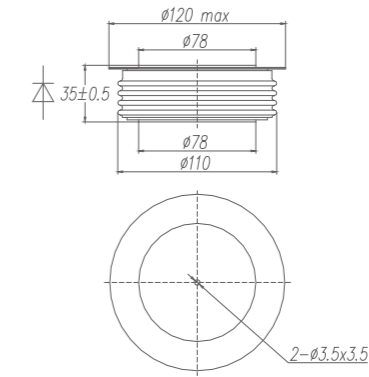
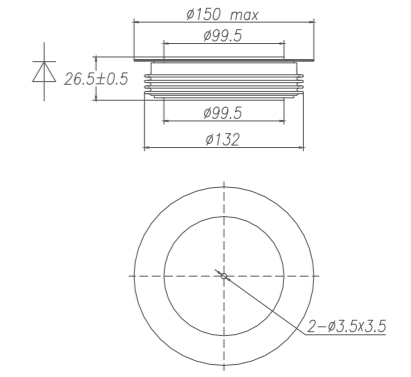
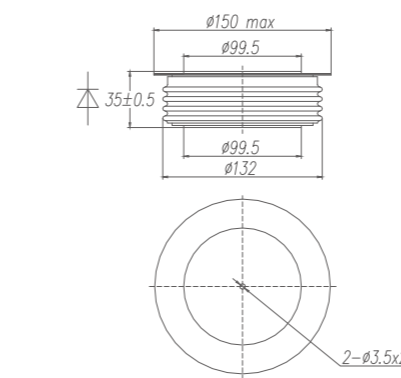
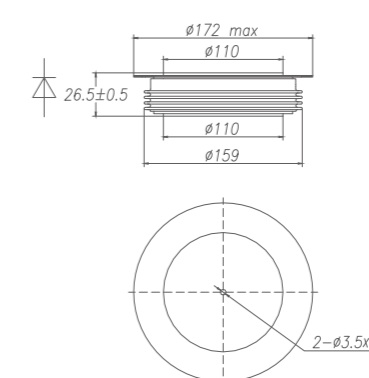
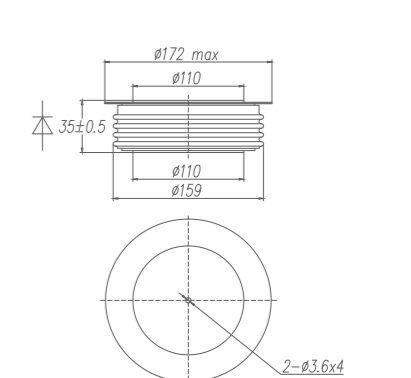
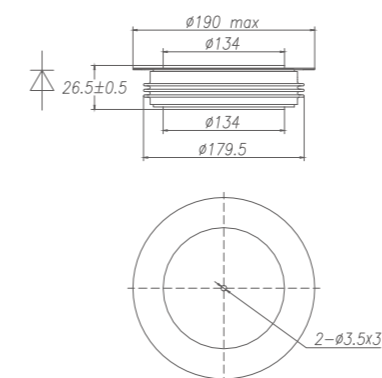
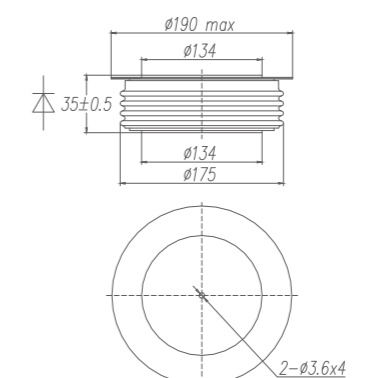




# 全压接型整流管 Free Floating Rectifier Diodes

型号 **= $V_{RSM}/100$	$I_{F(AV)}$		$V_{RSM}$	$V_{RRM}$	$I_{FSM}$ @ $T_{VJM}$ &10ms	$V_{FM}$ @ $T_{VJM}$		$V_{FO}$ @ $T_{VJM}$	$r_F$ @ $T_{VJM}$	$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$F$ ±10%	外形 Outlines
	A	°C				A	V							
	@ $T_c$		V	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN	
<b>电压至 2200V (Up to 2200V)</b>														
ZP <sub>B</sub> 6900_**	6940	90	1600-2200	1600-2200	78.0	6000	1.09	0.82	0.045	175	0.007	0.002	70	ZP <sub>B</sub>
ZP <sub>C</sub> 7500_**	7570	90	1600-2200	1600-2200	94.0	6000	1.03	0.82	0.035	160	0.0057	0.0015	90	ZH <sub>C</sub>
ZP <sub>D</sub> 10000_**	10200	85	1600-2200	1600-2200	125.0	6000	0.98	0.77	0.035	160	0.004	0.0008	120	ZH <sub>D</sub>
<b>电压至 3400V (Up to 3400V)</b>														
ZP <sub>B</sub> 5600_**	5660	90	2400-3400	2400-3400	64.2	6000	1.29	0.80	0.082	175	0.007	0.002	70	ZP <sub>B</sub>
ZP <sub>C</sub> 6800_**	6800	90	2400-3400	2400-3400	84.4	6000	1.17	0.75	0.070	160	0.0057	0.0015	90	ZH <sub>C</sub>
ZP <sub>D</sub> 9000_**	9000	85	2400-3400	2400-3400	118.0	6000	1.06	0.72	0.057	160	0.004	0.0008	120	ZH <sub>D</sub>
ZP <sub>E</sub> 12000_**	12080	85	2400-3400	2400-3400	133.0	6000	0.97	0.68	0.048	160	0.0028	0.0005	180	ZH <sub>E</sub>
<b>电压至 4500V (Up to 4500V)</b>														
ZP <sub>B</sub> 4600_**	4630	90	3600-4500	3600-4500	59.4	6000	1.50	0.98	0.086	160	0.007	0.002	70	ZP <sub>B</sub>
ZP <sub>C</sub> 5600_**	5600	90	3600-4500	3600-4500	79.0	6000	1.32	0.80	0.086	160	0.0057	0.0015	90	ZH <sub>C</sub>
ZP <sub>D</sub> 6200_**	6280	100	3600-4500	3600-4500	99.4	6000	1.19	0.80	0.065	150	0.004	0.0008	120	ZH <sub>D</sub>
<b>电压至 5500V (Up to 4500V)</b>														
ZP <sub>B</sub> 3600_**	3600	90	4600-5500	4600-5500	53.9	3000	1.26	0.90	0.120	160	0.009	0.002	70	ZP <sub>B</sub>
ZP <sub>C</sub> 4700_**	4710	100	4600-5500	4600-5500	74.0	6000	1.44	0.82	0.104	160	0.0057	0.0015	90	ZH <sub>C</sub>
ZP <sub>D</sub> 6100_**	6140	100	4600-5500	4600-5500	96.9	6000	1.21	0.79	0.070	150	0.004	0.0008	120	ZH <sub>D</sub>
ZP <sub>E</sub> 8200_**	8270	100	4600-5500	4600-5500	120.0	6000	1.10	0.74	0.060	150	0.0028	0.0005	180	ZH <sub>E</sub>
<b>电压至 6500V (Up to 6500V)</b>														
ZP <sub>B</sub> 2600_**	2670	100	5600-6500	4900-6000	51.0	3000	1.35	0.90	0.150	150	0.009	0.002	70	ZH <sub>B</sub>
ZP <sub>C</sub> 3900_**	3960	100	5600-6500	4900-6000	61.5	6000	1.56	0.84	0.120	150	0.0057	0.0015	90	ZH <sub>C</sub>
ZP <sub>D</sub> 5500_**	5520	100	5600-6500	4900-6000	88.4	6000	1.37	0.83	0.090	150	0.004	0.0008	120	ZH <sub>D</sub>
<b>电压至 8500V (Up to 8500V)</b>														
ZP <sub>B</sub> 2200_**	2260	100	7400-8500	6900-8000	42.5	3000	1.70	1.07	0.210	150	0.009	0.002	70	ZH <sub>B</sub>
ZP <sub>C</sub> 3300_**	3360	100	7400-8500	6900-8000	53.0	6000	2.05	1.21	0.140	150	0.0057	0.0015	90	ZH <sub>C</sub>
ZP <sub>D</sub> 4800_**	4800	100	7400-8500	6900-8000	76.2	6000	1.66	1.00	0.115	150	0.004	0.0008	120	ZH <sub>D</sub>
ZP <sub>D</sub> 5000_**	5030	100	6600-7200	6100-6700	80.4	6000	1.58	0.95	0.105	150	0.004	0.0008	120	ZH <sub>D</sub>
ZP <sub>E</sub> 6500_**	6510	100	7400-8500	6900-8000	112.0	6000	1.59	1.05	0.090	150	0.0028	0.0005	180	ZH <sub>E</sub>

## 外形图 Outlines

ZP<sub>B</sub>ZH<sub>B</sub>ZP<sub>C</sub>ZH<sub>C</sub>ZP<sub>D</sub>ZH<sub>D</sub>ZP<sub>E</sub>ZH<sub>E</sub>

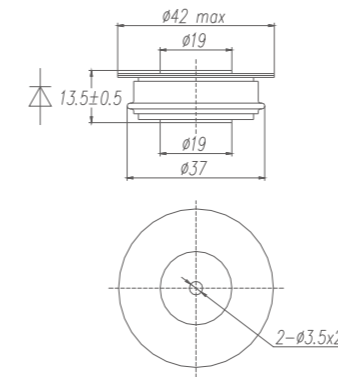
注: 未标注数量单位的统一为毫米 (mm)

# 烧结型整流管 Alloying Rectifier Diodes

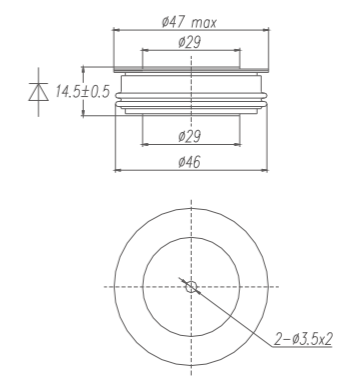
型号 _**= $V_{RSM}/100$	$I_{F(AV)}$ @ $T_C=100^\circ C$	$V_{RRM}$	$I_{FSM}$ @ $T_{VJM}$ &10ms	$V_{FM}$ @ $I_{FM}$ & $T_C=25^\circ C$	$V_{FO}$ @ $T_{VJM}$	$r_F$ @ $T_{VJM}$	$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$F$ ±10%	外形 Outline											
												A	V	kA	A	V	V	mΩ	°C	K/W	K/W	kN
												<b>电压至 1400V(Up to 1400V)</b>										
ZP <sub>5</sub> 500_**	520	600-1400	5.9	800	1.45	0.80	0.657	190	0.08	0.020	5	ZP <sub>6</sub>										
ZP <sub>7</sub> 1300_**	1360	600-1400	15.2	1500	1.30	0.78	0.257	190	0.035	0.010	10	ZP <sub>7</sub>										
ZP <sub>8</sub> 1500_**	1510	600-1400	16.8	1500	1.20	0.78	0.188	190	0.035	0.008	15	ZP <sub>8</sub>										
ZP <sub>9</sub> 2700_**	2770	600-1400	31.0	1500	1.05	0.78	0.092	190	0.02	0.005	22	ZP <sub>9</sub>										
ZP <sub>4</sub> 3200_**	3220	600-1400	35.8	3000	1.15	0.77	0.073	190	0.018	0.005	30	ZP <sub>4</sub>										
ZP <sub>A</sub> 4600_**	4650	600-1400	45.0	3000	1.05	0.76	0.051	190	0.0125	0.004	45	ZP <sub>A</sub>										
ZP <sub>X</sub> 6000_**	6080	600-1400	60.0	3000	1.05	0.76	0.035	190	0.01	0.003	56	ZP <sub>X</sub>										
<b>电压至 2200V(Up to 2200V)</b>																						
ZP <sub>6</sub> 400_**	410	1600-2200	4.9	800	1.85	0.82	1.110	190	0.08	0.020	5	ZP <sub>6</sub>										
ZP <sub>7</sub> 900_**	990	1600-2200	12.5	1500	1.60	0.82	0.433	190	0.035	0.010	10	ZP <sub>7</sub>										
ZP <sub>8</sub> 1100_**	1100	1600-2200	13.9	1500	1.45	0.82	0.318	190	0.035	0.008	15	ZP <sub>8</sub>										
ZP <sub>9</sub> 2000_**	2030	1600-2200	25.7	1500	1.20	0.82	0.156	190	0.02	0.005	22	ZP <sub>9</sub>										
ZP <sub>4</sub> 2300_**	2360	1600-2200	29.8	3000	1.35	0.81	0.125	190	0.018	0.005	30	ZP <sub>4</sub>										
ZP <sub>A</sub> 3400_**	3430	1600-2200	42.2	3000	1.20	0.79	0.086	190	0.0125	0.004	45	ZP <sub>A</sub>										
ZP <sub>X</sub> 4400_**	4460	1600-2200	56.4	3000	1.15	0.81	0.059	190	0.01	0.003	56	ZP <sub>X</sub>										
<b>电压至 3400V(Up to 3400V)</b>																						
ZP <sub>7</sub> 800_**	850	2400-3400	10.8	1500	1.95	0.88	0.613	175	0.035	0.010	10	ZP <sub>7</sub>										
ZP <sub>8</sub> 900_**	960	2400-3400	12.0	1500	1.70	0.88	0.450	175	0.035	0.008	15	ZP <sub>8</sub>										
ZP <sub>9</sub> 1800_**	1830	2400-3400	23.0	1500	1.35	0.88	0.200	175	0.02	0.005	22	ZP <sub>9</sub>										
ZP <sub>4</sub> 2000_**	2050	2400-3400	25.8	3000	1.55	0.86	0.180	175	0.018	0.005	30	ZP <sub>4</sub>										
ZP <sub>A</sub> 2900_**	2980	2400-3400	36.5	3000	1.35	0.82	0.128	175	0.0125	0.004	45	ZP <sub>A</sub>										
ZP <sub>X</sub> 3900_**	3920	2400-3400	49.5	3000	1.25	0.85	0.084	175	0.01	0.003	56	ZP <sub>X</sub>										
<b>电压至 4500V(Up to 4500V)</b>																						
ZP <sub>8</sub> 600_**	640	3600-4500	10.6	1500	1.80	0.96	0.604	150	0.035	0.008	15	ZP <sub>8</sub>										
ZP <sub>9</sub> 1200_**	1200	3600-4500	19.6	1500	1.55	0.96	0.296	150	0.02	0.005	22	ZP <sub>9</sub>										
ZP <sub>4</sub> 1300_**	1370	3600-4500	22.8	3000	1.80	0.96	0.235	150	0.018	0.005	30	ZP <sub>4</sub>										
ZP <sub>A</sub> 1900_**	1980	3600-4500	32.0	3000	1.60	0.96	0.162	150	0.0125	0.004	45	ZP <sub>A</sub>										
ZP <sub>X</sub> 2600_**	2680	3600-4500	42.6	3000	1.35	0.80	0.135	150	0.01	0.003	56	ZP <sub>X</sub>										
<b>电压至 6500V(Up to 6500V)</b>																						
ZP <sub>X</sub> 2100_**	2140	4600-5200	35.0	3000	1.60	1.00	0.195	150	0.01	0.003	56	ZP <sub>X</sub>										
ZP <sub>A</sub> 1400_**	1470	5400-6500	25.7	3000	1.90	1.00	0.290	150	0.015	0.004	45	ZP <sub>A</sub>										
ZP <sub>X</sub> 1900_**	1950	5400-6500	30.0	3000	1.80	1.21	0.230	150	0.01	0.003	56	ZP <sub>X</sub>										
ZP <sub>8</sub> 600_**	600	5000-6500	9.5	1500	1.90	0.95	0.800	150	0.035	0.008	15	ZP <sub>8</sub> /ZH <sub>8</sub>										
ZP <sub>9</sub> 1000_**	1060	5400-6500	16.5	1500	1.70	1.05	0.450	150	0.02	0.005	22	ZP <sub>9</sub> /ZH <sub>9</sub>										
<b>电压至 8500V(Up to 8500V)</b>																						
ZP <sub>5</sub> 500_**	570	6600-7200	8.0	1500	2.25	1.10	0.850	150	0.035	0.008	15	ZH <sub>8</sub>										
ZP <sub>9</sub> 900_**	960	6600-7200	11.0	1500	2.00	1.20	0.500	150	0.02	0.005	22	ZH <sub>9</sub>										
ZP <sub>8</sub> 400_**	420	7500-8500	7.0	1500	2.65	1.15	0.900	150	0.035	0.008	15	ZH <sub>8</sub>										
ZP <sub>9</sub> 900_**	910	7500-8500	11.0	1500	2.10	1.25	0.550	150	0.02	0.005	22	ZH <sub>9</sub>										

# 外形图 Outlines

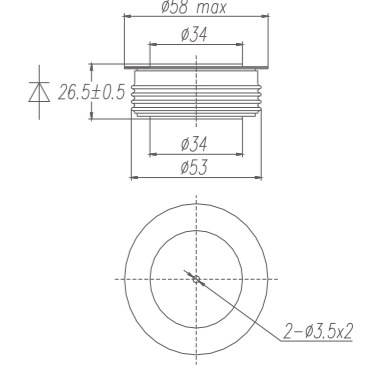
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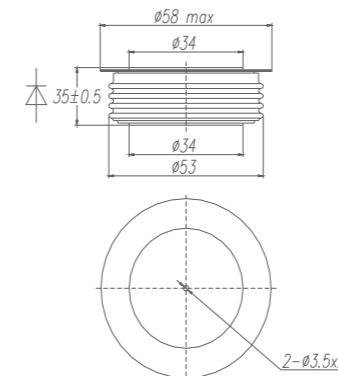
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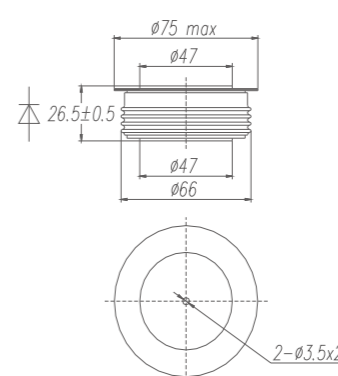
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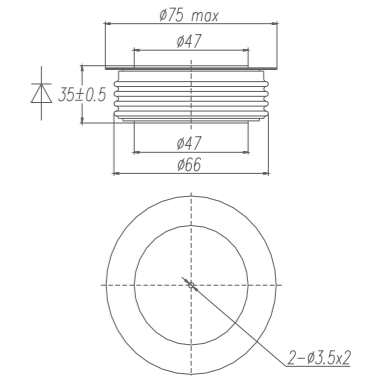
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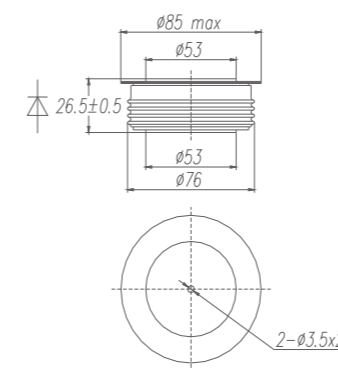
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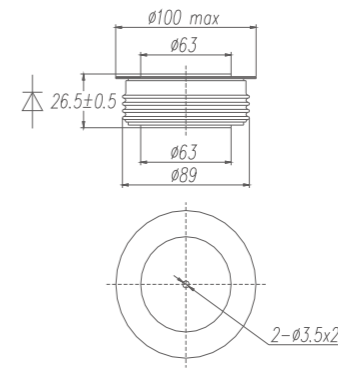
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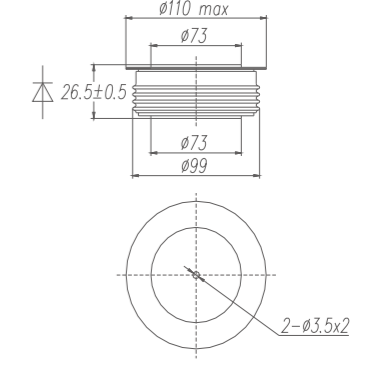
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ZP<sub>A</sub>



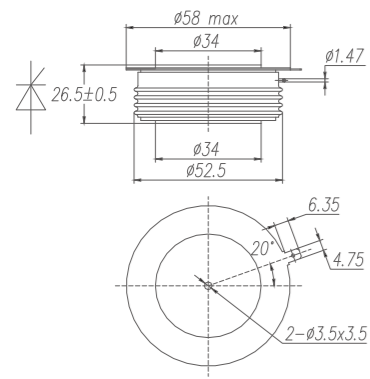
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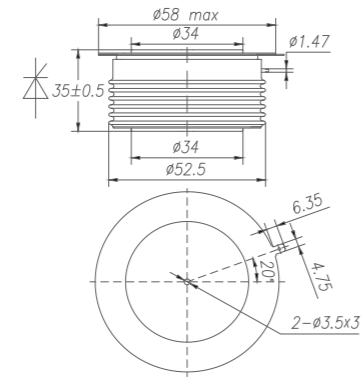


# 外形图 Outlines

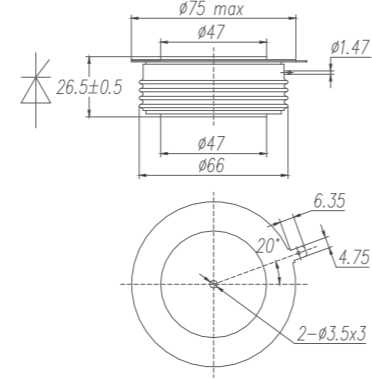
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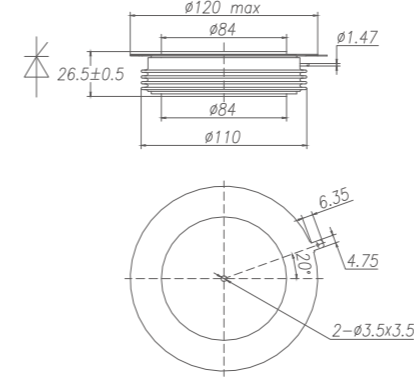
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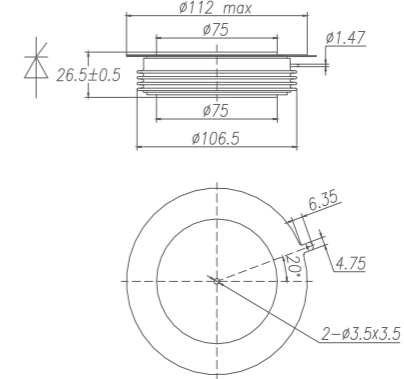
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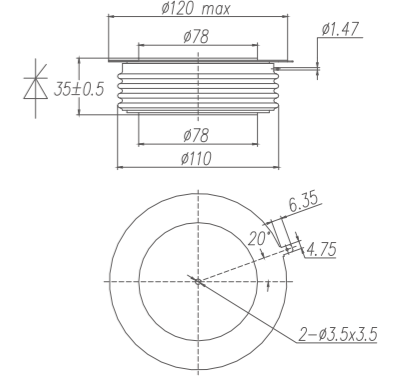
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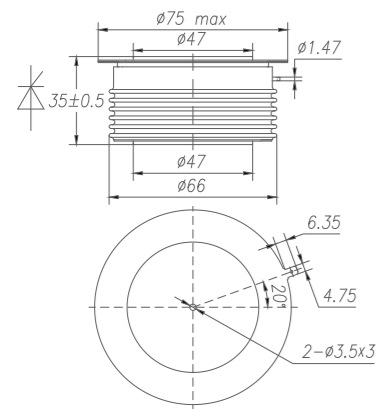
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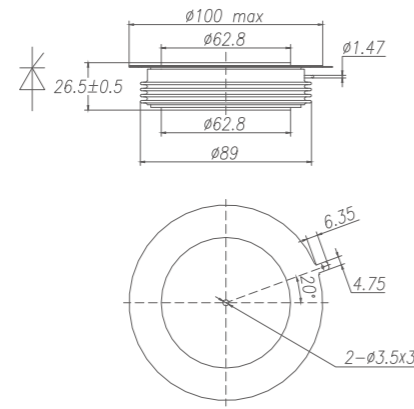
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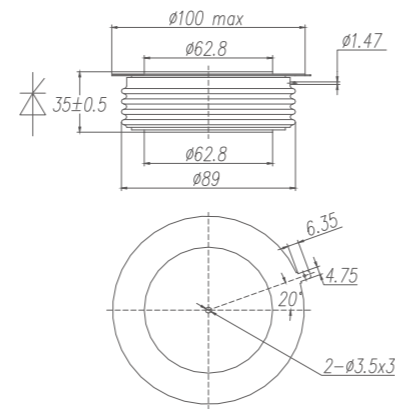
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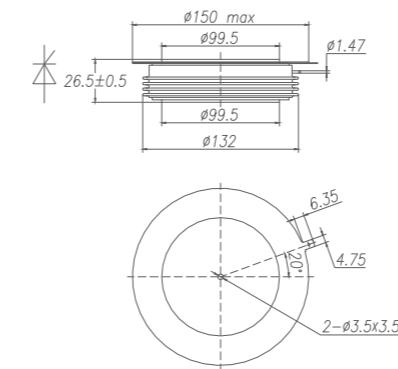
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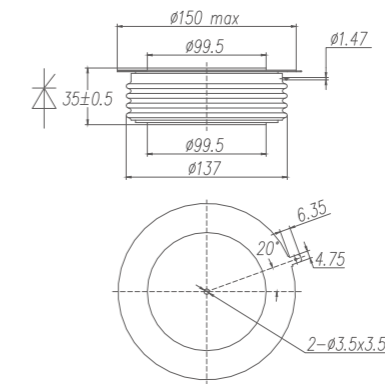
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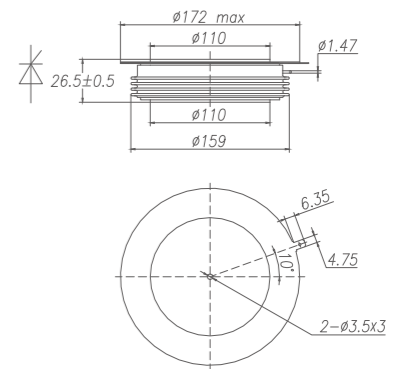
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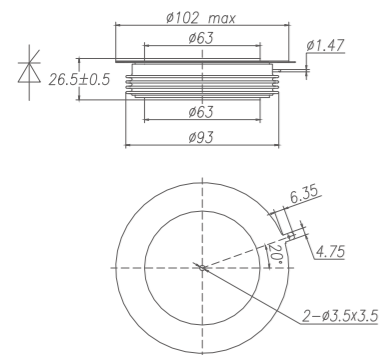
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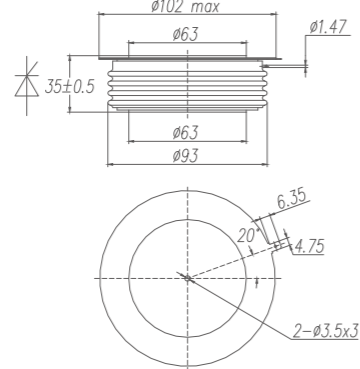
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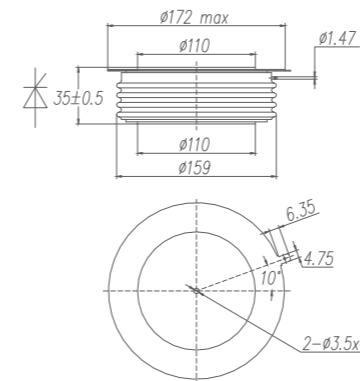
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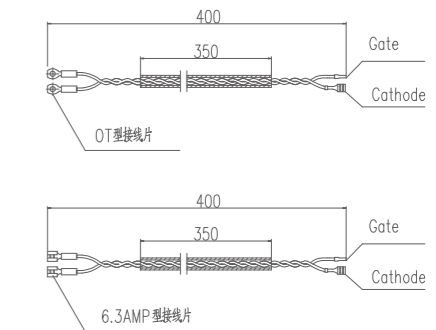
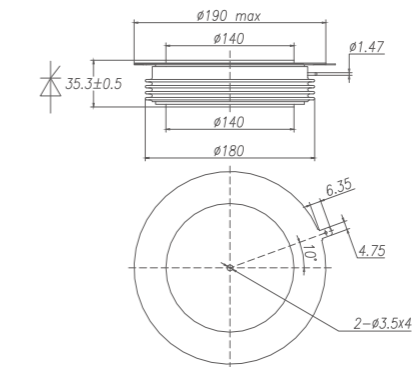
KH<sub>x</sub>



KH<sub>b</sub>



KH<sub>E</sub>



注:未标注数量单位的统一为毫米(mm)

注:未标注数量单位的统一为毫米(mm)

# 烧结型晶闸管 Alloying Thyristors

型号 - **= $V_{RRM}/100$	$I_T(AV)$	$V_{DRM}$	$I_{TSM}$	$V_{TM}$	$V_{TO}$	$r_T$	$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$F$	外形 Outline
	@ $T_c=70^\circ C$	$V_{RRM}$	@ $T_{VJM}$	@ $I_{TM}$	@ $T_{VJM}$	@ $T_{VJM}$				$\pm 10\%$	
	A	V	kA	A	V	V				m $\Omega$	

### 电压至 1400V (Up to 1400V)

KP <sub>6</sub> 400_**	400	600-1400	6.3	600	1.40	0.85	0.640	125	0.08	0.02	5	KP <sub>6</sub>
KP <sub>5</sub> 700_**	700	600-1400	9.1	1500	1.75	0.95	0.530	125	0.041	0.01	5	KP <sub>5</sub>
KP <sub>7</sub> 800_**	850	600-1400	12.8	1500	1.60	0.87	0.382	125	0.035	0.01	10	KP <sub>7</sub>
KP <sub>8</sub> 900_**	900	600-1400	15.0	1500	1.35	0.85	0.330	125	0.035	0.008	15	KP <sub>8</sub>
KP <sub>9</sub> 1700_**	1700	600-1400	26.0	1500	1.20	0.86	0.160	125	0.02	0.005	22	KP <sub>9</sub>
KP <sub>4</sub> 1800_**	1850	600-1400	29.0	3000	1.40	0.84	0.130	125	0.018	0.005	30	KP <sub>4</sub>
KP <sub>A</sub> 2600_**	2640	600-1400	47.0	3000	1.30	0.87	0.098	125	0.0125	0.004	45	KP <sub>A</sub>
KP <sub>X</sub> 3300_**	3310	600-1400	60.0	3000	1.15	0.83	0.092	125	0.01	0.003	56	KP <sub>X</sub>

### 电压至 1800V (Up to 1800V)

KP <sub>6</sub> 300_**	320	1600-1800	5.0	600	1.80	0.93	1.150	125	0.08	0.02	5	KP <sub>6</sub>
KP <sub>5</sub> 600_**	640	1600-1800	8.3	1500	1.90	1.09	0.587	125	0.041	0.01	5	KP <sub>5</sub>
KP <sub>7</sub> 700_**	770	1600-1800	11.5	1500	1.80	0.90	0.500	125	0.035	0.01	10	KP <sub>7</sub>
KP <sub>8</sub> 800_**	850	1600-1800	14.0	1500	1.60	0.91	0.360	125	0.035	0.008	15	KP <sub>8</sub>
KP <sub>9</sub> 1500_**	1520	1600-1800	25.0	1500	1.35	0.88	0.200	125	0.02	0.005	22	KP <sub>9</sub>
KP <sub>4</sub> 1700_**	1710	1600-1800	28.0	3000	1.50	0.88	0.160	125	0.018	0.005	30	KP <sub>4</sub>
KP <sub>A</sub> 2500_**	2520	1600-1800	45.0	3000	1.45	0.91	0.120	125	0.0125	0.004	45	KP <sub>A</sub>
KP <sub>X</sub> 3000_**	3030	1600-1800	60.0	3000	1.35	0.90	0.110	125	0.01	0.003	56	KP <sub>X</sub>

### 电压至 2400V (Up to 2400V)

KP <sub>5</sub> 500_**	510	2000-2600	7.8	1500	2.40	0.94	1.036	125	0.041	0.01	5	KP <sub>5</sub>
KP <sub>7</sub> 600_**	670	2000-2600	10.0	1500	2.15	0.92	0.720	125	0.035	0.01	10	KP <sub>7</sub>
KP <sub>8</sub> 750_**	750	2000-2600	11.0	1500	1.85	0.95	0.500	125	0.035	0.008	15	KP <sub>8</sub>
KP <sub>9</sub> 1400_**	1400	2000-2600	24.0	1500	1.50	0.89	0.270	125	0.02	0.005	22	KP <sub>9</sub>
KP <sub>4</sub> 1400_**	1470	2000-2400	23.0	3000	1.80	0.96	0.230	125	0.018	0.005	30	KP <sub>4</sub>
KP <sub>A</sub> 2100_**	2110	2000-2400	35.0	3000	1.65	0.96	0.179	125	0.0125	0.004	45	KP <sub>A</sub>
KP <sub>X</sub> 2700_**	2730	2000-2400	45.0	3000	1.45	0.90	0.137	125	0.01	0.003	56	KP <sub>X</sub>

### 电压至 3400V (Up to 3400V)

KP <sub>5</sub> 400_**	410	2600-3400	6.3	1500	2.80	1.04	1.725	125	0.041	0.01	5	KP <sub>5</sub>
KP <sub>7</sub> 500_**	530	3000-3400	8.0	1500	2.65	0.98	1.200	125	0.035	0.01	10	KP <sub>7</sub>
KP <sub>8</sub> 500_**	580	3000-3400	8.4	1500	2.40	1.03	0.970	125	0.035	0.008	15	KP <sub>8</sub>
KP <sub>8</sub> 700_**	700	2600-2800	10.5	1500	1.90	1.00	0.600	125	0.035	0.008	15	KP <sub>8</sub>
KP <sub>9</sub> 1000_**	1010	3000-3400	17.0	1500	2.05	1.08	0.560	125	0.02	0.005	22	KP <sub>9</sub>
KP <sub>4</sub> 1200_**	1240	2600-3400	19.2	3000	2.25	1.06	0.350	125	0.018	0.005	30	KP <sub>4</sub>
KP <sub>9</sub> 1300_**	1300	2600-2800	23.0	1500	1.55	0.95	0.300	125	0.02	0.005	22	KP <sub>9</sub>
KP <sub>A</sub> 1700_**	1770	3000-3400	30.0	3000	2.10	1.05	0.298	125	0.0125	0.004	45	KP <sub>A</sub> /KH <sub>A</sub>
KP <sub>A</sub> 1800_**	1850	2600-2800	30.0	3000	1.90	1.02	0.250	125	0.0125	0.004	45	KP <sub>A</sub>
KP <sub>X</sub> 2100_**	2190	3000-3400	33.0	3000	1.85	1.00	0.235	125	0.01	0.003	56	KP <sub>X</sub> /KH <sub>X</sub>
KP <sub>X</sub> 2400_**	2470	2600-2800	43.0	3000	1.65	0.98	0.170	125	0.01	0.003	56	KP <sub>X</sub>

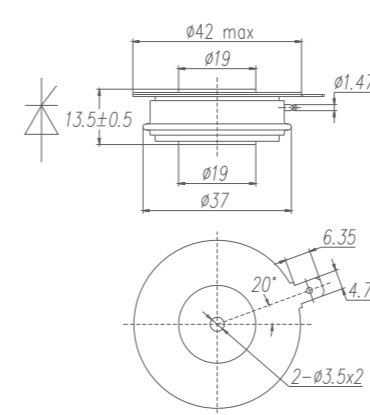
型号 - **= $V_{RRM}/100$	$I_T(AV)$	$V_{DRM}$	$I_{TSM}$	$V_{TM}$	$V_{TO}$	$r_T$	$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$F$	外形 Outline
	@ $T_c=70^\circ C$	$V_{RRM}$	@ $T_{VJM}$	@ $I_{TM}$	@ $T_{VJM}$	@ $T_{VJM}$				$\pm 10\%$	
	A	V	kA	A	V	V				m $\Omega$	

### 电压至 5200V (Up to 5200V)

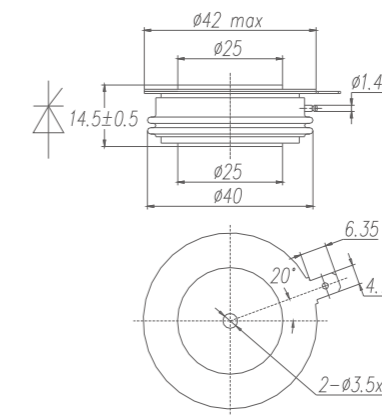
KP <sub>6</sub> 400_**	480	3600-4200	7.0	1500	3.25	1.15	1.470	125	0.035	0.008	15	KP <sub>6</sub> /KH <sub>6</sub>
KP <sub>9</sub> 800_**	870	3600-4200	15.0	1500	2.50	1.15	0.799	125	0.02	0.005	22	KP <sub>9</sub> /KH <sub>9</sub>
KP <sub>4</sub> 900_**	960	3600-4200	14.7	3000	2.80	1.15	0.680	125	0.018	0.005	30	KP <sub>4</sub>
KP <sub>A</sub> 1400_**	1440	3600-4200	25.0	3000	2.45	1.15	0.452	125	0.0125	0.004	45	KP <sub>A</sub> /KH <sub>A</sub>
KP <sub>X</sub> 1800_**	1880	3600-4200	25.0	3000	2.20	1.14	0.360	125	0.01	0.003	56	KP <sub>X</sub> /KH <sub>X</sub>
KP <sub>X</sub> 1400_**	1470	4600-5200	23.5	3000	2.80	1.18	0.525	125	0.01	0.003	56	KP <sub>X</sub> /KH <sub>X</sub>

## 外形图 Outlines

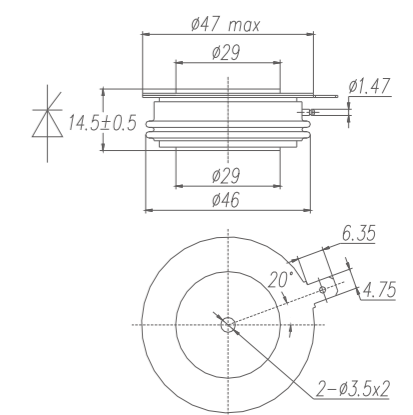
KP<sub>6</sub>



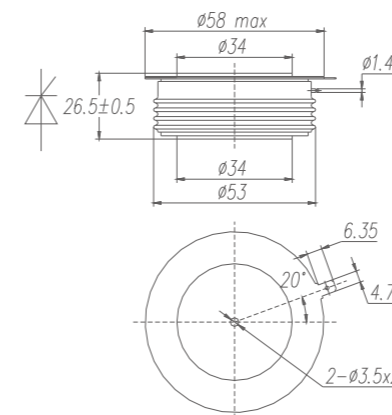
KP<sub>5</sub>



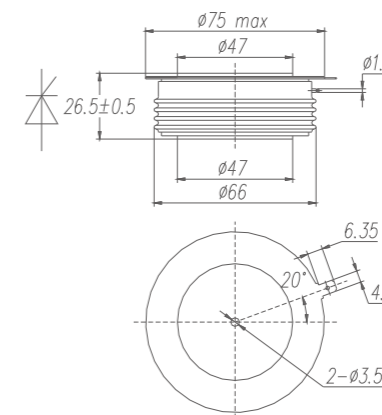
KP<sub>7</sub>



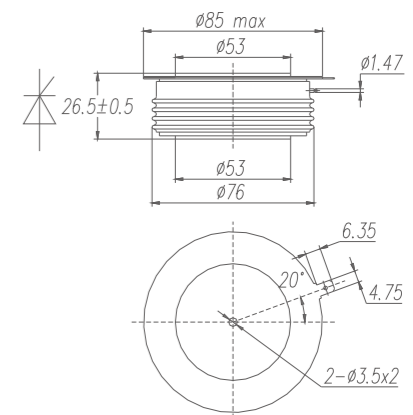
KP<sub>8</sub>



KP<sub>9</sub>

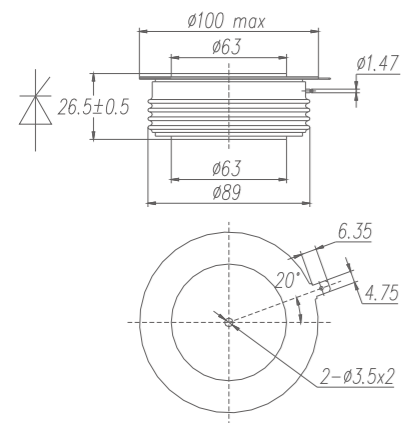


KP<sub>4</sub>

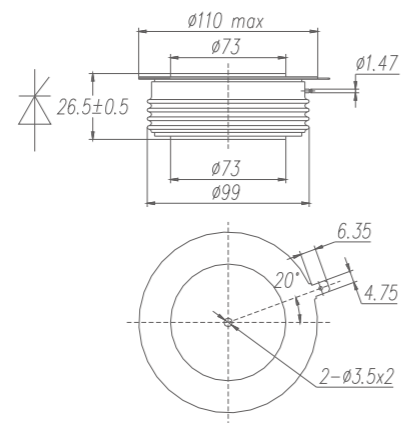


# 快速晶闸管 Fast Thyristors

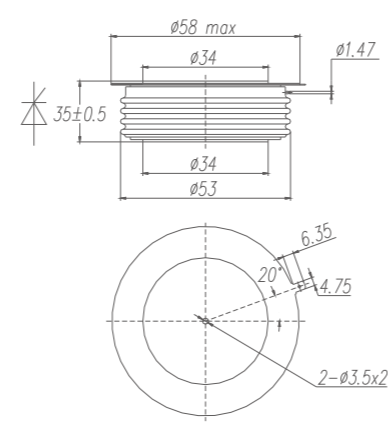
KP<sub>A</sub>



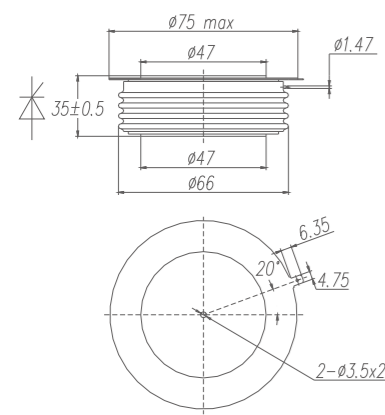
KP<sub>x</sub>



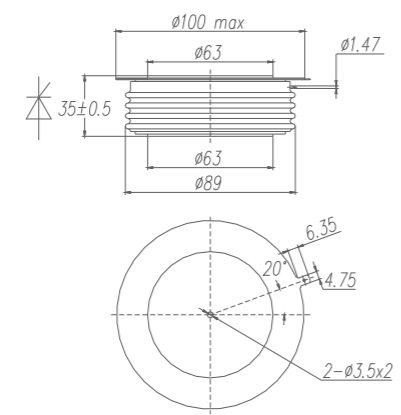
KH<sub>8</sub>



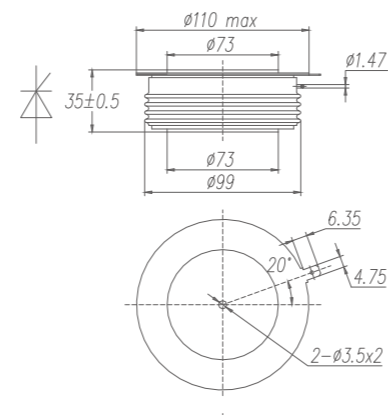
KH<sub>9</sub>



KH<sub>A</sub>



KH<sub>x</sub>



注：门阴极引线长400mm。

型号 - ** = V <sub>RRM</sub> / 100	I <sub>T(AV)</sub>	V <sub>DRM</sub>	I <sub>TSM</sub>	V <sub>TM</sub>		T <sub>VJM</sub>	R <sub>thJC</sub>	R <sub>thCH</sub>	t <sub>q</sub>	F	外形 Outline
	@ T <sub>C</sub> = 55°C	V <sub>RRM</sub>	@ T <sub>VJM</sub>	@ I <sub>TM</sub>					@ T <sub>VJM</sub>	± 10%	
	A	V	kA	A	V				μs	kN	

**电压至 1200V (Up to 1200V)**

KK <sub>8</sub> 800_**	850	800-1200	10.7	1500	2.08	125	0.035	0.008	25	15	KP <sub>8</sub>
KK <sub>9</sub> 1300_**	1380	800-1200	17.4	2000	1.85	125	0.02	0.005	25	22	KP <sub>9</sub>
KK <sub>4</sub> 1600_**	1680	800-1200	21.1	2000	1.75	125	0.018	0.005	25	30	KP <sub>4</sub>
KK <sub>A</sub> 2100_**	2190	800-1200	27.5	3000	2.00	125	0.0124	0.004	25	45	KP <sub>A</sub>
KK <sub>x</sub> 2900_**	2950	800-1200	31.6	4000	1.80	125	0.01	0.003	25	56	KP <sub>x</sub>

**电压至 1400V (Up to 1400V)**

KK <sub>8</sub> 700_**	750	1200-1400	9.5	1500	2.45	125	0.035	0.008	35	15	KP <sub>8</sub>
KK <sub>9</sub> 1200_**	1270	1200-1400	16.0	2000	2.00	125	0.02	0.005	35	22	KP <sub>9</sub>
KK <sub>4</sub> 1600_**	1600	1200-1400	20.2	2000	1.85	125	0.018	0.005	35	30	KP <sub>4</sub>
KK <sub>A</sub> 2100_**	2110	1200-1400	26.6	3000	2.15	125	0.0124	0.004	35	45	KP <sub>A</sub>
KK <sub>x</sub> 2900_**	2900	1200-1400	30.9	4000	1.90	125	0.01	0.003	35	56	KP <sub>x</sub>

**电压至 2000V (Up to 2000V)**

KK <sub>8</sub> 600_**	680	1600-2000	8.6	1500	2.80	125	0.035	0.008	50	15	KP <sub>8</sub>
KK <sub>9</sub> 1200_**	1200	1600-2000	15.1	2000	2.15	125	0.02	0.005	50	22	KP <sub>9</sub>
KK <sub>4</sub> 1500_**	1510	1600-2000	19.0	2000	2.00	125	0.018	0.005	50	30	KP <sub>4</sub>
KK <sub>A</sub> 2000_**	2010	1600-2000	25.3	3000	2.35	125	0.0124	0.004	50	45	KP <sub>A</sub>
KK <sub>x</sub> 2700_**	2740	1600-2000	28.9	4000	2.15	125	0.01	0.003	50	56	KP <sub>x</sub>

**电压至 3000V (Up to 3000V)**

KK <sub>A</sub> 2000_**	2000	2200-2500	25.2	3000	2.47	125	0.0124	0.004	65	45	KP <sub>A</sub>
KK <sub>x</sub> 2500_**	2520	2200-2500	26.4	4000	2.80	125	0.01	0.003	65	56	KP <sub>x</sub>
KK <sub>x</sub> 2000_**	2087	2800-3000	22.0	3000	2.80	125	0.01	0.003	100	56	KP <sub>x</sub>
KK <sub>B</sub> 3000_**	3000	2500-3000	32.2	4000	2.80	125	0.007	0.002	100	70	KP <sub>B</sub>
KK <sub>C</sub> 4000_**	4016	2500-3000	42.3	6000	2.80	125	0.0057	0.002	100	90	KH <sub>C</sub>

**电压至 3500V (Up to 3500V)**

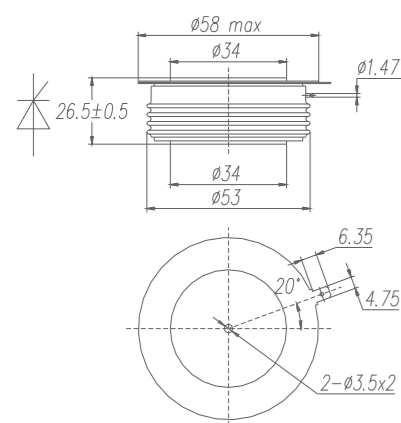
KK <sub>x</sub> 2000_**	2008	3200-3500	21.2	3000	2.95	125	0.01	0.003	120	56	KP <sub>x</sub>
KK <sub>B</sub> 2500_**	2521	3200-3500	27.0	4000	3.20	125	0.007	0.002	120	70	KP <sub>B</sub>
KK <sub>C</sub> 3000_**	3005	3200-3500	32.3	4000	3.00	125	0.0057	0.002	120	90	KH <sub>C</sub>

**电压至 4500V (Up to 4500V)**

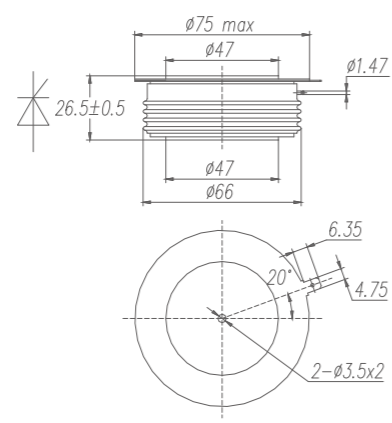
KK <sub>B</sub> 2300_**	2320	4000-4200	24.9	3000	3.20	125	0.007	0.002	150	70	KP <sub>B</sub>
KK <sub>C</sub> 2700_**	2766	4000-4200	31.2	4000	3.40	125	0.0057	0.002	150	90	KH <sub>C</sub>
KK <sub>C</sub> 2700_**	2786	4200-4500	36.8	4000	3.20	125	0.0057	0.002	200	90	KH <sub>C</sub>

# 外形图 Outlines

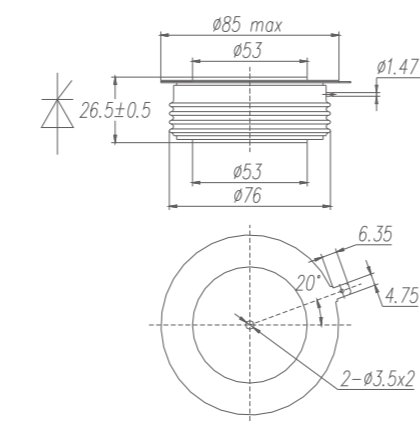
KP<sub>8</sub>



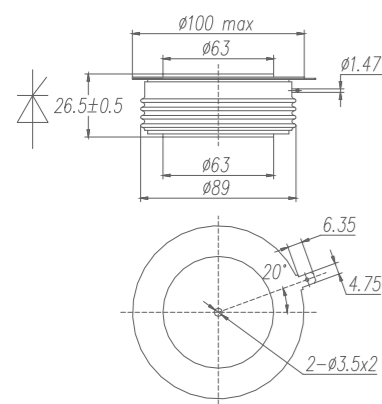
KP<sub>9</sub>



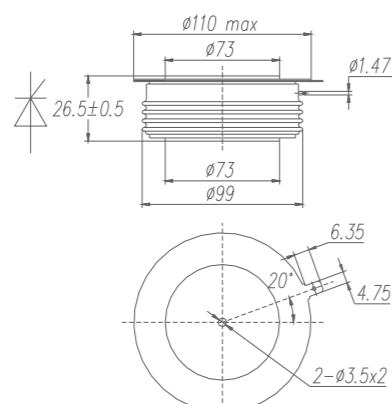
KP<sub>4</sub>



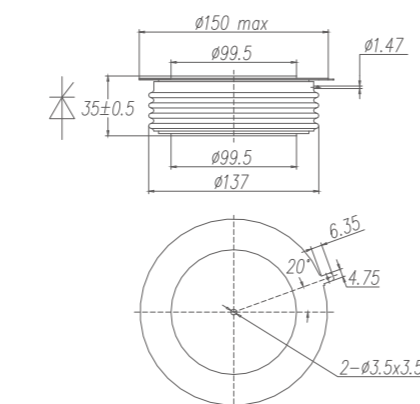
KP<sub>A</sub>



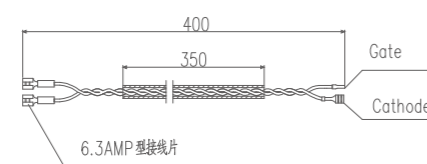
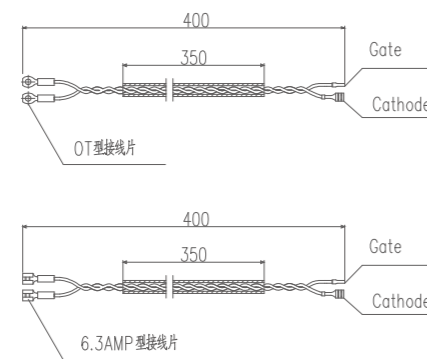
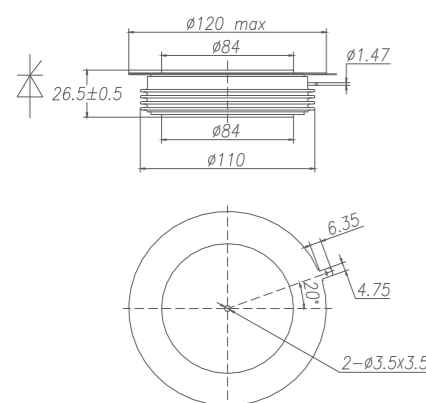
KP<sub>x</sub>



KH<sub>c</sub>



KP<sub>B</sub>



注:门阴极引线长400mm

# 双向晶闸管 Bi-directional Thyristors

型号 -**= $V_{DSM}/100$	$I_{T(AV)}$	$I_{T(RMS)F}$	$V_{DSM}$	$V_{DRM}$	$I_{TSM}$	$V_{TM}$	$V_{TO}$	$r_T$	$T_{VM}$	$R_{thJC}$	$R_{thCH}$	$F$	外形 Outline
	@ $T_C=70^\circ C$		$V_{RSM}$	$V_{RRM}$	@ $T_{VM}$	@ $I_{TM}$	@ $T_{VM}$	@ $T_{VM}$				$\pm 10\%$	
	A	A	V	V	kA	A	V	V				m $\Omega$	

**电压至 1400V(Up to 1400V)**

KB <sub>9</sub> 1600_**	720	1600	600-1400	600-1400	11.0	1000	1.31	1.02	0.29	125	0.045	0.008	22	KB <sub>9</sub>
KB <sub>A</sub> 2600_**	1200	2660	600-1400	600-1400	18.3	1000	1.14	0.91	0.23	125	0.026	0.005	50	KB <sub>A</sub>
KB <sub>x</sub> 3300_**	1500	3320	600-1400	600-1400	23.2	1000	1.07	0.92	0.15	125	0.022	0.005	50	KB <sub>x</sub>

**电压至 1800V(Up to 1800V)**

KB <sub>9</sub> 1400_**	640	1420	1600-1800	1600-1800	9.5	1000	1.48	1.06	0.42	125	0.045	0.008	22	KB <sub>9</sub>
KB <sub>A</sub> 2500_**	1180	2600	1600-1800	1600-1800	18.0	1000	1.18	0.95	0.23	125	0.026	0.005	50	KB <sub>A</sub>
KB <sub>x</sub> 3200_**	1470	3250	1600-1800	1600-1800	22.4	1000	1.09	0.92	0.17	125	0.022	0.005	50	KB <sub>x</sub>

**电压至 2800V(Up to 2800V)**

KB <sub>c</sub> 5200_**	2360	5240	2200-2800	2200-2800	38.0	3000	1.47	0.99	0.16	125	0.011	0.003	90	KB <sub>c</sub>
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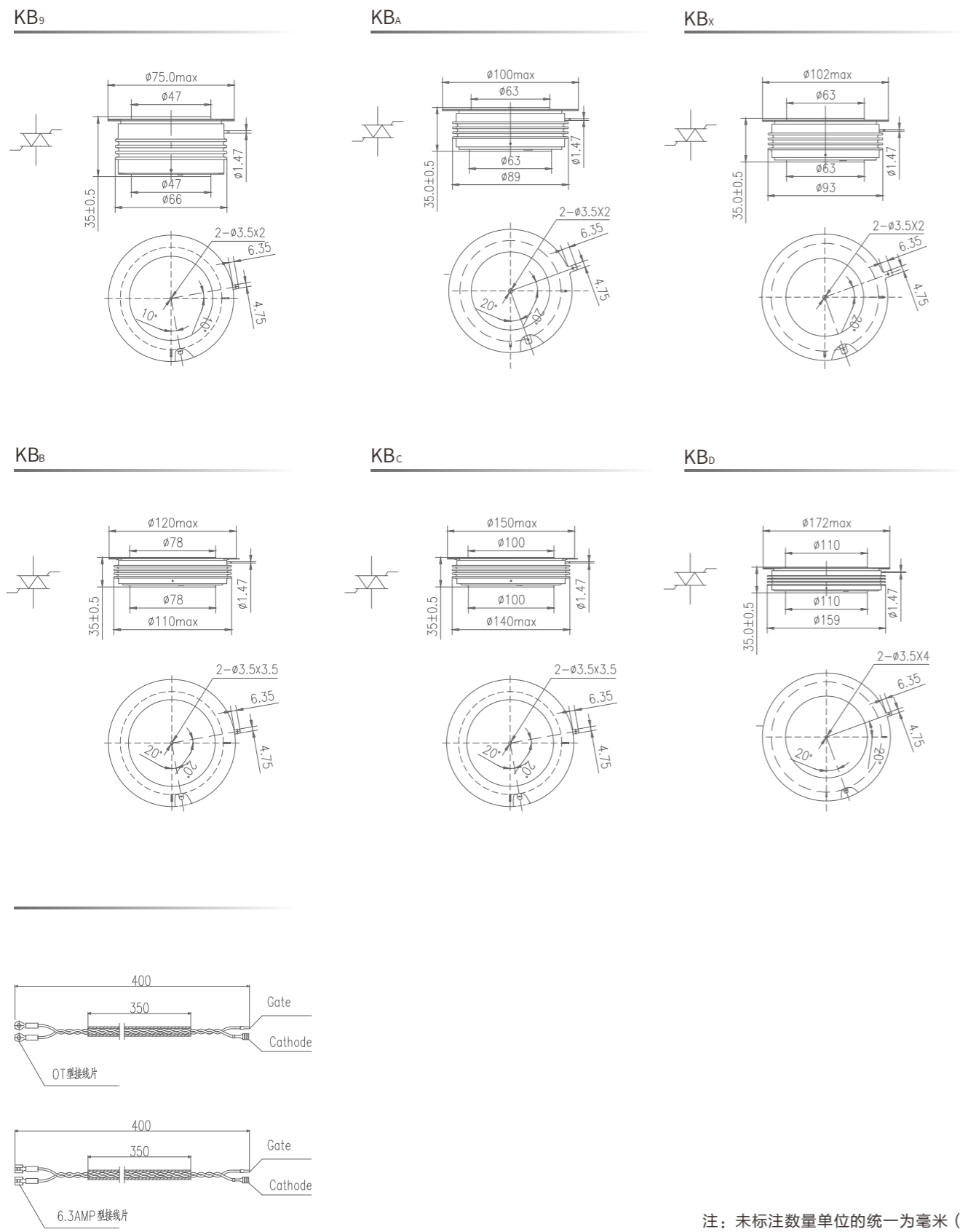
**电压至 4200V(Up to 4200V)**

KB <sub>9</sub> 1000_**	460	1020	3600-4200	3600-4200	6.0	1000	2.25	1.15	1.000	125	0.045	0.008	22	KB <sub>9</sub>
KB <sub>A</sub> 1800_**	840	1850	3600-4200	3600-4200	12.0	1000	1.65	1.05	0.600	125	0.026	0.005	50	KB <sub>A</sub>
KB <sub>x</sub> 2200_**	1000	2219	3600-4200	3600-4200	15.0	1000	1.55	1.05	0.500	125	0.022	0.005	50	KB <sub>x</sub>
KB <sub>B</sub> 2900_**	1310	2912	3600-4200	3600-4200	23.0	1500	1.65	1.02	0.420	125	0.016	0.004	70	KB <sub>B</sub>
KB <sub>c</sub> 4400_**	1980	4400	3600-4200	3600-4200	32.5	2000	1.52	1.00	0.260	125	0.011	0.003	90	KB <sub>c</sub>
KB <sub>D</sub> 5600_**	2560	5680	3600-4200	3600-4200	40.0	3000	1.50	0.90	0.200	125	0.009	0.002	120	KB <sub>D</sub>

**电压至 6500V(Up to 6500V)**

KB <sub>9</sub> 700_**	350	770	5400-6500	4500-5600	4.5	1000	3.50	1.20	2.300	125	0.045	0.008	22	KB <sub>9</sub>
KB <sub>A</sub> 1300_**	610	1360	5400-6500	4500-5600	11.0	1000	2.50	1.30	1.200	125	0.026	0.005	50	KB <sub>A</sub>
KB <sub>x</sub> 1600_**	740	1640	5400-6500	4500-5600	11.8	1000	2.25	1.25	1.000	125	0.022	0.005	50	KB <sub>x</sub>
KB <sub>B</sub> 2300_**	1060	2347	5400-6500	4500-5600	14.0	1500	2.25	1.18	0.680	125	0.016	0.004	70	KB <sub>B</sub>
KB <sub>c</sub> 3100_**	1410	3124	5400-6500	4500-5600	22.5	3000	2.95	1.30	0.540	125	0.011	0.003	90	KB <sub>c</sub>
KB <sub>D</sub> 4200_**	1910	4242	5400-6500	4500-5600	32.0	3000	2.25	1.11	0.380	125	0.009	0.002	120	KB <sub>D</sub>

# 外形图 Outlines



注：未标注数量单位的统一为毫米（mm）

# 型号说明 Nomenclature

该项数字表示： $I_{F(AV)} / I_{F(AV)}$   
This number tells the rating of  $I_{F(AV)} / I_{F(AV)}$

该项数字的100倍表示： $V_{DRM} / V_{RRM}$   
100 times of this number tells the rating of  $V_{DRM} / V_{RRM}$

**KP** × **2600** — **16** **00**\*

二个字母表示器件的种类  
the two letters represent the type of the devices

符号 symbols	器件种类 Device types
ZP	普通整流管 Rectifier diodes
KP	晶闸管 Thyristors
KK	快速晶闸管 Fast switching thyristors
KB	双向晶闸管 Bi-directional control thyristors

设计序号表示器件结构、参数及工艺等的变化序列  
The number represents the changes in structure process and parameters etc.

设计序号 Design	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
☆	代表新产品 New products

# 符号说明 Symbols

符号	参数名称	Characteristics
$F$	安装力	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
$I_{FSM}$	正向浪涌电流	Surge forward current
$I_{T(AV)}$	通态平均电流	Mean on-state current
$I_{T(RMS)}$	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) on-state 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(高效)结温	Max.(vital)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 off reverse voltage
$V_{FM}$	正向峰值电压	Peak forward voltage
$V_{TM}$	通态峰值电压	Peak on-stat voltage
$V_{TO}$	通态门坎电压	On-state threshold voltage
$r_T$	通态斜率电阻	On-state slope voltag
$V_{FO}$	正向门坎电压	Forward threshold voltag
$r_F$	正向斜率电阻	Forward slope voltag



## 快速二极管 Fast Diodes

型号 **= $V_{RRM}/100$	$I_{T(AV)}$	$V_{RRM}$	$I_{FSM}$	$V_{FM}$		$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$t_{rr}$	$F$	外形 Outline
	@ $T_c=70^\circ\text{C}$		@ $T_{VJM}$	@ $I_{FM}$					@ $T_{VJM}$	$\pm 10\%$	
	A		V	kA	A				V	$\mu\text{s}$	

## 电压至 2200V (Up to 2200V)

ZK <sub>8</sub> 800_**	816	1800-2200	10.8	1500	2.40	150	0.035	0.008	6.0	15	ZP <sub>8</sub>
ZK <sub>9</sub> 1200_**	1280	1800-2200	17.0	2000	2.40	150	0.02	0.005	6.0	22	ZP <sub>9</sub>
ZK <sub>A</sub> 2000_**	2082	1800-2200	27.5	3000	2.30	150	0.0124	0.004	6.5	45	ZP <sub>A</sub>
ZK <sub>x</sub> 2500_**	2598	1800-2200	34.3	4000	2.30	150	0.01	0.003	6.5	56	ZP <sub>x</sub>

## 电压至 2800V (Up to 2800V)

ZK <sub>8</sub> 700_**	770	2500-2800	10.1	1500	2.60	150	0.035	0.008	6.2	15	ZP <sub>8</sub>
ZK <sub>9</sub> 1100_**	1190	2500-2800	15.8	2000	2.60	150	0.02	0.005	6.2	22	ZP <sub>9</sub>
ZK <sub>A</sub> 2000_**	2030	2500-2800	26.8	3000	2.50	150	0.0125	0.004	6.7	45	ZP <sub>A</sub>
ZK <sub>x</sub> 2500_**	2531	2500-2800	33.4	4000	2.50	150	0.01	0.003	6.7	56	ZP <sub>x</sub>

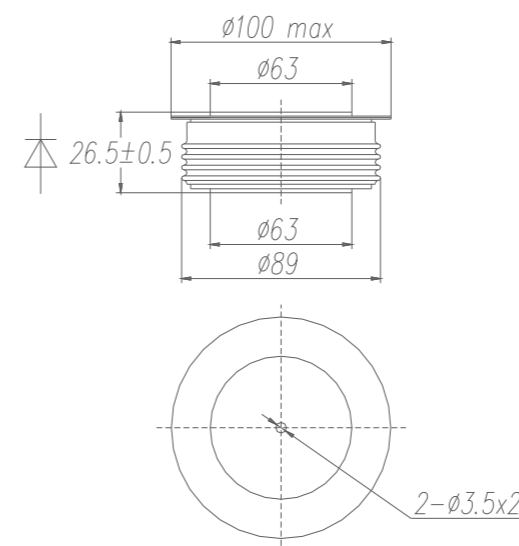
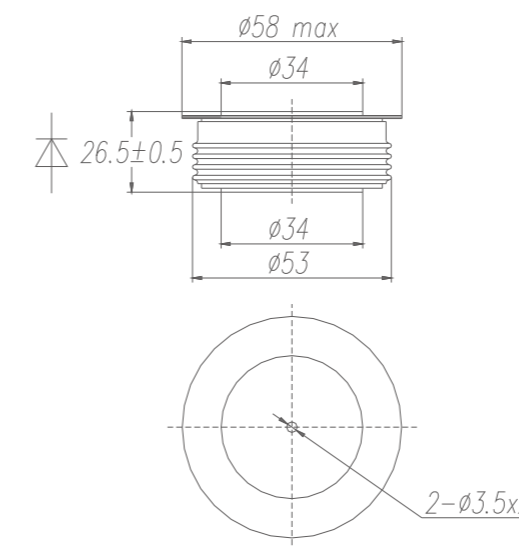
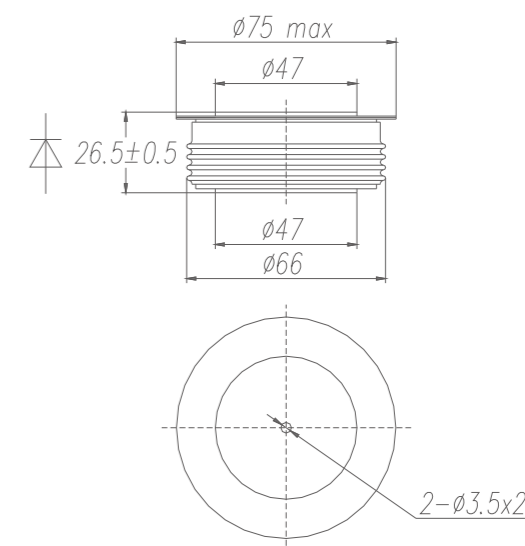
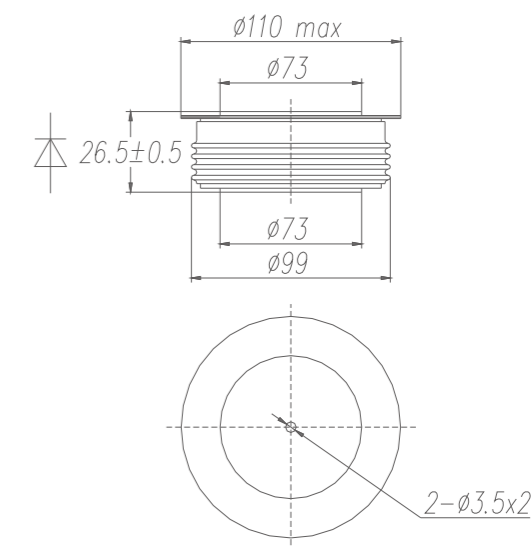
## 电压至 3500V (Up to 3500V)

ZK <sub>8</sub> 600_**	680	3000-3500	9.9	1500	3.00	150	0.035	0.008	6.5	15	ZP <sub>8</sub>
ZK <sub>9</sub> 1000_**	1016	3000-3500	13.4	2000	3.00	150	0.02	0.005	6.5	22	ZP <sub>9</sub>
ZK <sub>A</sub> 1800_**	1855	3000-3500	24.5	3000	2.80	150	0.0124	0.004	7.0	45	ZP <sub>A</sub>
ZK <sub>x</sub> 2200_**	2228	3000-3500	29.4	4000	2.80	150	0.01	0.003	7.0	56	ZP <sub>x</sub>

## 电压至 4500V (Up to 4500V)

ZK <sub>8</sub> 500_**	530	4000-4500	7.1	1500	3.50	150	0.035	0.008	7.0	15	ZP <sub>8</sub>
ZK <sub>9</sub> 900_**	925	4000-4500	12.2	2000	3.50	150	0.02	0.005	7.0	22	ZP <sub>9</sub>
ZK <sub>A</sub> 1800_**	1820	4000-4500	24.1	3000	3.20	150	0.0124	0.004	7.5	45	ZP <sub>A</sub>
ZK <sub>x</sub> 2000_**	2032	4000-4500	26.8	4000	3.20	150	0.01	0.003	7.5	56	ZP <sub>x</sub>

## 外形图 Outlines

ZP<sub>8</sub>ZP<sub>A</sub>ZP<sub>9</sub>ZP<sub>x</sub>

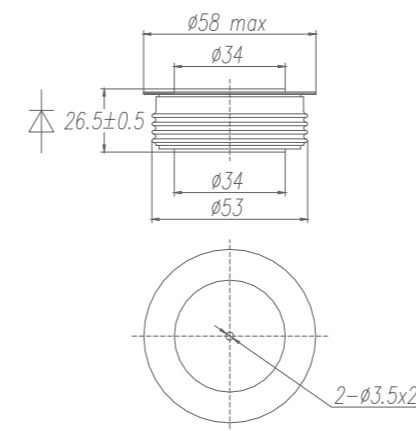
注:门阴极引线长400mm。

# 快恢复二极管 Fast Recovery Diodes

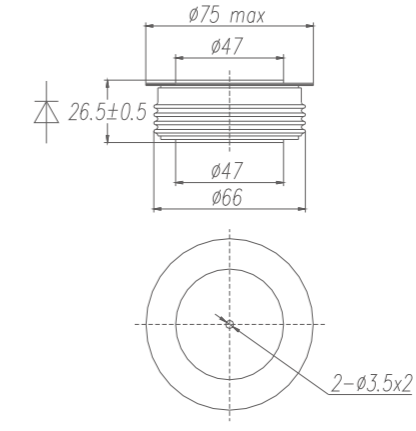
型号 **= $V_{RRM}/100$	$I_{F(AV)}$	$V_{RRM}$	$I_{FSM}$	$V_{FM}$		$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$I_{rr}$	$Q_{rr}$	$F$	外形 Outline
	@ $T_c = 70^\circ C$		@ $T_{VJM}$	@ $T_{FM}$							$\pm 10\%$	
	A	V	kA	A	V	$^\circ C$	K/W	K/W	A	$\mu C$	kN	
<b>电压至2500V (Up to 2500V)</b>												
FY <sub>9</sub> 1100_**	1150	2500	18	4500	3.0	125	0.020	0.005	750	180	22	ZP <sub>9</sub>
<b>电压至4500V (Up to 4500V)</b>												
FY <sub>9</sub> 400_**	400	4500	5	1000	2.9	125	0.035	0.008	750	2300	15	ZP <sub>8</sub>
FY <sub>9</sub> 600_**	630	4500	16	2000	3.5	125	0.020	0.005	800	2500	22	ZP <sub>9</sub>
FY <sub>x</sub> 1100_**	1184	4500	20	2500	3.6	125	0.010	0.003	1600	4500	40	ZS <sub>x</sub>
FY <sub>9</sub> 2000_**_01	2000	4500	25	2500	3.6	125	0.007	0.002	2300	5600	40	ZS <sub>B</sub>
FY <sub>9</sub> 2000_**_02	2620	4500	40	2500	2.0	125	0.007	0.002	2800	9000	40	ZS <sub>B</sub>
FY <sub>9</sub> 4600_**	4600	4500	85	2500	2.1	125	0.004	0.001	3200	7200	120	ZP <sub>D</sub>
FY <sub>E</sub> 6000_**	6000	4500	100	2500	1.9	125	0.003	0.0005	3500	8000	180	ZP <sub>E</sub>
<b>电压至6000V (Up to 6000V)</b>												
FY <sub>9</sub> 400_**	360	6000	10	900	5.2	125	0.020	0.005	750	2300	22	ZP <sub>9</sub>
FY <sub>9</sub> 800_**	800	6000	18	1800	4.8	125	0.010	0.003	1600	4500	40	ZS <sub>x</sub>
FY <sub>9</sub> 1100_**	1100	6000	20	2500	4.5	125	0.007	0.002	2000	4000	40	ZS <sub>B</sub>
FY <sub>c</sub> 1700_**	1696	6000	24	2500	4.6	125	0.005	0.002	2400	5000	60	ZP <sub>c</sub>

# 外形图 Outlines

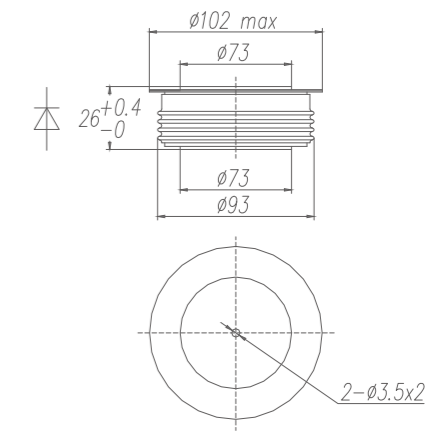
ZP<sub>8</sub>



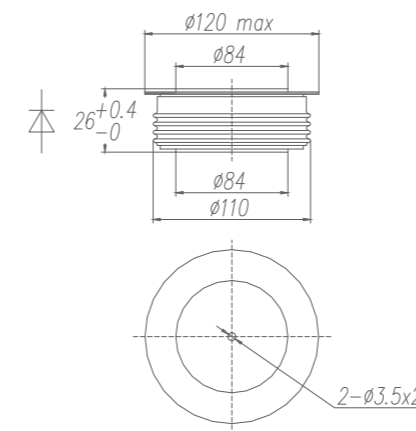
ZP<sub>9</sub>



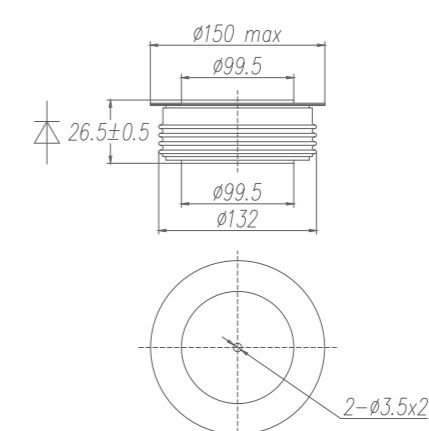
ZS<sub>x</sub>



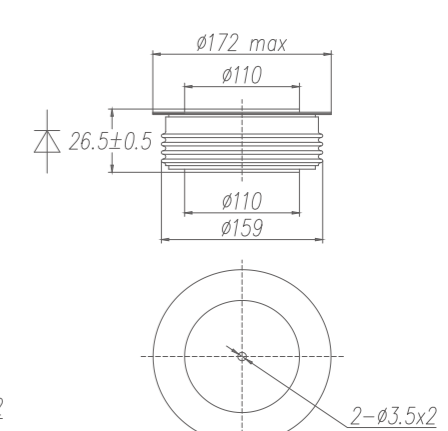
ZS<sub>B</sub>



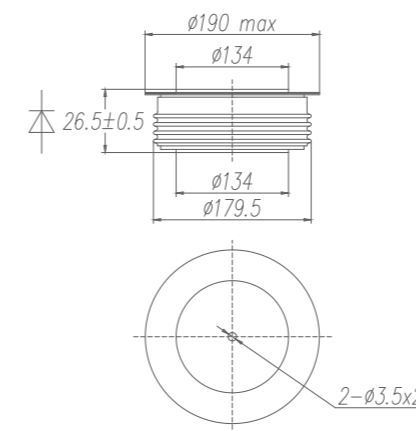
ZP<sub>c</sub>



ZP<sub>D</sub>

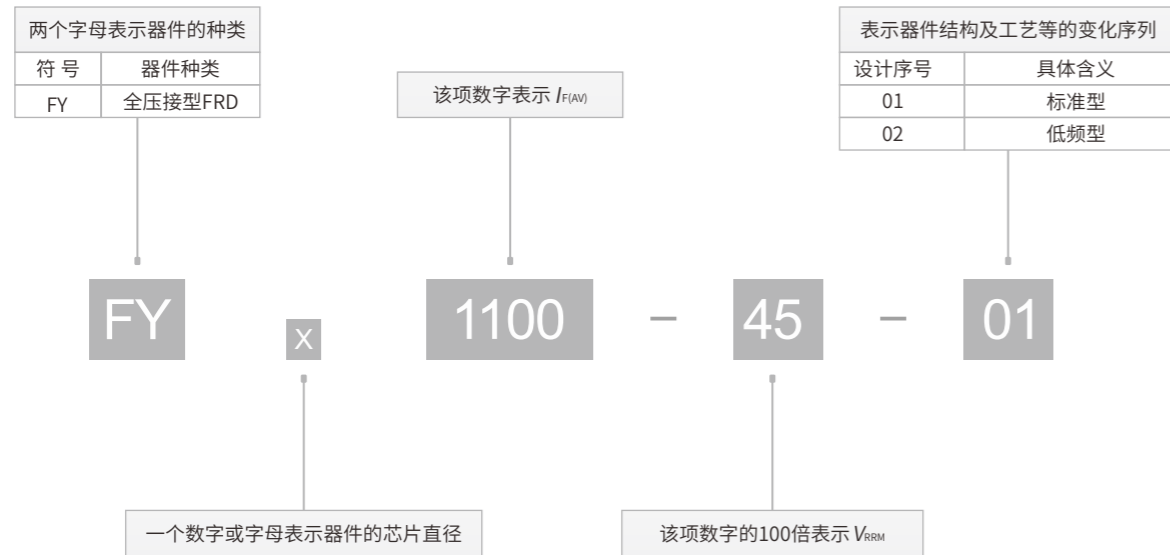


ZP<sub>E</sub>



注: 未标注数量单位的统一为毫米 (mm)

## 型号说明 Nomenclature



## 符号说明 Symbols

符号 Symbol	参数名称	Parameter Name
$F$	紧固力	Mounting Force
$I_{F(AV)}$	正向平均电流	Forward Average Current
$I_{FM}$	正向峰值电流	Forward Peak Current
$I_{FSM}$	浪涌电流	Surge 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 Charge Recovery
$T_c$	壳温	Case Temperature
$T_{VJM}$	最高(等效)结温	Maximum Virtual Junction Temperature
$V_{FM}$	正向峰值电压	Forward Peak Voltage
$V_{RRM}$	反向重复峰值电压	Repetitive Peak Reverse Voltage





# 集成门极换流晶闸管 IGCT



# IGCT

IGCT——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。

IGCT—Integrated gate commutate thyristor is adopted new technologies such as buffer layer, transparent anode, hard-driver unit, etc., and is a medium and high voltage switching device suitable for more than 5MW power equipment. It is widely used in power equipments such as motor drive, energy saving and environmental protection, power generation, ship drive, power quality control, etc., which has made great progress in power, reliability, efficiency, cost, volume and weight for those whole power apparatuses.

## 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 Conduction Loss
- 浪涌电流大 High Surge Current
- 失效长期短路模式 Short-circuit Failure Mode
- 电磁兼容能力强 Strong EMC Performance



非对称型号 Part number	$I_{TGM}$	$I_{T(AV)}$	$V_{DRM}$	$V_{GK}$	$I_{TSM}$	$V_{TM@ITM}$		$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$V_{TO}$	$r_T$	$F$	外形 Outline
	$T_{VJM}$	$T_c=85^\circ C$	$T_{VJM}$	$T_{VJ}=25^\circ C$	$T_{VJM}$	$T_{VJM}$					$T_{VJM}$	$\pm 10\%$		
	A	A	V	V	kA	V	A				°C	K/W	V	
CAc3000-60	3000	1300	6000	17	27.5	3.4	3000	125	0.0085	0.003	1.50	0.650	40	CAc
CAc4000-45	4000	1700	4500	17	32	2.7	4000	125	0.0085	0.003	1.40	0.325	40	CAc
CAc4000-45-02	4000	2150	4500	17	35	1.9	4000	125	0.0085	0.003	1.05	0.213	40	CAc
CAc5000-45	5000	1870	4500	17	33	2.35	4000	125	0.0085	0.003	1.22	0.280	40	CA2c
CAc5000-45 Plus	5000	3000*	4500	17	35	2.61	5000	125	0.0085	0.003	1.22	0.280	40	CA3c
CAE8000-45	8000	3670	4500	17	64	2.30	8000	125	0.0046	0.0013	1.54	0.097	108	CAE

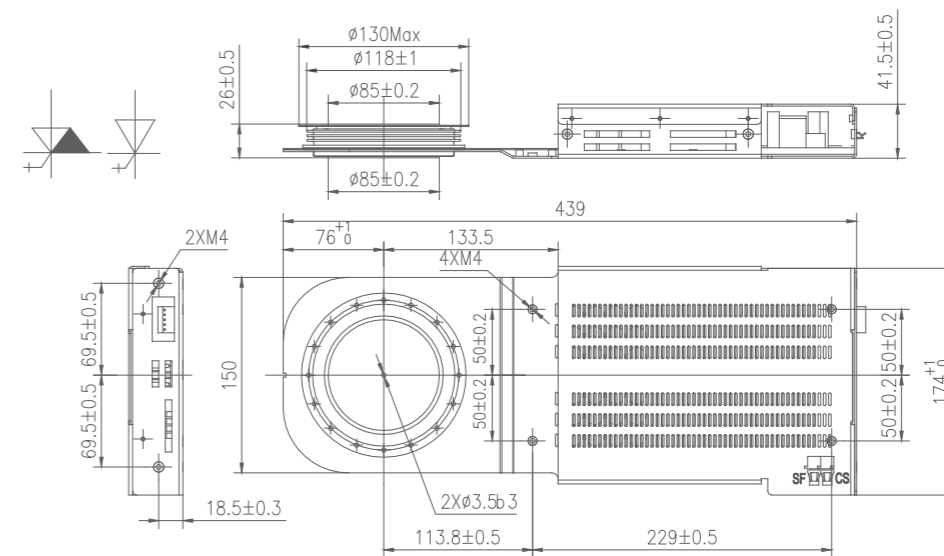
逆导型号 Part number	$I_{TGM}$	$I_{T(AV)}$	$V_{DRM}$	$V_{GK}$	$I_{TSM}$	$V_{TM@ITM}$		$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$V_{TO}$	$r_T$	$F$	外形 Outline	
	$T_{VJM}$	$T_c=85^\circ C$	$T_{VJM}$	$T_{VJ}=25^\circ C$	$T_{VJM}$	$T_{VJM}$					$T_{VJM}$	$\pm 10\%$			
	A	A	V	V	kA	V	A				°C	K/W	V		mΩ
CRc2200-45	GCT部分	2200	1130	4500	17	20	2.24	2200	125	0.0126	0.0042	1.31	0.373	40	CAc
	FRD部分	/	405	/	/	11	3.93	2200	125	0.0260	0.0104	2.32	0.735		

逆阻型号 Part number	$I_{TGM}$	$I_{T(AV)}$	$V_{DRM}$	$V_{GK}$	$I_{TSM}$	$V_{TM@ITM}$		$T_{VJM}$	$R_{thJC}$	$R_{thCH}$	$V_{TO}$	$r_T$	$F$	外形 Outline
	$T_{VJM}$	$T_c=75^\circ C$	$T_{VJM}$	$T_{VJ}=25^\circ C$	$T_{VJM}$	$T_{VJM}$					$T_{VJM}$	$\pm 10\%$		
	A	A	V	V	kA	V	A				°C	K/W	V	
CS <sub>e</sub> 6000-45★	6000	2800	4500	17	20	3.20	6000	115	0.0046	0.0013	1.52	0.230	108	CAE

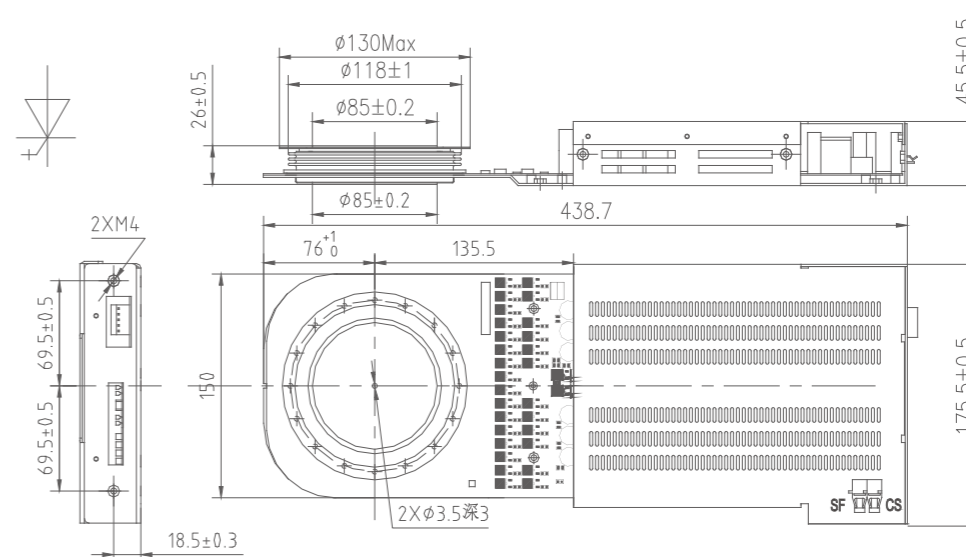
备注: \*表示直流连续电流 ★表示预研产品

# 外形图 Outlines

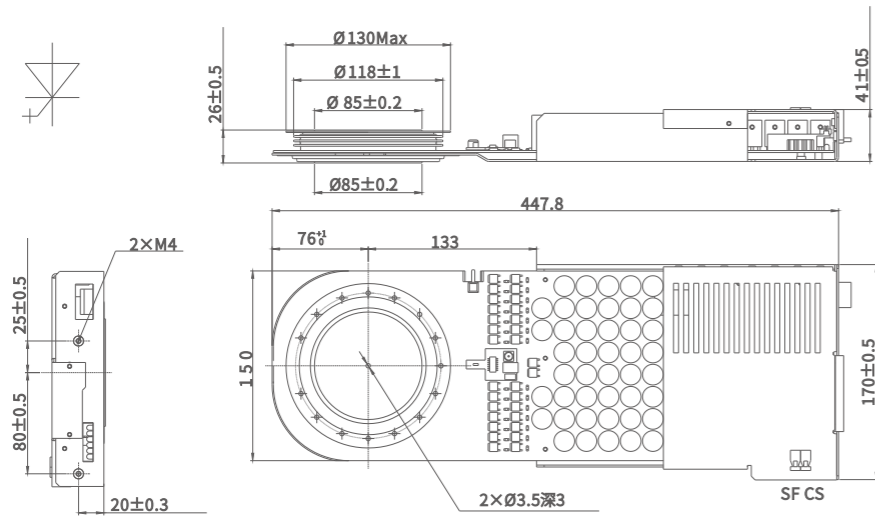
## CAc



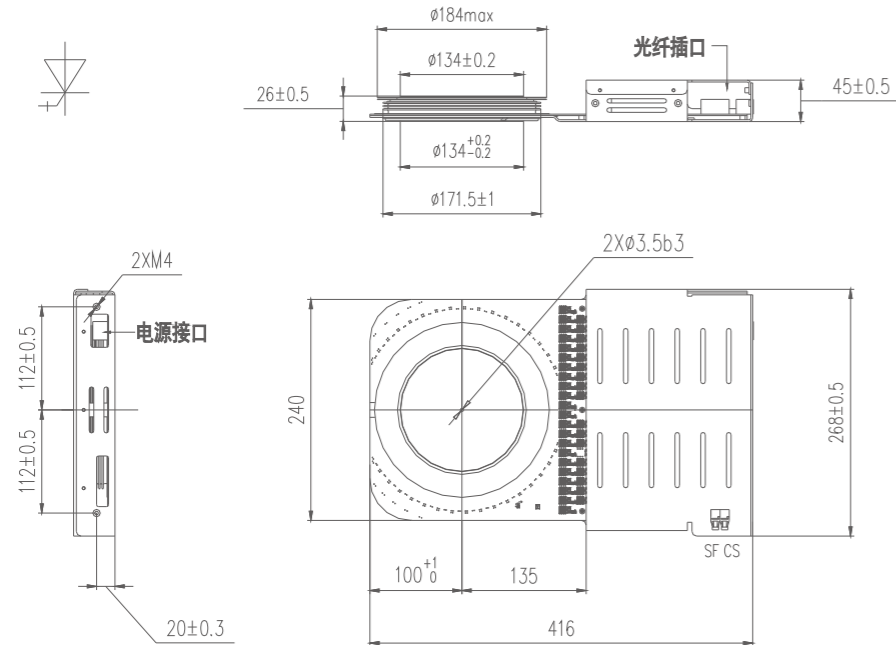
## CA2c



CA3C

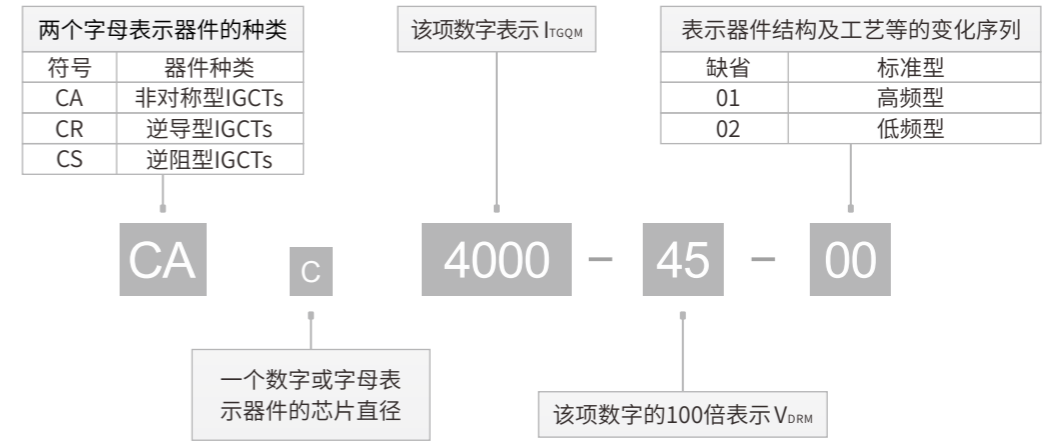


CAE



注：未标注数量单位的统一为毫米 (mm)

型号说明 Nomenclature



符号说明 Symbols

IGCT器件符号说明

符号	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
$V_{GK}$	门阴极反向耐压	Peak Reverse Voltage of Gate-Cathode
$V_{TM}$	通态峰值电压	Peak On-state Voltage At ITM
$V_{TO}$	GCT门槛电压	Threshold Voltage For GCT
$C_S$	控制信号接收器	Receiver For Command Signal
$S_F$	状态反馈发送器	Transmitter For Status Feedback

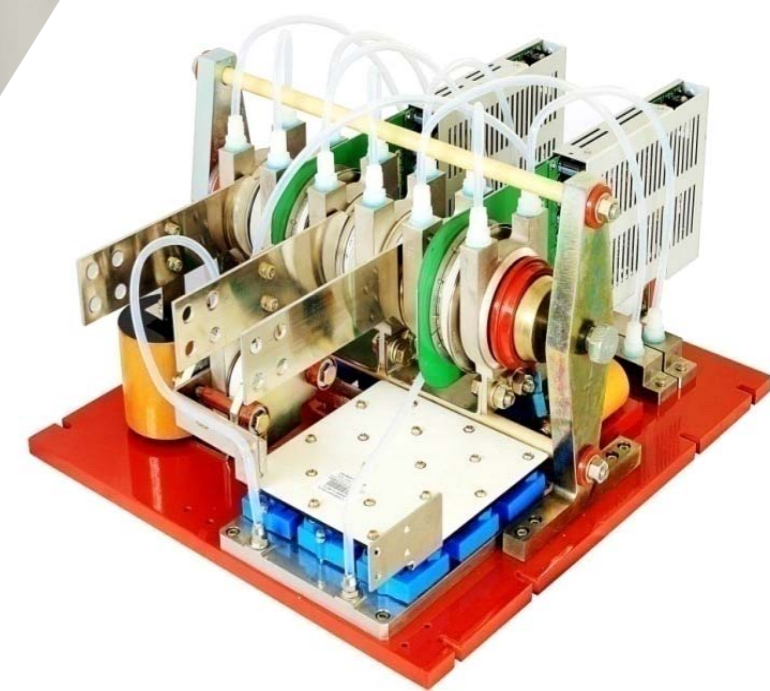
逆导GCT器件二极管部分符号说明

符号	参数名称	Characteristics
$I_{F(AV)}$	FRD正向平均电流	Mean Forward Current
$I_{FM}$	FRD正向峰值电流	Peak Forward Current
$I_{FSM}$	FRD通态不重复浪涌电流	Surge (Non-repetitive) Current
$r_F$	FRD斜率电阻	Slope Resistance For FRD
$R_{thJC}$	结壳热阻	Thermal Resistance, Junction To Case
$V_{FM}$	正向峰值电压	Peak Forward Voltage
$V_{FO}$	FRD门槛电压	Threshold Voltage For FRD



# 功率组件

## Power Assemblies



# 风冷功率组件 Air-cooling Power Assemblies

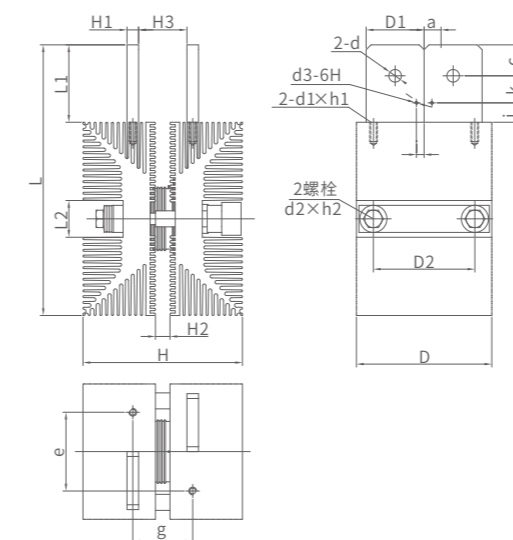
型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension	风速 Speed	热阻 Rsa	重量 Weight (单个散热器)	散热器材质 Heat sink type	外形图 Outline
					mm			kg		
tPower-SA.KP (ZP)*****F	SF12 (国标)	1	KP <sub>8</sub> 、ZP <sub>8</sub>	自冷或风冷	200×110×125	6	≤0.090	2.6	铝型材	1
	SF13 (国标)	1	KP <sub>9</sub> 、ZP <sub>9</sub>	自冷或风冷	220×120×130	6	≤0.071	3.5	铝型材	1
	SF14 (国标)	1	KP <sub>9</sub> 、ZP <sub>9</sub>	自冷或风冷	250×140×145	6	≤0.056	4.9	铝型材	2
	SF15 (国标)	1	KP <sub>9</sub> 、ZP <sub>9</sub>	自冷或风冷	280×140×165	6	≤0.048	6	铝型材	2
	SF16 (国标)	1	KP <sub>A</sub> 、ZP <sub>A</sub>	自冷或风冷	280×180×200	6	≤0.037	9.5	铝型材	2
	SF16L (国标)	1	KP <sub>B</sub> 、ZP <sub>B</sub>	自冷或风冷	300×250×215	4	≤0.030	13.5	铝型材	2

型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension	风速 Speed	热阻 Rsa	重量 Weight	散热器材质 Heat sink type	外形图 Outline
					mm			kg		
tPower-SA.KP (ZP)*****F	ZB16/ZB17/ZB18	≤3	KP <sub>A</sub> 、ZP <sub>A</sub>	自冷或风冷	≤440×120×107	6	≤0.2	3.5-7.9	铝型材	3
	XF12/XF15	≤3	KP <sub>x</sub> 、ZP <sub>x</sub>	自冷或风冷	≤690×200×174	6	≤0.1	6-38.5	铝型材	3
	DXC615	≤2	KP <sub>c</sub> 、ZP <sub>c</sub>	自冷或风冷	≤480×240×247	6	≤0.027	17-31	铝型材	3
	XSF19	≤2	KP <sub>b</sub> 、ZP <sub>b</sub>	风冷	≤540×250×376	6	≤0.021	50	铝型材	3

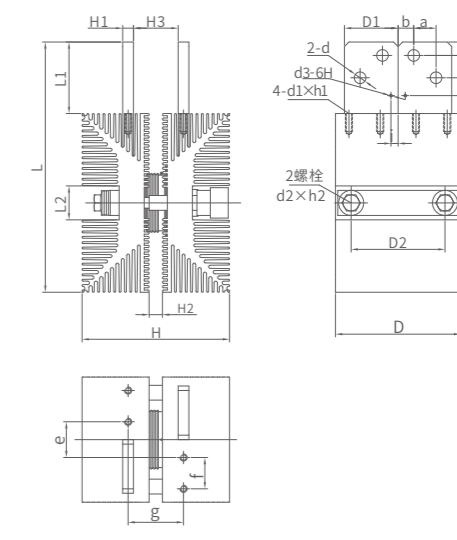
型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension	风速 Speed	热阻 Rsa	重量 Weight	散热器材质 Heat sink type	外形图 Outline
					mm			kg		
tPower-SA.KP (ZP)*****F	LSP6	1	KP <sub>7</sub> 、ZP <sub>7</sub>	自冷或风冷	205×90	—	≤0.8	2.2	铝型材	4
	LSF8	1	KP <sub>8</sub> 、ZP <sub>8</sub>	自冷或风冷	180×110	6	≤0.09	4.5	铝型材	5
	LSFA	1	KP <sub>x</sub> 、ZP <sub>x</sub>	自冷或风冷	222×145	6	≤0.045	8.5	铝型材	6
	TSFA-1	1	KP <sub>A</sub> 、ZP <sub>A</sub>	自冷或风冷	232×127	6	≤0.05	12	铜	8
	TSFA-3	1	KP <sub>A</sub> 、ZP <sub>A</sub>	自冷或风冷	222×145	6	≤0.044	13	铜	9
	ZS331	1	KP <sub>x</sub> 、ZP <sub>x</sub>	自冷或风冷	253×168	6	≤0.026	18	铜	10

# 外形图 Outlines

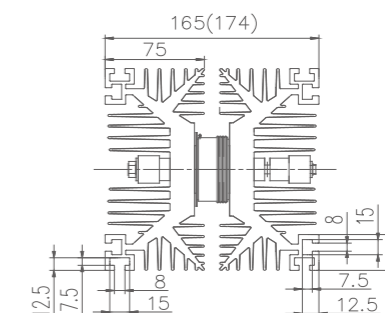
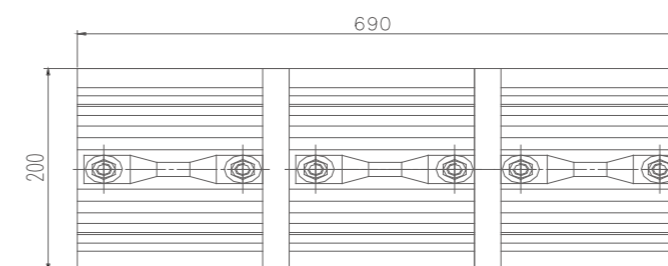
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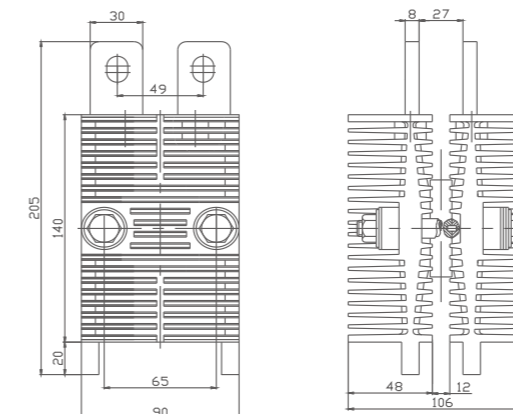
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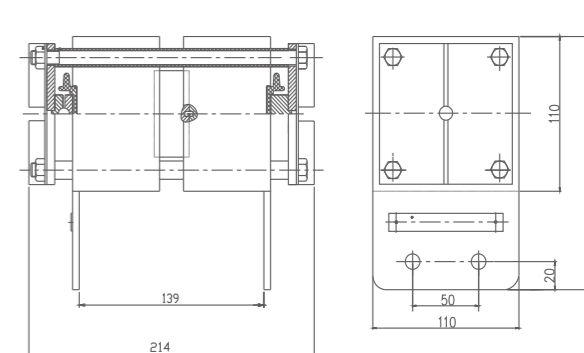
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4

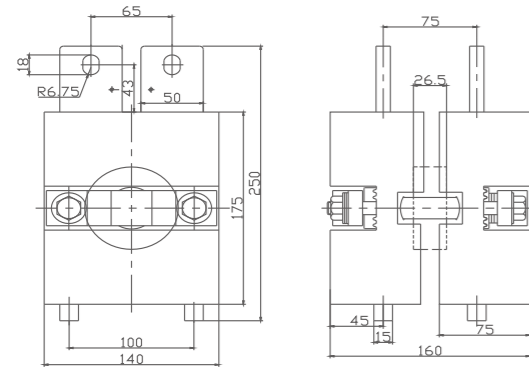


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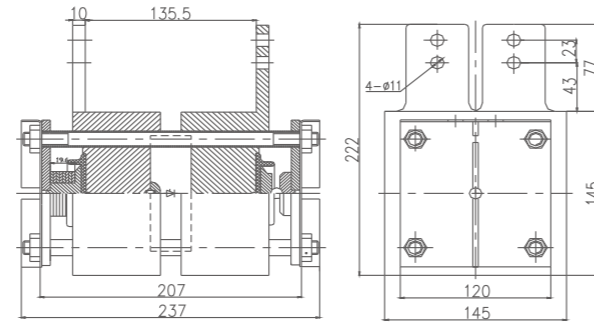




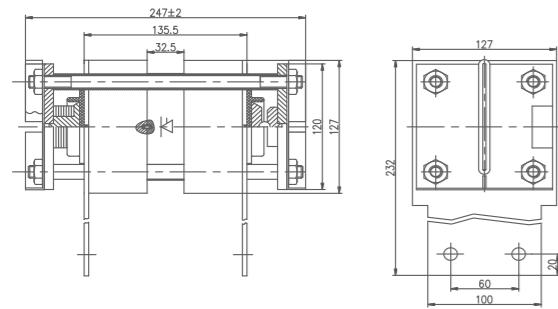
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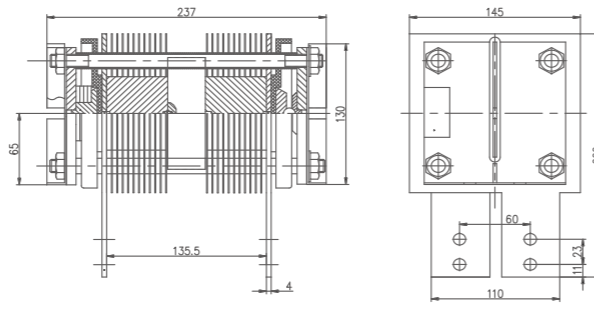
7



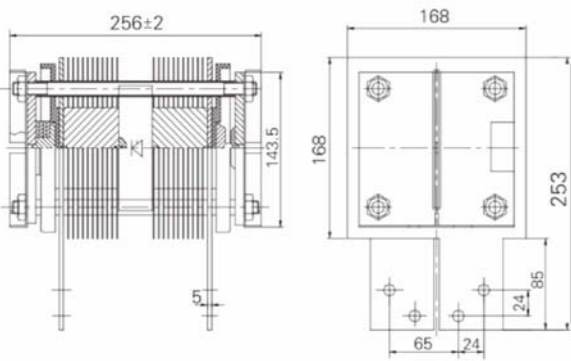
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9



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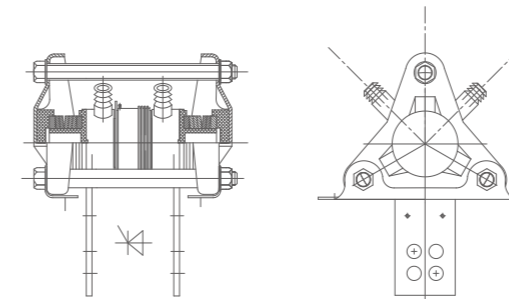
# 液冷功率组件 Liquid-cooling Power Assemblies

型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension	流量 Speed	热阻 Rsa	重量 Weight	外形图 Outline
					mm	L/min	K/W	kg	
tPower-SA.KP (ZP)*****S	SS12	≤4	KP <sub>8</sub> 、ZP <sub>8</sub>	液冷	190×160×152	4	≤0.018	15	1
	SS13	≤4	KP <sub>9</sub> 、ZP <sub>9</sub>	液冷	190×160×152	4	≤0.015	33	
	SS14	≤6	KP <sub>x</sub> 、ZP <sub>x</sub>	液冷	220×195×188	4	≤0.013	12	
	SS15	≤6	KP <sub>c</sub> 、ZP <sub>c</sub>	液冷	235×195×190	4	≤0.010	20	
	SS16	≤6	KP <sub>0</sub> 、ZP <sub>0</sub>	液冷	288×260×230	4	≤0.008	25	

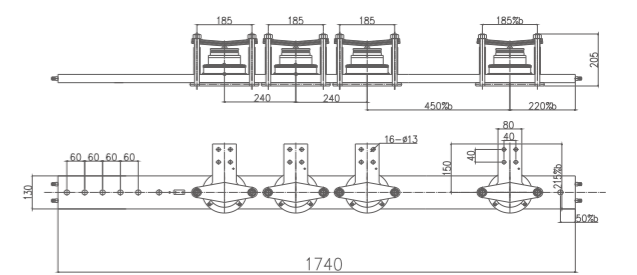
型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension	流量 Speed	热阻 Rsa	重量 Weight	外形图 Outline
					mm	L/min	K/W	kg	
tPower-SA.KP (ZP)*****S	SS402-1740G4C	≤6	KP <sub>c</sub> 、ZP <sub>c</sub>	液冷	见图纸	4	≤0.018	≤25	2
	SS403-780D10X	≤10	KP <sub>x</sub> 、ZP <sub>x</sub>	液冷	见图纸	4	≤0.02	≤55	3
	SS404-142G6C	≤6	KP <sub>c</sub> 、ZP <sub>c</sub>	液冷	见图纸	4	≤0.03	≤35	4

## 外形图 Outlines

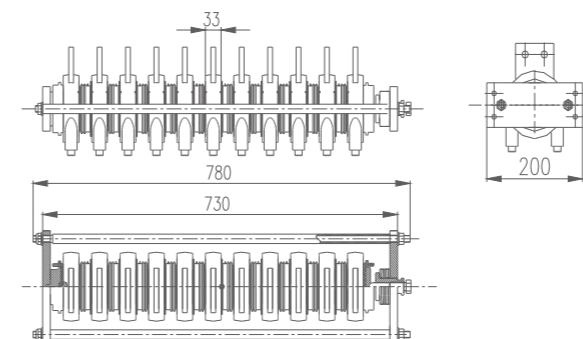
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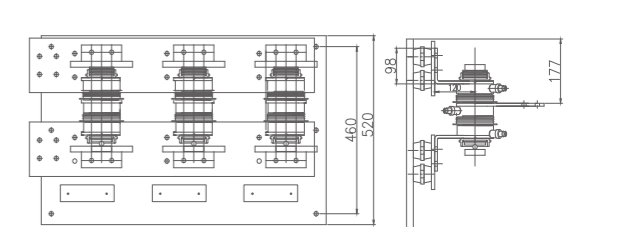
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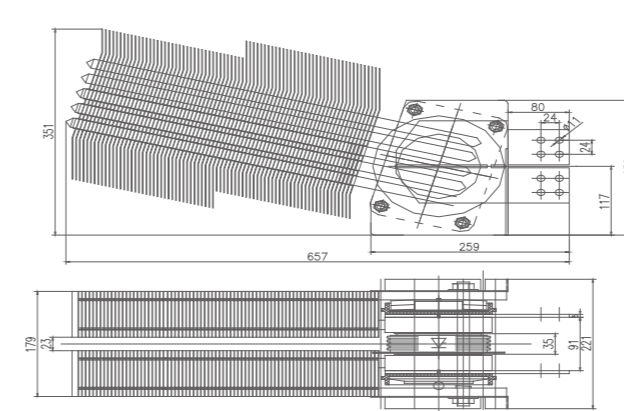


# 热管功率组件 Heat Pipe Power Assemblies

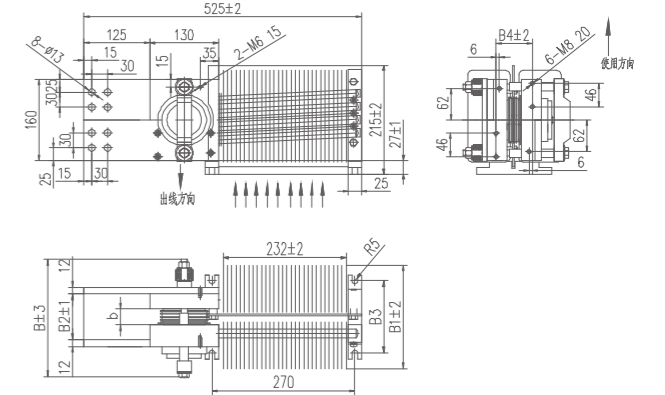
型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension mm	风速 Speed m/s	热阻 Rsa K/W	重量 Weight kg	安装方式 Heat sink type	外形图 Outline
tPower-SA.KP (ZP)*****F	ZS757 (热管)	1	KP <sub>A</sub> 、ZP <sub>A</sub>	自冷或风冷	400×230×178.5	—	≤0.095	8.5	水平	1
	ZS803 (热管)	1	KP <sub>B</sub> 、ZP <sub>B</sub>	自冷或风冷	587×270×221	—	≤0.053	15	水平	2
	ZS891 (热管)	1	KP <sub>D</sub> 、ZP <sub>D</sub>	自冷或风冷	657×351×221	—	≤0.040	33	水平	3
	ZB291 (热管)	1	KP <sub>X</sub> 、ZP <sub>X</sub>	自冷或风冷	525×251×213	—	≤0.1	12	水平	4
	ZB292 (热管)	1	KP <sub>C</sub> 、ZP <sub>C</sub>	自冷或风冷	792×291×211.5	—	≤0.027	20	水平	5
	ZB293 (热管)	1	KP <sub>E</sub> 、ZP <sub>E</sub>	自冷或风冷	1013×365×211.5	—	≤0.019	25	水平	6

型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适应最大元件 Maximum device	冷却方式 Cooling method	尺寸 Dimension mm	风速 Speed m/s	热阻 Rsa K/W	重量 Weight kg	安装方式 Heat sink type	外形图 Outline
tPower-SA.KP (ZP)*****F	SH507-450D2X	≤2	KP <sub>X</sub> 、ZP <sub>X</sub>	自冷或风冷	≤450×360	—	≤0.02	8	垂直	7
	SH507-500G2B	≤2	KP <sub>B</sub> 、ZP <sub>B</sub>	自冷或风冷	≤500×230	—	≤0.02	10	垂直	8
	SH512-330D99	≤9	KP <sub>9</sub> 、ZP <sub>9</sub>	自冷或风冷	≤1300×330	—	≤0.05	65	垂直	9
	SH513-352G7C	≤7	KP <sub>C</sub> 、ZP <sub>C</sub>	自冷或风冷	≤1300×352	—	≤0.05	70	垂直	10
	SH509-318G149	≤14	KP <sub>9</sub> 、ZP <sub>9</sub>	自冷或风冷	—	—	≤0.05	110	垂直	11

3



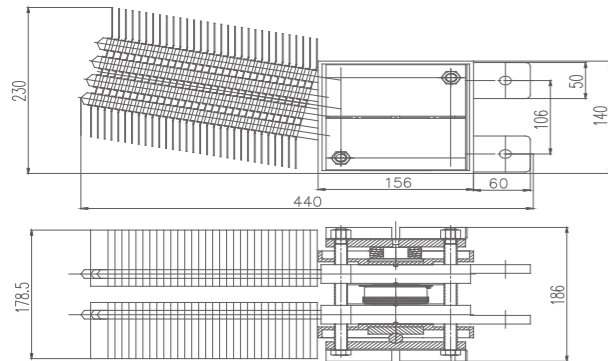
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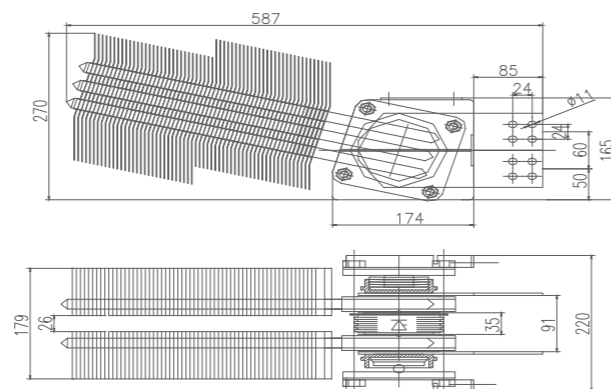
项目 型号	原厚度 b	外形尺寸(mm)				安装尺寸(mm)	
		B	B1	B2	B3	B4	
505G1B01	26.5	213	176.7	57.5	123	68.5	
505G1B02	35	223	185	86	131.5	77	

## 外形图 Outlines

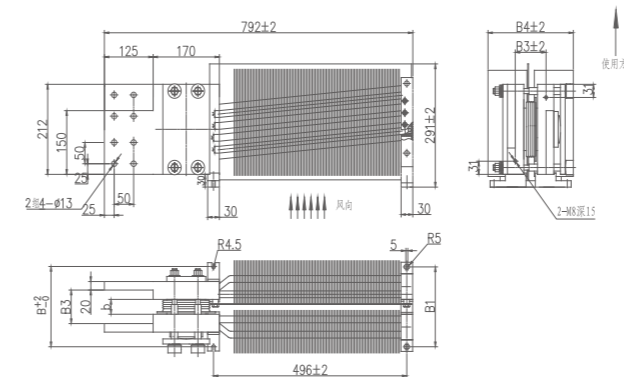
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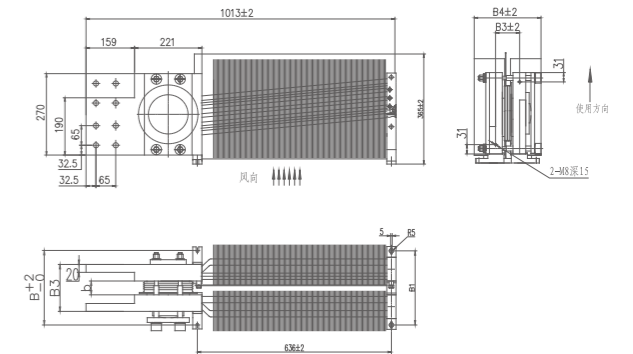


5



项目 型号	厚度 b	安装尺寸(mm)				外形尺寸(mm)	
		B	B1	B2	B3	B4	
HPS02A	26.5	180.5	179.5	70.5	70.5	211.5	
HPS02B	35	189	188	79	79	220	

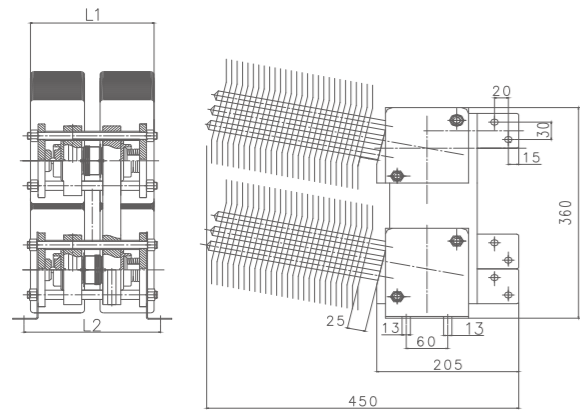
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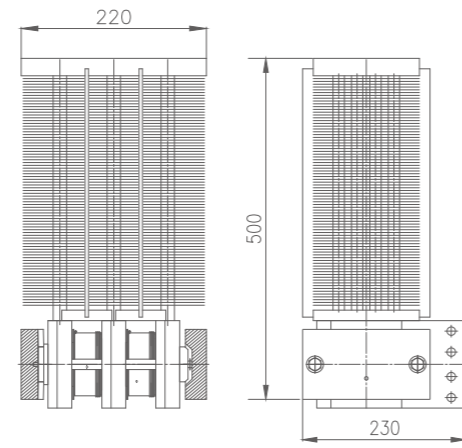
项目 型号	厚度 b	安装尺寸(mm)				外形尺寸(mm)	
		B	B1	B2	B3	B4	
HPS03A	26.5	180.5	179.5	70.5	70.5	211.5	
HPS03B	35	189	188	79	79	220	

# 定制式功率组件 Commission Power Assemblies

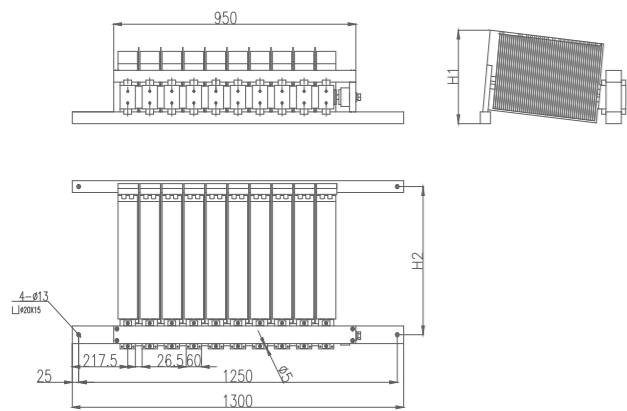
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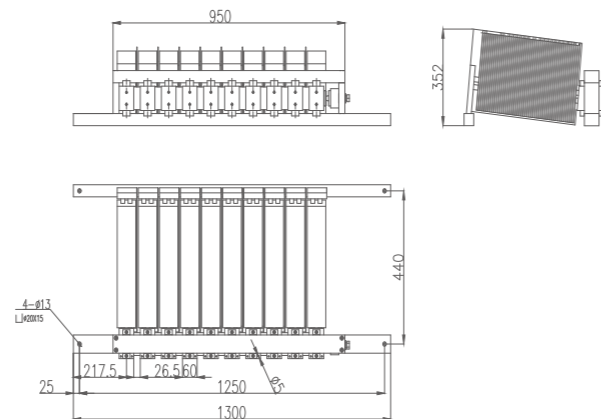
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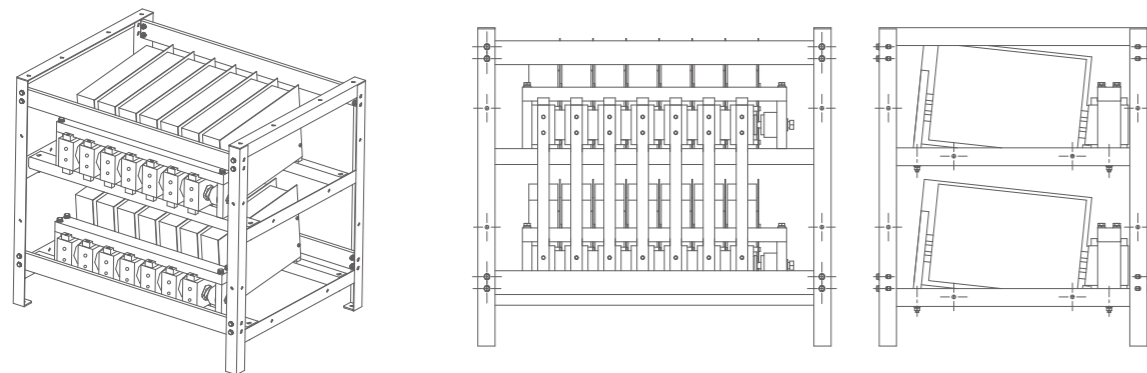
9



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11



型号 Part number	散热器型号 Heat Sink	元件数量 Device quantity	适用元件 Maximum device	冷却方式 Cooling method	输出电流	V <sub>DRM</sub> /V <sub>RRM</sub>	触发接口	频率	外形图 Outline	
					Dimension	kV	Interface	Frequency		
					A			Hz		
tPower-SA.KP(ZP)****F	定制	≤6	晶闸管及整流管	风冷	≤1500	≤25	—	—	1	
tPower-SA.KK(KP)****S	定制	≤8	晶闸管及整流管	液冷	≤3000	≤35	—	—	2	
tPower-SA.KS****F	定制	≤6	双向晶闸管	风冷	≤1000	≤15	光纤	≤100	3	
tPower-SA.KP****N	定制	≤12	晶闸管及整流管	自冷	—	≤50	光纤	≤100	3	

## 外形图 Outlines

1 风冷式组件 Air-cooling assembly



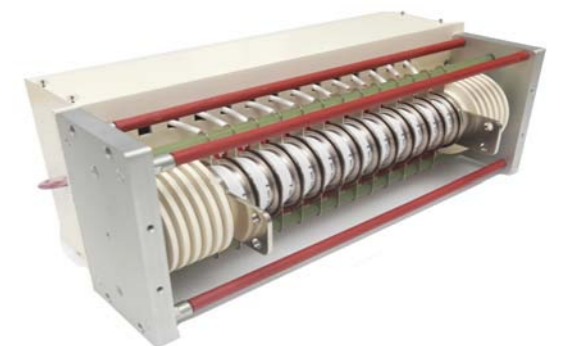
2 液冷式组件 Liquid-cooling assembly



3 双向晶闸管组件 Bi-directional thyristor assembly



4 高压自冷组件 High-voltage nature-cooling assembly



## 集成门极换流晶闸管功率组件 IGCT Power Assembly

型号 Part number	散热器型号 Heat Sink	拓扑结构 Topological	冷却方式 Cooling method	功率等级 Power	输出电流 Current	V <sub>dc</sub>	触发接口 Interface	频率 Frequency	外形图 Outline
				MVA	A	kV		Hz	
tPower-SA.C***ML**S	定制	3L-NPC	液冷	≤14	≤2500	≤7	光纤	≤1000	1
tPower-SA.C***B**S	定制	半桥	液冷	≤5	≤1500	≤3.6	光纤	≤1000	2
tPower-SA.C***H**F	定制	H桥	定制	—	≤5000	≤10	光纤	—	3
tPower-SA.C*****S	定制	定制	定制	—	≤20000	≤20	光纤	≤1000	4

### 外形图 Outlines

1 3L-NPC IGCT功率组件 3L-NPC IGCT power assembly



2 半桥IGCT功率组件 Half bridge IGCT power assembly



3 断路器IGCT功率组件 Breaker IGCT power assembly



4 定制IGCT功率组件 Customized IGCT power assembly

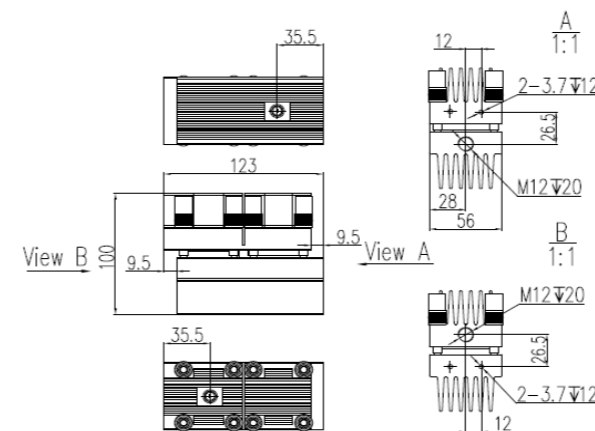


## 软启动模块 Soft-starter Modules

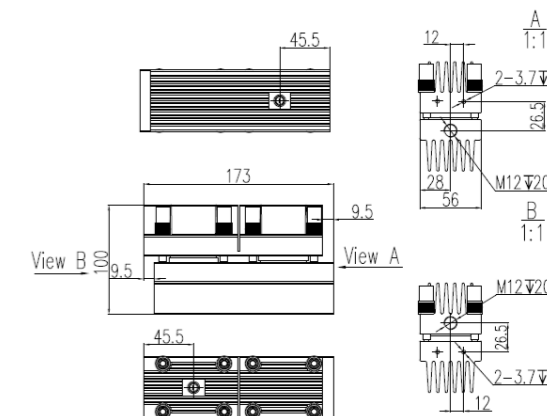
型号 Part number	V <sub>DRM</sub> /V <sub>RRM</sub>	I <sub>overload</sub> (21S)	I <sub>TSM</sub> @T <sub>VJM</sub> 10ms	I <sub>t max</sub> @T <sub>VJM</sub>	V <sub>TO</sub> @T <sub>VJM</sub>	r <sub>r</sub> @T <sub>VJM</sub>	T <sub>VJM</sub>	T <sub>vi</sub> overload @20s	重量 Weight	外形图 Outline
	V	A	kA	A <sup>2</sup> s	V	mΩ	°C	°C	Kg	
tPower-SA.KP12X14FJ	1400	1400	12.8	81.9×10 <sup>4</sup>	0.87	0.382	125	150	1.4	1
tPower-SA.KP12X18FJ	1800	1800	10	50×10 <sup>4</sup>	0.9	0.46	125	150	1.4	1
tPower-SA.KP15X14FJ	1400	1400	15	113×10 <sup>4</sup>	0.85	0.33	125	150	1.4	1
tPower-SA.KP15X18FJ	1800	1800	14	98×10 <sup>4</sup>	0.85	0.37	125	150	1.4	1
tPower-SA.KP15X14FJ1	1400	1400	15	113×10 <sup>4</sup>	0.85	0.33	125	150	1.85	2
tPower-SA.KP15X18FJ1	1800	1800	14	98×10 <sup>4</sup>	0.85	0.38	125	150	1.85	2
tPower-SA.KP20X14FJ	1400	1400	15	113×10 <sup>4</sup>	0.85	0.33	125	150	3.4	3
tPower-SA.KP20X18FJ	1800	1800	14	98×10 <sup>4</sup>	0.91	0.36	125	150	3.4	3
tPower-SA.KP30X14FJ	1400	1400	26	338×10 <sup>4</sup>	0.86	0.16	125	150	3.4	3
tPower-SA.KP30X18FJ	1800	1800	25	313×10 <sup>4</sup>	0.88	0.2	125	150	3.4	3

### 外形图 Outlines

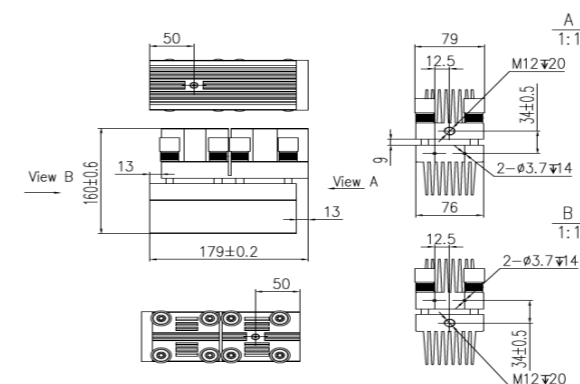
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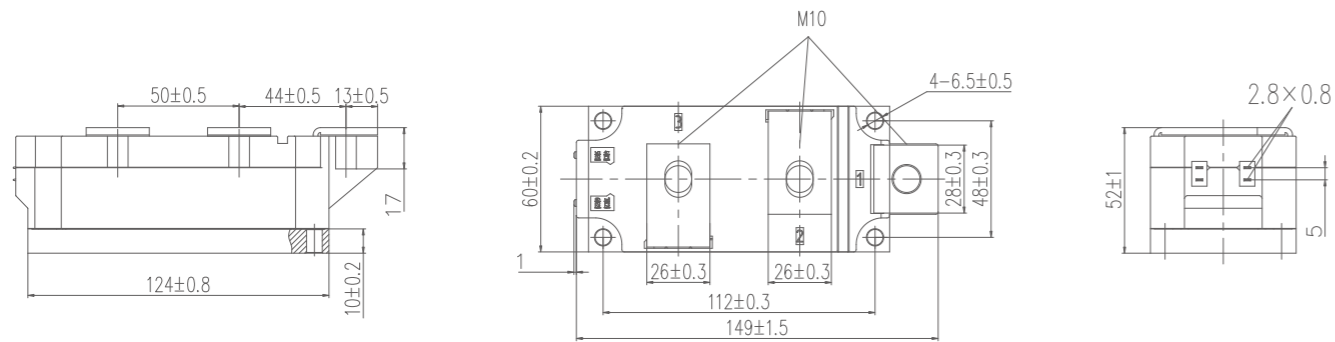
# 晶闸管模块 Thyristor Modules

型号 Part number	$V_{DRM} / V_{RRM}$ V	$I_{TAV}$ A	$I_{TSM}@T_{VJM}$ 10ms kA	$I^2t_{max}@T_{VJM}$ A <sup>2</sup> s	$V_{TO}@T_{VJM}$ V	$r_T@T_{VJM}$ mΩ	$T_{VJM}$ °C	外形图 Outline
TMTC320-xx	3000-3600	320	6	$18 \times 10^4$	1.03	0.97	125	1
TMTC420-xx	2000-2400	430	10	$50 \times 10^4$	0.92	0.72	125	1
TMTC550-xx	1200-1800	542	14	$98 \times 10^4$	0.87	0.32	125	1

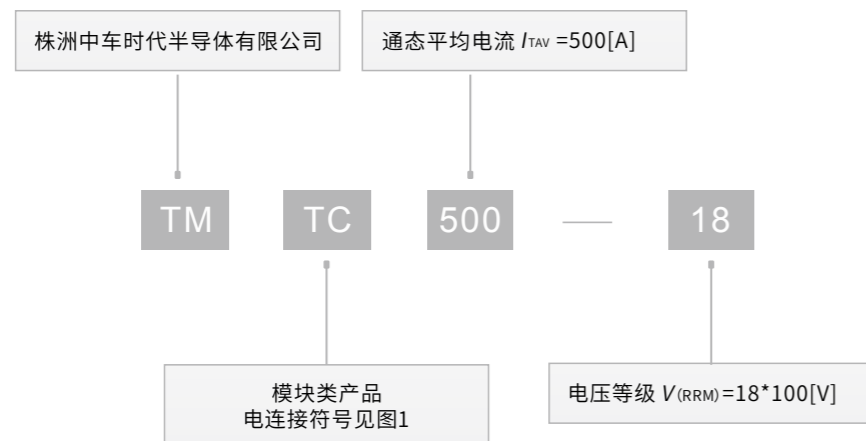


## 外形图 Outlines

1



## 型号说明 Nomenclature



# 质量体系与保障 Quality System And Insurance



# 全球布局 Globe Landscape



6英寸功率半导体器件产业化基地



林肯研发中心

英国·林肯



美国·洛杉矶



俄罗斯·莫斯科



美国·芝加哥



南非



巴西·里约



6英寸碳化硅器件产业化基地



8英寸IGBT产业化基地



6英寸双极器件产业化基地

中国·株洲



澳大利亚·墨尔本

