

A complete analysis of high-voltage silicon stack technology and industry application solutions

1. Overview and core advantages of high-voltage silicon stack technology

The high-voltage silicon stack is a high-voltage rectifier device composed of multiple PN junction chips through professional technology.

Its working principle is based on the unidirectional conductive characteristics of the semiconductor PN junction.

Achieve high voltage resistance. Compared with traditional discrete devices, high voltage silicon stacks have small size and high voltage resistance.

It has the advantages of high performance and high reliability, and is an indispensable core device in high-voltage DC power supply systems.

As a professional high-voltage silicon stack manufacturer, we use the well-known domestic semiconductor high-voltage silicon stack

Full range of production and testing equipment; high frequency alloy & alkali washing & polyimide protection technology, or high temperature

Glass passivation packaging technology ensures that each high-voltage silicon stack has excellent performance.

Our products have the following core competitive advantages:

1. Ultra-wide parameter range: reverse withstand voltage covers 1KV to 500KV, forward current from 5mA

to 10A, meeting the requirements of various stringent applications. In particular, our pulsed high voltage silicon stack series,

Able to withstand transient surge currents up to 1000A, providing reliable protection for special application scenarios

高压脉冲硅堆 High Voltage pulse Rectifier Assembly

特点 Features:

低漏电流、低功率 Low leakage, low power,

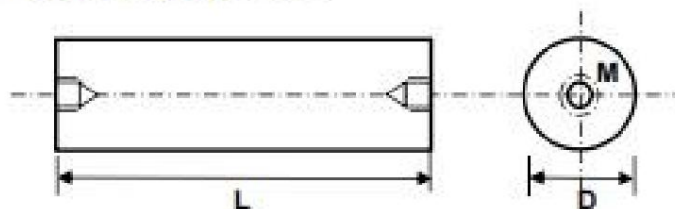
工作结温 -40℃~ +120℃ T_j : -40℃~+120℃.

多尺寸或定制 A wide variety of sizes or customization

■ 电特性及极限值 Electrical characteristics and limits ($T_a=25^\circ\text{C}$)

项目 Item	符号 Sym	条件 Conditions	数值 Value	单位 Unit
反向重复峰值电压 Repetitive Peak Reverse Voltage	V_{RRM}		200	KV
反向不重复峰值电压 Non-Repetitive Peak Reverse Voltage	V_{RSM}		300	KV
正向平均电流 Average Forward Rectifier	$I_{F(AV)}$	50Hz 正弦半波平均值($T_j=50^\circ\text{C}$) 50Hz Sine-half Wave Rectification Average Value ($T_j=50^\circ\text{C}$)	30.0	A
正向(不重复)浪涌电流 Non-Repetitive Foreward Surge Current	I_{FSM}	8.3ms@ 60Hz 正弦半波 8.3ms@ 60Hz sine-half Wave	120.0	A
脉冲电流 Pulse Current	I_{PRM}	$T_p \leq 0.5\mu\text{s}$ @ $T_a=50^\circ\text{C}$	1000	A
最大正向压降 Max. Forward Voltage	V_{FM}	$I_F=0.5\text{A}$	400.0	V
反向峰值电流 Max. Reverse Leakage Current	I_{RMI}	$V_R=V_{RRM}$	5.0	μA
反向恢复时间 Reverse Recovery Time	T_{rr}	$I_F=0.5\text{A}$ 、 $I_R=1.0\text{A}$ 、 $I_{RR}=0.25\text{A}$	75	nS
最高结温 Max. Temperature of Junction	T_j		120	$^\circ\text{C}$
储存温度范围 Range of storage temperature	T_{stg}		-40 ~ +130	$^\circ\text{C}$

■ 外形图式 Dimension



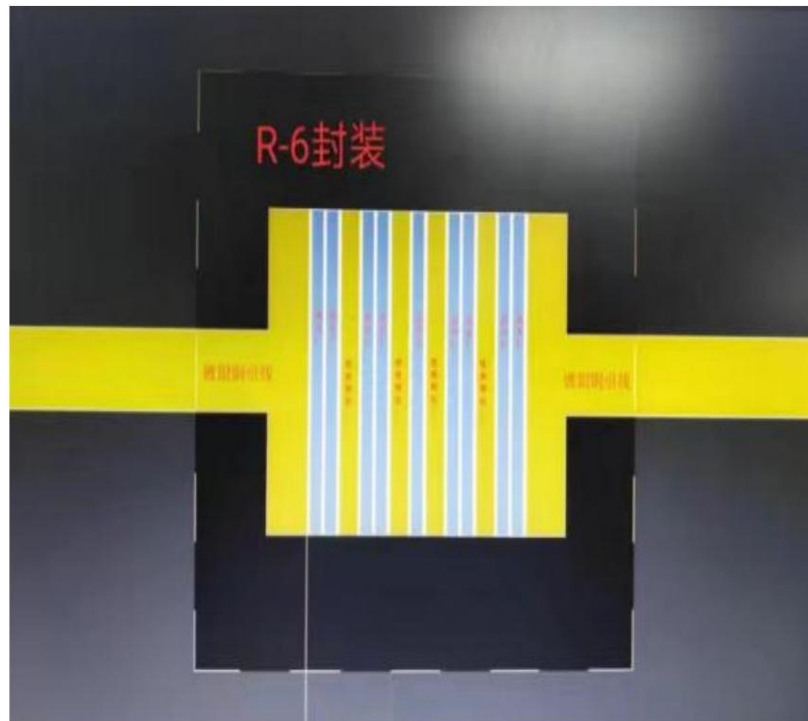
符号 Symbol	数值 Size	
L	280	mm
D	100	mm
M	12	mm

2. Excellent electrical characteristics: Adopt optimized structural design to effectively reduce forward voltage drop.

The reverse leakage current is controlled within 5 μ A (@25°C), significantly reducing system power consumption. There are

special For silicon stacks with high performance requirements, we will use unique chip layout and heat dissipation design to make

our The product can still maintain low temperature rise during continuous operation, ensuring long-term stable operation.



3. Strong environmental adaptability: The product's operating temperature range is -55°C to +175°C.

Epoxy resin molding or epoxy vacuum potting technology has excellent moisture resistance and corrosion resistance.

Our industrial microwave dedicated silicon stack series has specially enhanced anti-oil and anti-dust performance, suitable for

Applications in special industries such as food processing and chemical industry.

High voltage silicon diodes		Features							
 		• $I_{F(AV)}$ 750mA • V_{RRM} 9 kV ~16KV • High reliability							
		Applications							
		Rectification for high voltage power supply of magnetron in Micro wave oven and others							
		Mechanical data							
		• Epoxy meets UL 94V-0 flammability rating • Terminals: Nickel-plated brass(or tin plating) • Marking: Type number • Polarity:As Marked on Body • Lead Free: For RoHS /Lead Free Version							
Maximum rating ($T_a=25^{\circ}\text{C}$ unless otherwise noted)									
Parameter		Symbol	HVP -9	HVP -10	HVP -12	HVP -14	HVP -15	HVP -16	Unit
Repetitive peak reverse voltage		V_{RRM}	9	10	12	14	15	16	kV
Average forward current	AT $T_A=55^{\circ}\text{C}$	$I_{F(AV)}$	750						mA
Forward surge current	8.3ms single half sine-wave (JEDEC methode) $T_A=25^{\circ}$	I_{FSM}	50						A
Peak forward voltage	$I_{FM}=750\text{mA}$	V_{FM}	10		12		15		V
Peak reverse current	$V_{RM}=V_{RRM}$	I_{RRM1}	≤ 5						μA

4. Fast response characteristics: The reverse recovery time (T_{rr}) of high-frequency series products can be as short as 35nS, operating frequency up to 300KHz, can perfectly replace international products of the same model.

UX-FOB

Ultra-Fast Recovery High Voltage Diodes



Features

- $I_{F(AV)}$ 500 mA
- V_R 8KV
- T_{rr} 35nS

Typical Applications

Rectification for high voltage power supply of Magnetron in Micro wave oven and others



Mechanical Data

- Package: DO-722
- Epoxy meets UL 94 V-0 flammability rating
- Terminals: Pure tin plated leads, solderable per J-STD-002 and JESD22-B102,
- Polarity: Color band denotes the cathode end

Maximum Ratings ($T_a=25^\circ\text{C}$ Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Conditions	UX-FOB
Device marking code				UX-FOB
Repetitive Peak Reverse Voltage	V_{RRM}	KV		8
Average Forward Current	$I_{F(AV)}$	mA	60Hz half-sine wave, Resistance load, $T_a=25^\circ\text{C}$	500
Forward Surge Current	I_{FSM}	A	8.3ms, Single Half sine	20
Peak Forward Voltage	V_{FM}	V	$I_{FM}=500\text{mA}$	12
Peak Reverse Current	I_{RSM}	μA	At V_{RRM}	0.5
Reverse Recovery Time	t_{rr}	ns	$I_F=500\text{mA}; I_R=1000\text{mA}; I_{RR}=250\text{mA}$	35
Storage Temperature	T_{stg}	$^\circ\text{C}$		$-40 \sim +150$
Virtual Junction Temperature	T_{vj}	$^\circ\text{C}$		150

Overview of the core parameter range of high voltage silicon stack:

Parameter Category	Technical indicators	Model examples
Reverse withstand voltage	1KV-500KV	MCLG200KV/1A
Forward Current	1mA-10A	2CLG5KV/10A
Reverse recovery time	35nS-2000nS	2CLG1020 (150nS)
Operating frequency	50Hz-300KHz	high frequency series (up to 300KHz)
Operating temperature	-55°C~+175°C	Military-grade wide temperature model

2. Detailed description of the full range of high voltage silicon stack product lines

We have built the most complete high-voltage silicon stack product system in the industry, targeting different industry applications

Features: We have developed several professional series to ensure accurate matching for various high voltage rectification needs.

Solution.

1. Electron accelerator and medical equipment high voltage silicon stack

High-energy electron accelerators play an important role in the fields of material modification, sterilization, food preservation, etc.

The reliability of its high voltage power supply system directly determines the performance of the entire equipment.

The high-voltage silicon stack we developed for electron accelerators achieves high voltage shock resistance and high withstand voltage.

Perfect balance.

Highlights of the series include:

2CLG60KV2A/*2CLG100KV2A*: Adopt fast recovery chip technology ($T_{rr} \leq 100\text{nS}$),

The operating frequency can reach 300KHz, which is particularly suitable for pulsed electron accelerator applications.

2CL150KV Core device of high-power irradiation equipment, PN junction operating temperature can reach 175°C,

Adapt to the long-term continuous working environment of the accelerator.

2CL300KV0.5A: Cylindrical silicon stack design, reverse withstand voltage up to 300KV, widely used

Used in linear accelerators and equipment high voltage generators.

2. Industrial microwave and high frequency application silicon stack series

Industrial microwave equipment is widely used in food drying, rubber vulcanization, ceramic sintering and other fields.

However, its high-voltage rectifier components have long been exposed to severe tests in high temperature and high humidity environments.

The wave specific silicon stack series adopts epoxy vacuum curing molding technology and has excellent moisture resistance.

The main products of this series are:

HVP12/*HVP16*/*HVP18*: Compact design, reverse withstand voltage 12-18KV, forward

The current is 750mA, optimized for commercial microwave ovens and industrial microwave drying equipment.

2CL15KV3A/*2CL30KV4A*: Using high temperature glass passivation technology, the junction temperature reaches

175°C, suitable for long-term stable work in high temperature environment.

3. Ultra-high voltage and special silicon stack solutions

In special fields such as scientific research experiments and power testing, ultra-high voltage level rectification is often required. Devices. Relying on our strong R&D capabilities, we have developed a series of ultra-high voltage silicon stack products:

2CL1000KV1A: reverse withstand voltage up to 1000KV, adopts segmented insulation design, can be used for high

Pressure tests and particle accelerator experiments.

Customized avalanche silicon stack: specially developed for special applications such as lightning simulation and electromagnetic

pulse, Controllable avalanche characteristics.

3. Advanced Manufacturing Technology

As the core component of the high-voltage power supply system, the reliability of the high-voltage silicon stack directly affects the entire The operation safety and life of the equipment are guaranteed. From raw material selection to final testing, every link is carefully To reassure customers.

1. Packaging technology and production process

We use high frequency alloy & alkali washing & polyimide protection technology or high temperature glass passivation sealing The mounting technology greatly improves the stability and reliability of the PN junction. It can effectively prevent moisture penetration and ion pollution, so that the product can still maintain excellent electrical characteristics in high temperature and high humidity environment.

In the production of high-current silicon stacks, special thermal conductive materials are used to transfer the heat generated by the chip to the

Fast conduction solves the problem of heat dissipation in high-current silicon stacks.

It has the lowest temperature rise and the longest service life among products of the same specification.

2. Precision manufacturing and process control

The manufacturing of high-voltage silicon stacks involves multiple precision process links. We have set up

Set strict standards:

(1). *Chip preparation*: High-purity silicon wafers are used and formed through semiconductor processes such as diffusion.

PN junction. We pay special attention to controlling the junction depth and doping concentration to ensure that each unit chip has the same parameters.

Number consistency.

(2). *Chip assembly*: Connect multiple unit PN junction chips in series/parallel according to the design specifications

For ultra-high voltage products such as MCLG1000KV1A, insulation treatment technology is used to avoid

No partial discharge.

(3). *Welding process*: Use high temperature welding to ensure internal connection reliability, and the welding temperature is

accurate. The temperature is precisely controlled within the range of $\pm 5^{\circ}\text{C}$.

(4). *Packaging curing*: Epoxy resin curing in a constant temperature and humidity environment, curing

curve Carefully optimized to reduce internal stress generation.

3. Complete test verification

To ensure the reliability of our products, we have established the most comprehensive testing laboratory in the industry.

Equipped with a variety of professional testing equipment:

High Voltage Test Bench: Accurately verify the breakdown voltage and leakage current of each silicon stack.

High temperature reverse bias test bench: simulates high temperature working environment to accelerate the evaluation of long-term product

reliability.*TRR Tester*: Accurately measure reverse recovery time.

High Temperature Storage Box: Evaluates the performance of the product at high temperatures.

etc.

We establish a complete test file for each batch of high-voltage silicon stacks to achieve full-process product quality Process tracing.

IV. Industry application solutions and successful cases

As the core device of power conversion, high voltage silicon stack has applications in almost all

Where high voltage DC power is required. With our comprehensive product line and deep technical accumulation,

Provide targeted high-voltage rectification solutions for customers in various industries.

1. Medical and health field

In the field of medical equipment, the reliability and stability of high-voltage silicon stacks are directly related to diagnostic accuracy.

Our medical-grade high-voltage silicon stacks are designed with ultra-low noise and strict

The aging screening process ensures that the X-ray machine, CT scanner, medical linear accelerator and other equipment

Prepare for medium to long-term stable work.

Our company currently manufactures high-voltage silicon stacks for a century-old Japanese manufacturer and has received positive reviews.

2. Industrial manufacturing

In the industrial manufacturing process, high voltage DC power supply is the core power source for many key processes.

We have developed a series of dedicated silicon stacks for different industrial application scenarios to help customers improve production

Efficiency and reduce energy consumption.

Electrostatic Precipitator System: 2CL72KV1A silicon stack performs excellently in power plant dust removal equipment.

Industrial Microwave Equipment: Produced HV07-16 series and

HV03-10 series high voltage silicon stack.

3. Import substitution:

The silicon stack produced by our company can completely replace the 2CL series and CL03 of the American HVCA company.

Series, HCF Series, HL Series, HV Series7, HV550 Series, HVRT Series, HVRD Series, DV series, UX series and other full specification

products.

4. Scientific research and special applications

In the field of scientific research experiments and special equipment, high-voltage silicon stacks often need to withstand extreme working conditions. Our customized R&D capabilities demonstrate unique value in these areas.

Among them, the high-voltage silicon stack for high-energy ignition of nuclear facilities is an innovative technology product of our

company.