

# S1P02R170HBG-D (Preliminary)



## 1700V / 900A All-Silicon Carbide MOSFET Half-Bridge Module

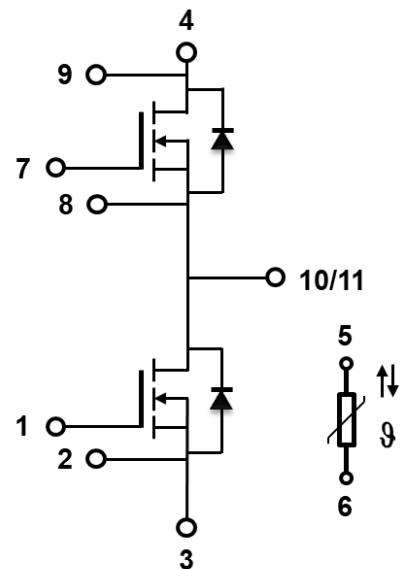
### Features

- Electrical features
  - $V_{DSS} = 1700V$
  - $I_{D\ nom} = 900A$
- High-speed Switching Possible
- High Power Density
- High Frequency Operation
- Ultra-low Losses



### Applications

- Motor drives
- High power converters
- Photovoltaics, wind power generation
- Induction heating equipment
- Electrified vehicle traction inverter



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### 1、Maximum ratings

Table 1 Maximum rating ( $T_c = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
$V_{DS,max}$	Drain source voltage	1700	V	$V_{GS} = 0V, I_D = 100 \mu A$	
$V_{GS,max}$	Gate source voltage	-8 /+22	V	Absolute maximum values	
$V_{GSop}$	Gate source voltage	-4 /+18	V	Recommended operational values	
$I_D$	Continuous drain current	900	A	$V_{GS} = 18V, T_C = 100^\circ\text{C}$	
$I_{D(pulse)}$	Pulsed drain current	1800	A	Pulse width tp limited by $T_{j,max}$	
$T_J, T_{stg}$	Operating Junction and storage temperature	-40 to +175	$^\circ\text{C}$		

## 2、Packaging Characteristics

Table 2 Package Characteristics

Symbol	Description	Value	Unit	Note
$R_{HS}$	High-side Resistance	1.6	m $\Omega$	
$R_{LS}$	Low-side Resistance	1.6		
$L_s$	Stray inductance	18	nH	
$V_{ISO}$	Isolation Test Voltage RMS, f=50Hz, t=1min	3.4	kV	
Distance	Terminal to Heatsink Creepage Distance	14.5	mm	
	Terminal to Terminal Creepage Distance	13.0	mm	
	Terminal to Heatsink Clearance	12.5	mm	
	Terminal to Terminal Clearance	10.0	mm	
$R_{th}$	Average Thermal Resistance of Per Upper Switch	0.106	$^{\circ}\text{C}/\text{W}$	
	Average Thermal Resistance of Per Lower Switch	0.101	$^{\circ}\text{C}/\text{W}$	
$T_{jmax}$	Maximum Junction Temperature	175	$^{\circ}\text{C}$	
$T_{jop}$	Operation Junction Temperature	-40 to +175	$^{\circ}\text{C}$	
$T_{STG}$	Storage Temperature Range	-40 to +175	$^{\circ}\text{C}$	
W	Weight	380	g	
Ms	Maximum Mounting Torque	6.0	N·m	

<sup>1</sup> Not subject to production test. Parameter verified by design/characterization.

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### 3、Electrical characteristics

Table 4 SiC MOSFET characteristics (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	1700	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 100μA	
V <sub>GS(th)</sub>	Gate threshold voltage	2.5	3.1	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 288mA	
		-	2.3	-	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 288mA, T <sub>J</sub> = 175°C	
I <sub>DSS</sub>	Zero gate voltage drain current	-	12	120	μA	V <sub>DS</sub> = 1700V, V <sub>GS</sub> = 0V	
I <sub>GSS</sub>	Gate source leakage current	-	-	1.2	μA	V <sub>GS</sub> = 18V, V <sub>DS</sub> = 0V	
R <sub>DS(on)</sub>	Current drain-source on-state resistance	-	1.6	2.3	mΩ	V <sub>GS</sub> = 18V, I <sub>D</sub> = 900A	
		-	3.6	-		V <sub>GS</sub> = 18V, I <sub>D</sub> = 900A, T <sub>J</sub> = 175°C	
g <sub>fs</sub>	Transconductance	-	612	-	S	V <sub>DS</sub> = 20V, I <sub>D</sub> = 900A	
		-	492	-		V <sub>DS</sub> = 20V, I <sub>D</sub> = 900A, T <sub>J</sub> = 175°C	
R <sub>g,int</sub>	Internal gate resistance	-	0.7	-	Ω	V <sub>AC</sub> = 25mV, f = 1MHz, open drain	
C <sub>iss</sub>	Input capacitance	-	63.1	-	nF	V <sub>DS</sub> = 1400V, V <sub>GS</sub> = 0V	
C <sub>oss</sub>	Output capacitance	-	2.3	-		T <sub>J</sub> = 25°C, V <sub>AC</sub> = 25mV	
C <sub>rss</sub>	Reverse capacitance	-	0.09	-		f = 100KHz	
Q <sub>gs</sub>	Gate source charge	-	900	-	nC	V <sub>DS</sub> = 1200V, V <sub>GS</sub> = -4/+18V	
Q <sub>gd</sub>	Gate drain charge	-	672	-		I <sub>D</sub> = 900A	
Q <sub>g</sub>	Gate charge	-	2508	-			
E <sub>on</sub>	Turn on switching energy	-	80.5	-	mJ	V <sub>DS</sub> = 1200V, V <sub>GS</sub> = -4/+18V	
E <sub>off</sub>	Turn off switching energy	-	78.2	-		I <sub>D</sub> = 900A, R <sub>g</sub> = 8.2Ω, L = 16.7μH	

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**Table 5 Body diode characteristics** (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V <sub>SD</sub>	Diode forward voltage	-	3.8	-	V	V <sub>GS</sub> = -4V, I <sub>SD</sub> = 450A	
		-	3.3	-	V	V <sub>GS</sub> = -4V, I <sub>SD</sub> = 450A T <sub>J</sub> = 175°C	
I <sub>S</sub>	Continuous diode forward current	-	900	-	A	V <sub>GS</sub> = -4V, Tc = 100°C	
t <sub>rr</sub>	Reverse recovery time	-	28	-	ns	V <sub>R</sub> = 1200V, V <sub>GS</sub> = -4V I <sub>D</sub> = 900A, di/dt=6770A/μs, T <sub>J</sub> = 175°C	
Q <sub>rr</sub>	Reverse recovery charge	-	12.8	-	μC		
I <sub>rrm</sub>	Peak reverse recovery current	-	780	-	A		

**Table 6 NTC-Thermistor Characteristic**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
R <sub>25</sub>	Rate Resistance	-	5	-	kΩ	Tc=25°C	
ΔR/R	Deviation of R <sub>100</sub>	-5	-	5	%	Tc=100°C, R <sub>100</sub> =489Ω	
P <sub>25</sub>	Power Dissipation	-	-	60.0	mW	Tc=25°C	
B <sub>25/50</sub>	B-value	-	3380	3414	K	R <sub>2</sub> =R <sub>25</sub> exp[B <sub>25/50</sub> (1/T <sub>2</sub> - 1/T <sub>1</sub> )]	



### 5、 Test conditions

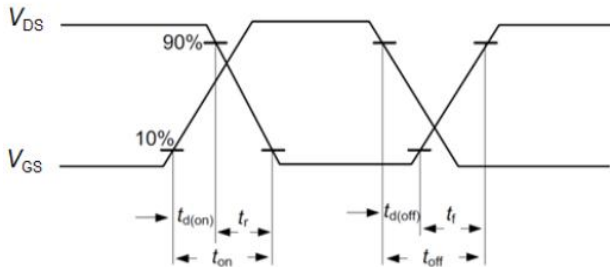


Figure A. Definition of switching times

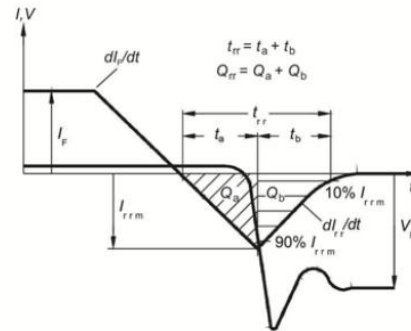


Figure B. Definition of body diode switching characteristics

### Revision history

Document version	Date of release	Description of changes	
V01_00	2024-11-30	---	

### Attention

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#### 1. RoHS compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/ EC (RoHS2), as implemented January 2, 2013.

#### 2. REACH compliance

REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a Sichain representative to insure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

3. With respect to information regarding the application of the product, Sichain hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

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8. For use of our products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a Sichain representatives, for example but not limited to: transportation equipment, primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, and power transmission systems.