

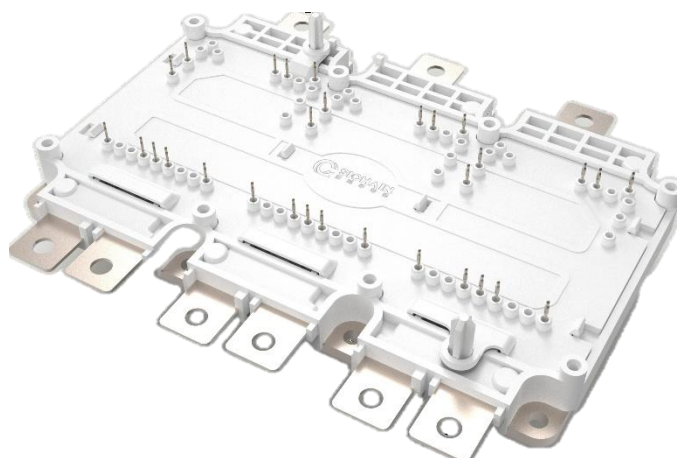
S1P02R120FBD-A (Preliminary)



1200V / 600A All-Silicon Carbide MOSFET Full-Bridge Module

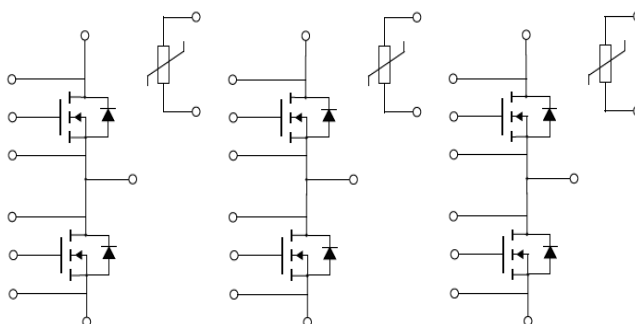
Features

- Electrical features
 - $V_{DS} = 1200V$
 - $I_D \text{ nom} = 600A$
- High-speed Switching Possible
- High Power Density
- High Frequency Operation
- Ultra-low Losses
- Pinfin baseplate



Applications

- Motor drives
- High power converters
- Electrified vehicle traction inverter



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1、Maximum ratings

Table 1 Maximum rating (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
$V_{DS,max}$	Drain source voltage	1200	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	600	A	$V_{GS} = 18V, T_C = 100^{\circ}C$	
$I_{D(pulse)}$	Pulsed drain current	1200	A	Pulse width tp limited by $T_{j,max}$	
T_J, T_{stg}	Operating Junction and storage temperature	-55 to +175	°C		

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2、Packaging Characteristics

Table 2 Package Characteristics

Symbol	Description	Value	Unit	Note
R _{HS}	High-side Resistance	2.1	mΩ	
R _{LS}	Low-side Resistance	2.1		
L _S	Stray inductance	8.0	nH	
V _{ISO}	Isolation Test Voltage RMS, f=50Hz, t=1min	4.2	kV	
Distance	Terminal to Heatsink Creepage Distance	9.0	mm	
	Terminal to Terminal Creepage Distance	9.0	mm	
	Terminal to Heatsink Clearance	4.5	mm	
	Terminal to Terminal Clearance	4.5	mm	
R _{th}	Average Thermal Resistance of Per Upper Switch	0.122	°C/W	
	Average Thermal Resistance of Per Lower Switch	0.122	°C/W	
T _{jmax}	Maximum Junction Temperature	175	°C	
T _{jop}	Operation Junction Temperature	-55 to +175	°C	
T _{STG}	Storage Temperature Range	-55 to +175	°C	
W	Weight	380	g	
Ms	Maximum Mounting Torque	6.0	N·m	

¹ 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
$V_{(BR)DSS}$	Drain-source breakdown voltage	1200	-	-	V	$V_{GS} = 0V, I_D = 600\mu A$	
$V_{GS(th)}$	Gate threshold voltage	2.3	2.8	3.6	V	$V_{DS} = V_{GS}, I_D = 168mA$	
		-	2.0	-	V	$V_{DS} = V_{GS}, I_D = 168mA,$ $T_J = 175^\circ C$	
I_{DSS}	Zero gate voltage drain current	-	6	60	μA	$V_{DS} = 1200V, V_{GS} = 0V$	
I_{GSS}	Gate source leakage current	-	-	600	nA	$V_{GS} = 18V, V_{DS} = 0V$	
$R_{DS(on)}$	Current drain-source on-state resistance	-	2.1	3	m Ω	$V_{GS} = 18V, I_D = 600A$	
		-	3.5	-		$V_{GS} = 18V, I_D = 600A,$ $T_J = 175^\circ C$	
g_{fs}	Transconductance	-	318	-	S	$V_{DS} = 20V, I_D = 200A$	
		-	309	-		$V_{DS} = 20V, I_D = 200A,$ $T_J = 175^\circ C$	
$R_{g,int}$	Internal gate resistance	-	1.8	-	Ω	$V_{AC} = 25mV, f = 1MHz,$ open drain	
C_{iss}	Input capacitance	-	33.2	-	nF	$V_{DS} = 1000V, V_{GS} = 0V$ $T_J = 25^\circ C, V_{AC} = 25mV$ $f = 100KHz$	
C_{oss}	Output capacitance	-	1.50	-			
C_{rss}	Reverse capacitance	-	0.1	-			
Q_{gs}	Gate source charge	-	1420	-	nC	$V_{DS} = 800V,$ $V_{GS} = -4/+18V$ $I_D = 600A$	
Q_{gd}	Gate drain charge	-	726	-			
Q_g	Gate charge	-	1420	-			
E_{on}	Turn on switching energy	-	6.43	-	mJ	$V_{DS} = 800V, V_{GS} = -4/+18V$ $I_D = 600A, R_g = 5.2\Omega,$ $L = 120\mu H$	
E_{off}	Turn off switching energy	-	4.30	-			

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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 _{SD}	Diode forward voltage	-	3.5	-	V	V _{GS} = -4V, I _{SD} = 300A	Fig.8,9,10
		-	3.0	-	V	V _{GS} = -4V, I _{SD} = 300A T _J = 175°C	
I _S	Continuous diode forward current	-	560	-	A	V _{GS} = -4V, T _c = 25°C	
t _{rr}	Reverse recovery time	-	66	-	ns	V _R = 800V, V _{GS} = -4V I _D = 600A di/dt=3000A/μs, T _J = 175°C	
Q _{rr}	Reverse recovery charge	-	11.0	-	μ C		
I _{rrm}	Peak reverse recovery current	-	300	-	A		

Table 6 NTC-Thermistor Characteristic

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
R ₂₅	Rate Resistance	-	5	-	kΩ	T _c =25°C	
ΔR/R	Deviation of R ₁₀₀	-5	-	5	%	T _c =100°C, R ₁₀₀ =493Ω	
P ₂₅	Power Dissipation	-	-	60.0	mW	T _c =25°C	
B _{25/50}	B-value	-	3375	-	K	R ₂ =R ₂₅ exp[B _{25/50} (1/T ₂ – 1/T ₁)]	

4、Electrical characteristic diagram

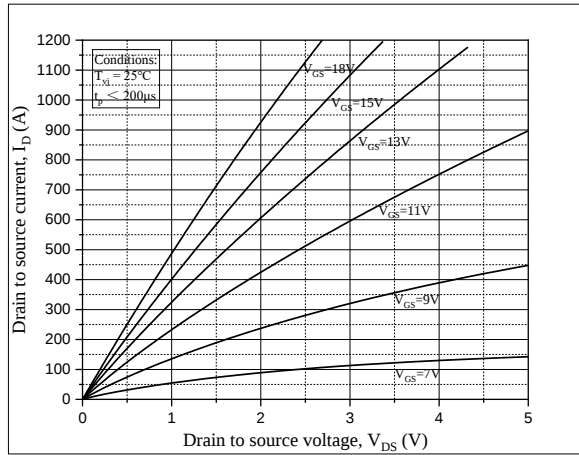


Figure 1. Output Characteristic, $T_{vj}=25^{\circ}\text{C}$

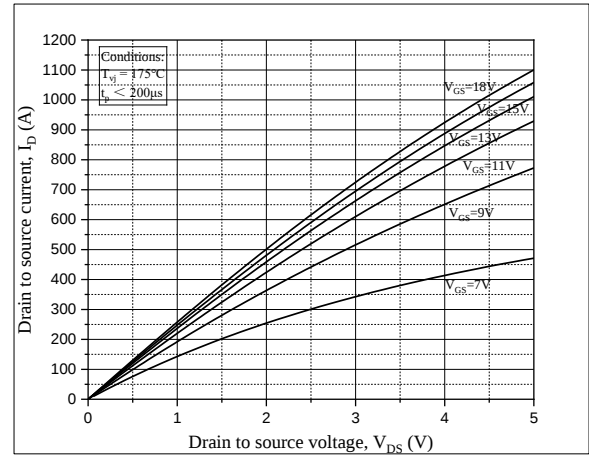


Figure 2. Output Characteristic, $T_{vj}=175^{\circ}\text{C}$

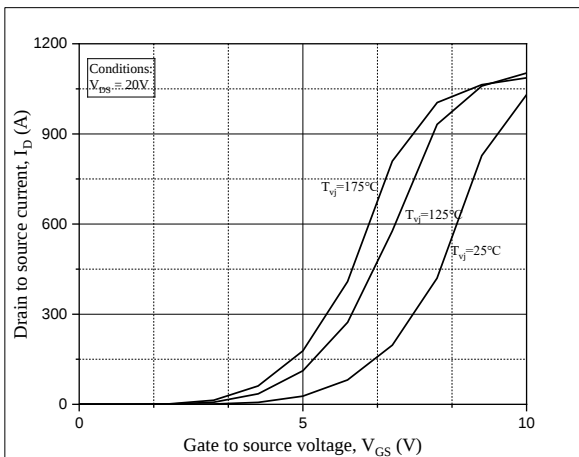


Figure 3. Transfer Characteristic

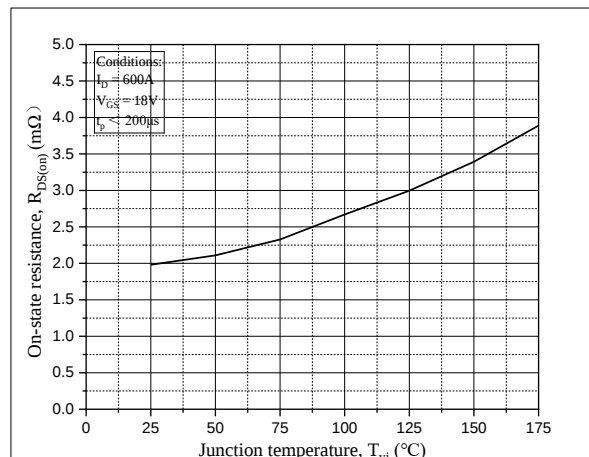


Figure 4. On-resistance VS. Junction Temperature

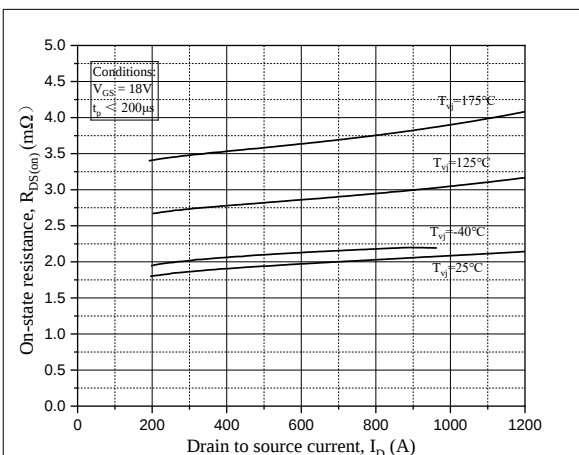


Figure 5. On-resistance VS. Drain to Source Current

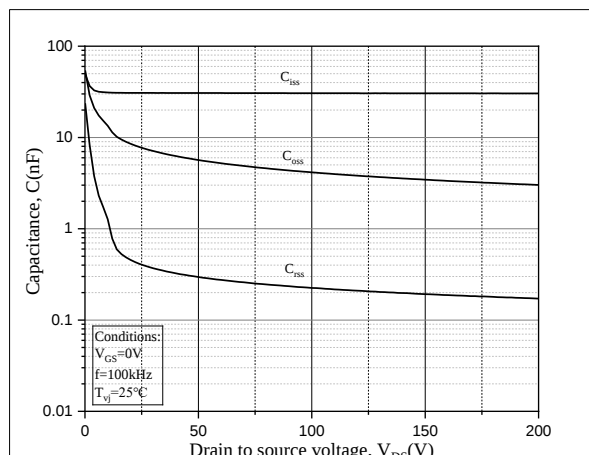


Figure 6. Capacitance VS. V_{DS}

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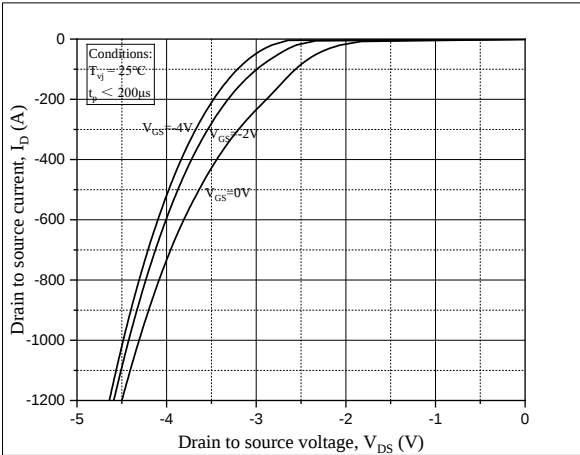


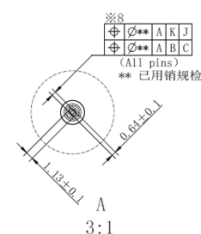
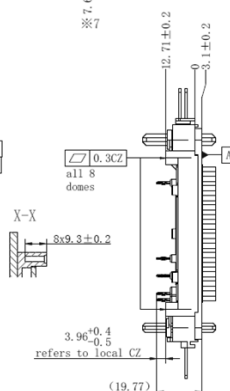
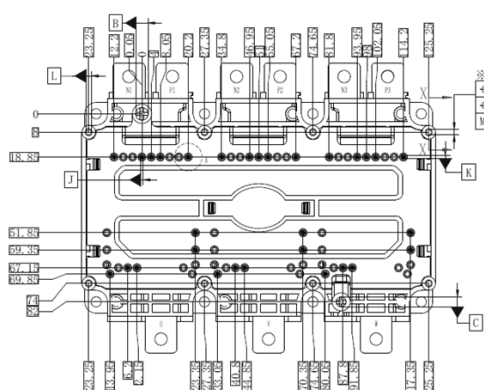
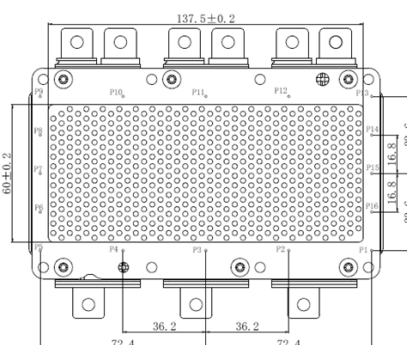
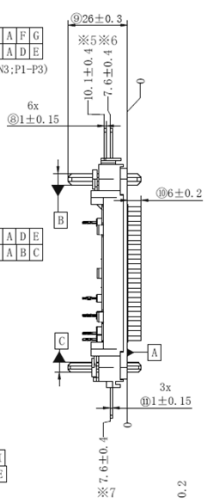
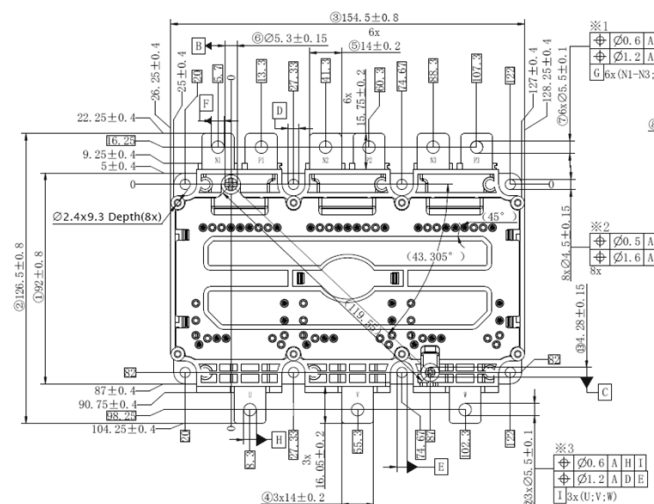
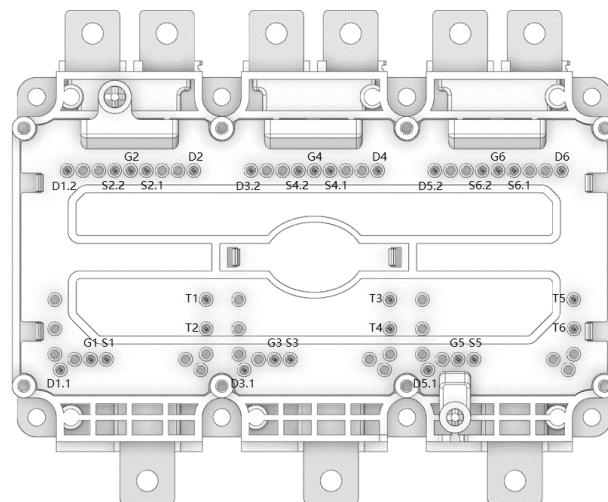
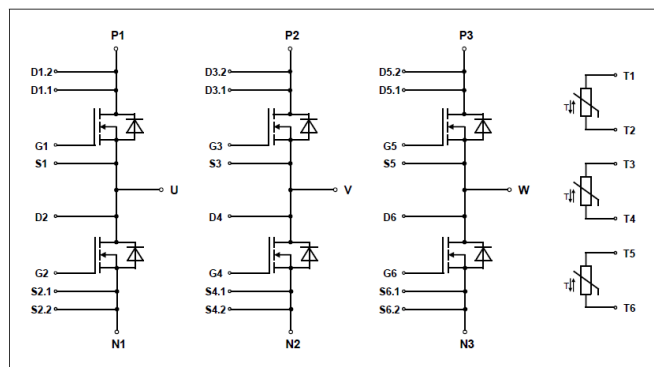
Figure 7. 3rd Quadrant Characteristic

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5、Package drawing



6、Test conditions

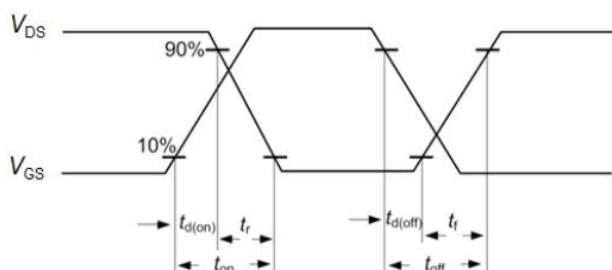


Figure A. Definition of switching times

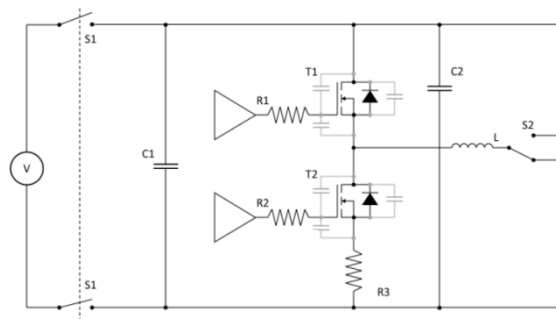


Figure B. Dynamic test circuit

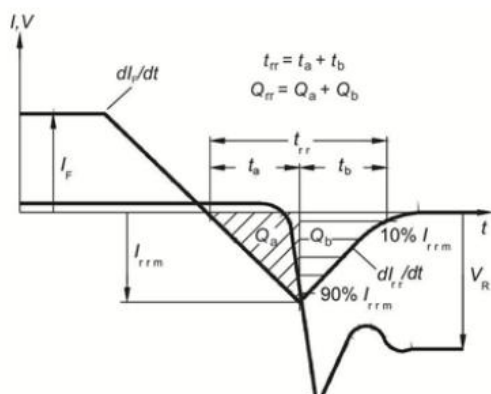


Figure C. Definition of diode switching characteristics

Figure C. Definition of body diode switching characteristics

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Revision history

Document version	Date of release	Description of changes	
V01_00	2024-05-30	——	

Attention

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.

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