S1P04R120HBH-B（Preliminary）

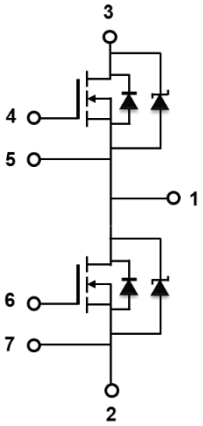
1200V / 400A All-Silicon Carbide MOSFET Half-Bridge Module

Features

- Electrical features
  V_{DSS} = 1200V
  $I_{D,\ nom}$ = 400A
- High-speed Switching Possible
- High Power Density
- High Frequency Operation
- Ultra-low Losses

Applications

- DC/DC converters
- UPS system
- 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** (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 μA	
$V_{GS,max}$	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	400	A	V_{GS} = 18V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed drain current	800	A	Pulse width tp limited by T_j,max	
T_J ,T_{stg}	Operating Junction and storage temperature	-40 to +150	˚C		

2、 Packaging Characteristics

Table 2 Package Characteristics

Symbol	Description	Value	Unit	Note
R_{HS}	High-side Resistance	3.5	mΩ	
R_{LS}	Low-side Resistance	3.5		
Ls	Stray inductance	12	nH	
V_{ISO}	Isolation Test Voltage RMS, f=50Hz, t=1min	5.0	kV	
Distance	Terminal to Baseplate Creepage Distance	40.0	mm	
	Terminal to Terminal Creepage Distance	30.0	mm	
	Terminal to Baseplate Clearance	30.0	mm	
	Terminal to Terminal Clearance	9.0	mm	
R_{th}	Average Thermal Resistance of Per Upper Switch	0.13	˚C/W	
	Average Thermal Resistance of Per Lower Switch	0.13	˚C/W	
T_{jmax}	Maximum Junction Temperature	175	˚C	
T_{jop}	Operation Junction Temperature	-40 to +150	˚C	
T_{STG}	Storage Temperature Range	-40 to +150	˚C	
W	Weight	300	g	
Ms	Maximum Mounting Torque	5.0	N·m	

[1] Not subject to production test. Parameter verified by design/characterization.

3、Electrical characteristics

3.1 Characteristics

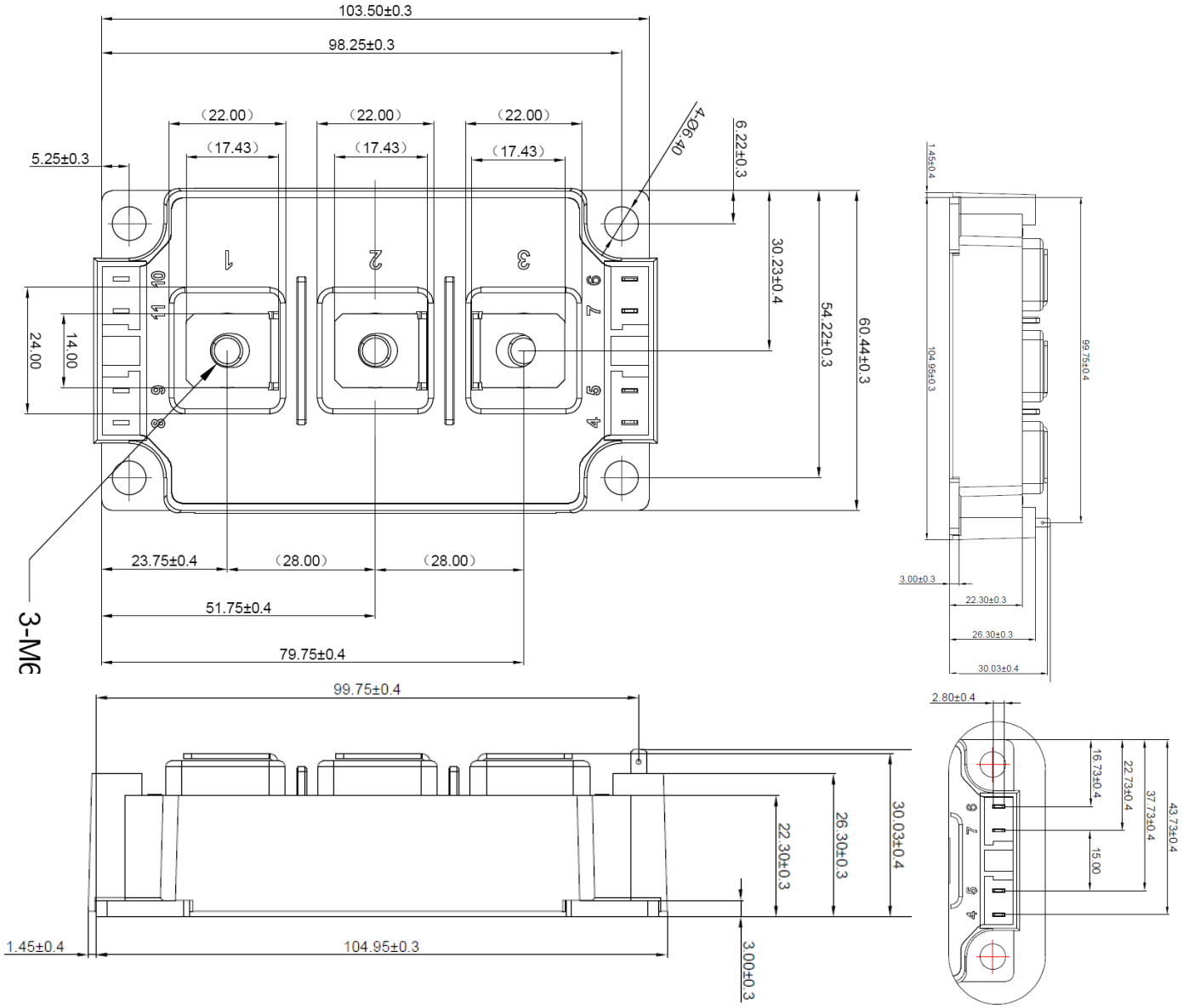
Table 4 SiC MOSFET characteristics (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-source breakdown voltage	1200	-	-	V	V_{GS} = 0V, I_D = 100μA	
$V_{GS(th)}$	Gate threshold voltage	2.3	2.8	4.0	V	V_{DS} = V_{GS}, I_D = 112mA	
		-	2.0	-	V	V_{DS} = V_{GS}, I_D = 112mA, T_J = 175°C	
I_{DSS}	Zero gate voltage drain current	-	4	40	μA	V_{DS} = 1200V, V_{GS} = 0V	
I_{GSS}	Gate source leakage current	-	-	400	nA	V_{GS} = 18V, V_{DS} = 0V	
$R_{DS(on)}$	Current drain-source on-state resistance	-	3.5	4.5	mΩ	V_{GS} = 18V, I_D = 400A	
		-	5.3	-		V_{GS} = 18V, I_D =400A, T_J = 175°C	
gfs	Transconductance	-	212	-	S	V_{DS} = 20V, I_D = 400A	
		-	206	-		V_{DS} = 20V, I_D =400A, T_J = 175°C	
$R_{g,int}$	Internal gate resistance	-	1.5	-	Ω	V_{AC} = 25mV, f = 1MHz, open drain	
C_{iss}	Input capacitance	-	19.8	-	nF	V_{DS} = 1000V, V_{GS} = 0V T_J = 25°C, V_{AC} = 25mV f = 100KHz	
C_{oss}	Output capacitance	-	1.0	-			
C_{rss}	Reverse capacitance	-	0.1	-			
Q_{gs}	Gate source charge	-	231	-	nC	V_{DS} = 800V, eV_{GS} = -4/+18V I_D = 400A	
Q_{gd}	Gate drain charge	-	484	-			
Q_g	Gate charge	-	947	-			
E_{on}	Turn on switching energy	-	17.2	-	mJ	V_{DS} = 800V, V_{GS} = -4/+18V I_D = 400A, Rg = 2.5Ω, L = 120μH	
E_{off}	Turn off switching energy	-	15.3	-			

Table 5 SiC SBD characteristics (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V_{RRM}	Repetitive Peak Reverse Voltage	1200	-	-	V		
I_F	Continuous Forward Current	-	528	-	A	Tc = 25℃	
		-	258	-		Tc = 135 ℃	
		-	180	-		Tc = 155 ℃	
I_{FSM}	Non-Repetitive Peak Forward Surge Current	-	1040	-	A	T_p=10ms, Half Sine Pulse	
V_F	Forward Voltage	-	1.4	1.8	V	I_{DS}=200A	
		-	1.9	2.5		I_{DS}=40A, T_j=175℃	
I_R	Reverse Current	-	6	600	μA	V_R=1200V	
			60	500		V_R=1200V, T_j=175℃	
Q_c	Total Capacitive Charge	-	628	-	nC	V_R=800V, I_F=40A di/dt=200A/μs	
C	Total Capacitance	-	12.8	-	nF	V_R=0V, f=1MHz	
		-	0.56	-		V_R=400V, f=1MHz	
		-	0,4	-		V_R=800V, f=1MHz	

4、Package drawing



5、Test conditions

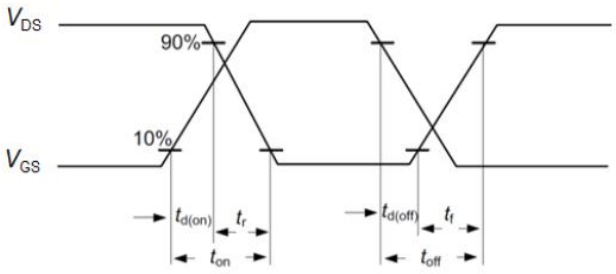


Figure A. Definition of switching times

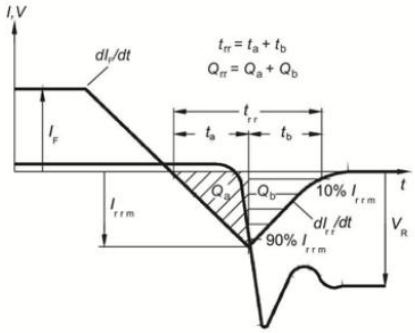


Figure B. Definition of body diode switching characteristics

Revision history

Document version	Date of release	Description of changes	
V01_00	2025-01-04	——	

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**

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