S1P09R120CSE-A（Preliminary）

1200V / 9mΩ SiC MOSFET Power Module

Features

- High-speed switching possible
- Very low switching losses
- High blocking voltage with low on-resistance
- Temperature independent turn-off switching losses
- Ultra-low thermal resistance
- Common source topology
- Isolated back-side

Applications

- Solar power optimizer
- UPS system
- Solid state circuit breaker
- High power converters
- Photovoltaics, wind power generation
- Induction heating equipment
- Smart grid transmission and distribution

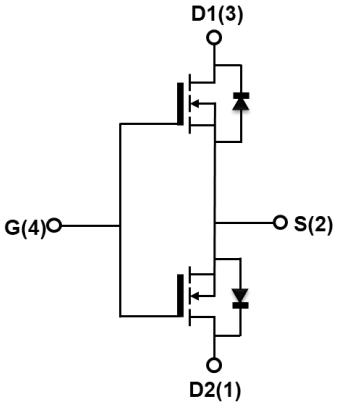

Table 1　Key performance and package parameters

Type	V_{DS}	I_{DS} (T_C = 25℃, $R_{th\ (j\text{-}c,max)}$)	$R_{DS(ON),\ typ}$ (V_{GS} = 18V, I_D = 100A, T_J = 25℃)	$T_{j,max}$	Package
S1P09R120CSE-A	1200V	240A	9mΩ	175℃	SOT227

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1、Maximum ratings

Table 2 **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	240	A	V_{GS} = 18V, T_C = 25˚C	
		160		V_{GS} = 18V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed drain current	480	A	Pulse width tp limited by T_j,max	
P_D	Power dissipation	375	W	T_C = 25˚C, T_J = 175˚C	
T_J , T_{stg}	Operating Junction and storage temperature	-55 to +175	˚C		

2、Thermal / Packaging Characteristics

Table 3 Package Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit	Note
R_{th-JC}	Thermal Resistance, Junction to Case	-	0.4	-	℃/W	
V_{ISO}	Isolation Test Voltage RMS, f=50Hz, t=1min	2.5	-	-	kV	
Creepage	Terminal to Heatsink Creepage Distance	-	8.5	-	mm	
	Terminal to Terminal Creepage Distance	-	10.5	-	mm	
Clearance	Terminal to Heatsink Clearance	-	6.8	-	mm	
	Terminal to Terminal Clearance	-	4.4	-	mm	
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	-	28.5	-	g	
T_M	Screws to Heatsink Mounting Torque	-	-	1.5	N·m	
T_C	Terminal Connection Torque (M4 *8mm)	-	-	1.3	N·m	

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

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 = 100μA	
$V_{GS(th)}$	Gate threshold voltage	2.3	2.8	4.0	V	V_{DS} = V_{GS}, I_D = 40mA	
		-	2.0	-	V	V_{DS} = V_{GS}, I_D = 40mA, T_J = 175°C	
I_{DSS}	Zero gate voltage drain current	-	1	10	μA	V_{DS} = 1200V, V_{GS} = 0V	
I_{GSS}	Gate source leakage current	-	-	100	nA	V_{GS} = 18V, V_{DS} = 0V	
$R_{DS(on)}$	Current drain-source on-state resistance	-	8.5	11		V_{GS} = 18V, I_D = 140A	
		-	13.5	-		V_{GS} = 18V, I_D =140A, T_J = 175°C	
gfs	Transconductance	-	118	-	S	V_{DS} = 20V, I_D = 140A	
		-	98	-		V_{DS} = 20V, I_D =140A, T_J = 175°C	
$R_{g,int}$	Internal gate resistance	-	1.0	-	Ω	V_{AC} = 25mV, f = 1MHz, open drain	
C_{iss}	Input capacitance	-	8521	-	pF	V_{DS} = 1000V, V_{GS} = 0V T_J = 25°C, V_{AC} = 25mV f = 100KHz	
C_{oss}	Output capacitance	-	347	-			
C_{rss}	Reverse capacitance	-	15	-			
Q_{gs}	Gate source charge	-	54	-	nC	V_{DS} = 800V, V_{GS} = -4/+18V I_D = 100A	
Q_{gd}	Gate drain charge	-	45	-			
Q_g	Gate charge	-	230	-			

* By estimated

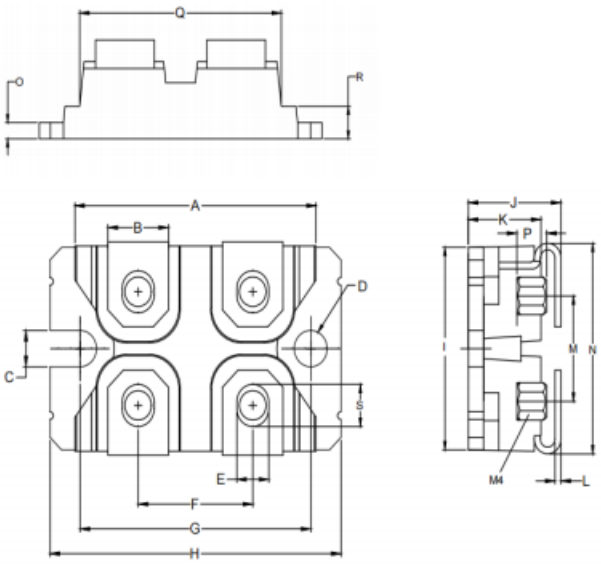
E_{on}	Turn on switching energy	-	812	-	μJ	V_{DS} = 800V, V_{GS} = -4/+18V I_D = 100A, Rg = 2.5Ω, L = 16.7μH	
E_{off}	Turn off switching energy	-	383	-			
$t_{d(on)}$	Turn on delay time	-	19	-	ns		
t_r	Rise time	-	29	-			
$t_{d(off)}$	Turn off delay time	-	42	-			
t_f	Fall time	-	9.3	-			

Table 5 Body diode characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode forward voltage	-	3.8	-	V	V_{GS} = -4V, I_{SD} = 70A	Fig.8,9, 10
		-	3.6	-	V	V_{GS} = -4V, I_{SD} = 70A T_J = 175°C	
I_S	Continuous diode forward current	-	240	-	A	V_{GS} = -4V, Tc = 25°C	
t_{rr}	Reverse recovery time	-	66	-	ns	V_R = 800V, V_{GS} = -4V I_D = 100A T_J = 175°C	
Q_{rr}	Reverse recovery charge	-	1830	-	nC		
I_{rrm}	Peak reverse recovery current	-	52	-	A		

Note : When using SiC Body Diode the maximum recommended V_{GS} = -4 V

4、Package drawing



DiM	Millimeter	
	Min	Max
A	31.40	31.60
B	7.70	8.10
C	4.20	4.40
D	4.20	4.40
E	4.10	4.30
F	14.90	15.10
G	30.10	30.20
H	38.00	38.40
I	23.80	24.20
J	11.80	12.20
K	9.40	9.60
L	0.75	0.85
M	12.40	12.80
N	24.50	25.40
O	1.90	2.10
P	3.10	3.95
Q	26.60	27.00
R	3.80	4.20
S	5.10	5.40

5、Test conditions

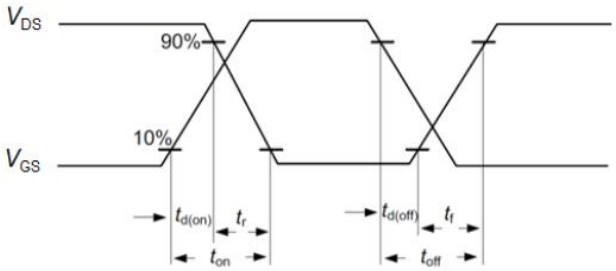


Figure A. Definition of switching times

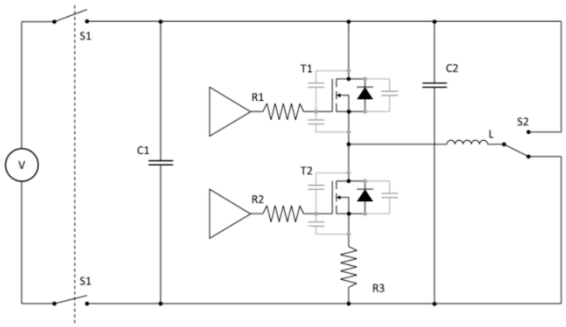


Figure B. Dynamic test circuit

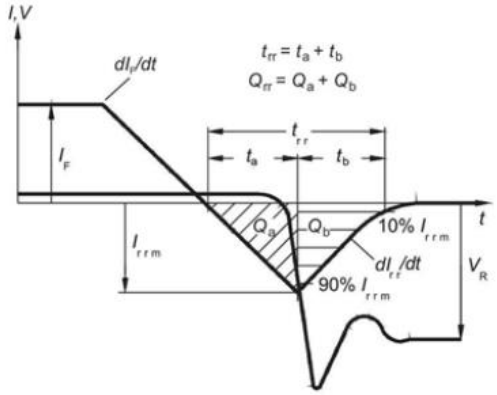


Figure C. **Definition of diode switching characteristics**

Figure C. Definition of body diode switching characteristics

Revision history

Document version	Date of release	Description of changes	
V01_00	2024-05-26	——	

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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