

S1P20R170SSE-A (Preliminary)

1700V / 20mΩ SiC Power MOSFET Module



Features

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



Applications

- Solar power optimizer
- UPS system
- Motor drives
- High power converters
- Photovoltaics, wind power generation
- Induction heating equipment
- Smart grid transmission and distribution

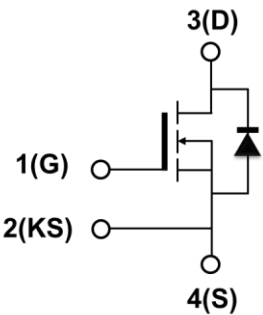


Table 1 Key performance and package parameters

Type	V _{DS}	I _{DS} (T _C = 25°C, R _{th(j-c,max)})	R _{DS(ON)} , typ (V _{GS} = 18V, I _D = 75A, T _J = 25°C)	T _{j,max}	Marking	Package
S1P20R170SSE	1700 V	90A	20 mΩ	175°C	S1P20R170SSE	SOT227

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1、Maximum ratings

Table 2 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	90	A	$V_{GS} = 18V, T_C = 25^{\circ}\text{C}$	Fig.19
		72		$V_{GS} = 18V, T_C = 100^{\circ}\text{C}$	
$I_{D(pulse)}$	Pulsed drain current	180	A	Pulse width tp limited by $T_{j,max}$	Fig.22
P_D	Power dissipation	375	W	$T_C = 25^{\circ}\text{C}, T_J = 175^{\circ}\text{C}$	Fig.20
T_J, T_{stg}	Operating Junction and storage temperature	-55 to +175	$^{\circ}\text{C}$		

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	-	°C/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

3.1 Static characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-source breakdown voltage	1700	-	-	V	$V_{GS} = 0V, I_D = 100\mu A$	
$V_{GS(th)}$	Gate threshold voltage	2.3	3.3	4.0	V	$V_{DS} = V_{GS}, I_D = 30mA$	Fig.11
		-	2.5	-	V	$V_{DS} = V_{GS}, I_D = 30mA,$ $T_J = 175^\circ C$	
I_{DSS}	Zero gate voltage drain current	-	1	10	μA	$V_{DS} = 1700V, V_{GS} = 0V$	
I_{GSS}	Gate source leakage current	-	-	100	nA	$V_{GS} = 18V, V_{DS} = 0V$	
$R_{DS(on)}$	Current drain-source on-state resistance	-	24	36	m Ω	$V_{GS} = 15V, I_D = 75A$	Fig.4,5 ,6
		-	46	-		$V_{GS} = 15V, I_D = 75A,$ $T_J = 175^\circ C$	
		-	20	30		$V_{GS} = 18V, I_D = 75A$	
		-	44	-		$V_{GS} = 18V, I_D = 75A,$ $T_J = 175^\circ C$	
g_{fs}	Transconductance	-	51	-	S	$V_{DS} = 20V, I_D = 75A$	Fig.7
		-	41	-		$V_{DS} = 20V, I_D = 75A,$ $T_J = 175^\circ C$	
$R_{g,int}$	Internal gate resistance	-	2.7	-	Ω	$V_{AC} = 25mV, f = 1MHz,$ open drain	

3.2 Dynamic characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
C_{iss}	Input capacitance	-	5265	-	pF	$V_{DS} = 1400V, V_{GS} = 0V$ $T_J = 25^\circ C, V_{AC} = 25mV$ $f = 100KHz$	Fig.17, 18
C_{oss}	Output capacitance	-	188	-			
C_{rss}	Reverse capacitance	-	7.5	-			
E_{oss}	Coss stored energy	-	189	-	μJ		Fig.16

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Q_{gs}	Gate source charge	-	75	-	nC	$V_{DS} = 1200V$, $V_{GS} = -4/+18V$, $I_D = 75A$	Fig.12
Q_{gd}	Gate drain charge	-	56	-			
Q_g	Gate charge	-	209	-			

3.3 Switching characteristics

Table 6 Dynamic characteristics($T_c = 25^\circ C$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
E _{on}	Turn on switching energy	-	2229	-	μJ	V _{DS} = 800V, V _{GS} = -4/+18V I _D = 100A, R _g = 2.5Ω, L = 16.7μH	
E _{off}	Turn off switching energy	-	501	-			
t _{d (on)}	Turn on delay time	-	39	-	ns		
t _r	Rise time	-	21	-			
t _{d (off)}	Turn off delay time	-	49	-			
t _f	Fall time	-	14	-			

Table 7 Body diode characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode forward voltage	-	4.0	-	V	$V_{GS} = -4V$, $I_{SD} = 50A$	Fig.8,9, 10
		-	3.5	-	V	$V_{GS} = -4V$, $I_{SD} = 50A$ $T_J = 175^\circ C$	
I_S	Continuous diode forward current	-	85	-	A	$V_{GS} = -4V$, $T_c = 25^\circ C$	
t_{rr}	Reverse recovery time	-	28	-	ns	$V_R = 800V$, $V_{GS} = -4V$ $I_D = 100A$ $T_J = 175^\circ C$	
Q_{rr}	Reverse recovery charge	-	1066	-	nC		
I_{rrm}	Peak reverse recovery current	-	65	-	A		

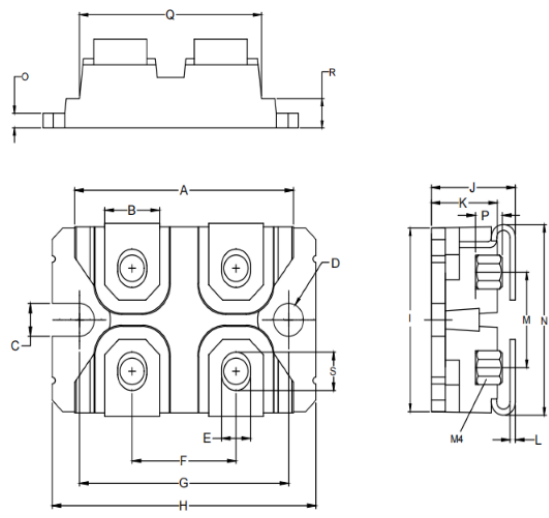
Note : When using SiC Body Diode the maximum recommended $V_{GS} = -4V$

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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

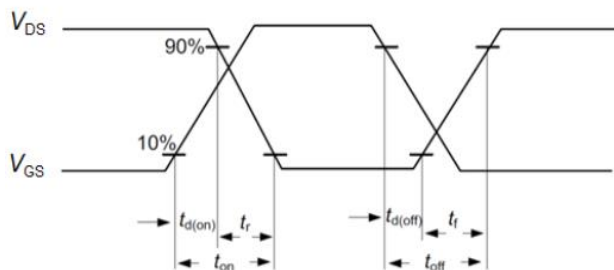


Figure A. Definition of switching times

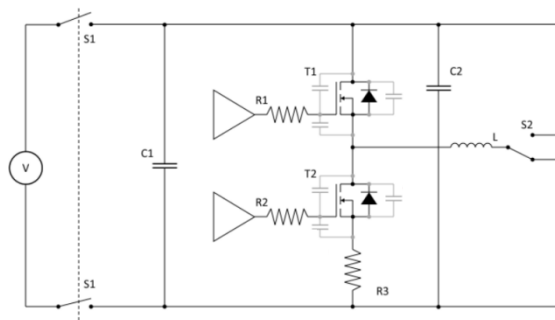


Figure B. Dynamic test circuit

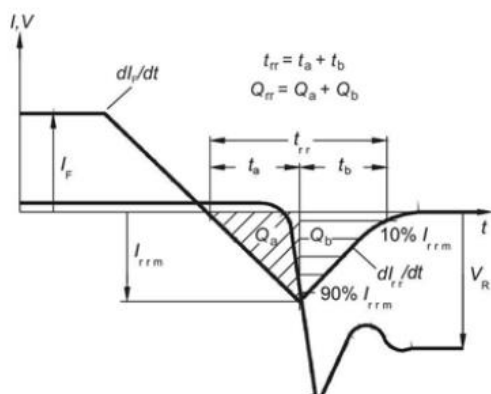


Figure C. Definition of diode switching characteristics

Figure C. Definition of body diode switching characteristics

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Revision history

Document version	Date of release	Description of changes
V01_00	2024-03-08	——

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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