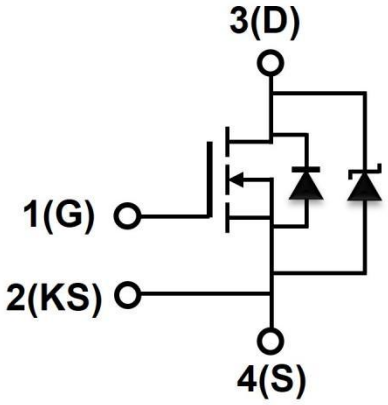
S1P14R120HSE-A

1200V / 14mΩ SiC Power MOSFET 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
- Isolated back-side



Applications

- Solar power optimizer
- UPS system
- Motor drives
- High power converters
- Photovoltaic, 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℃)	$T_{J,max}$	Marking	Package
S1P14R120HSE-A	1200V	120A	14mΩ	175℃	S1P14R120HSE-A	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 = 100μA	
$V_{GS,max}$	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	120	A	V_{GS} = 18V, T_C = 25˚C	Fig.16
		85		V_{GS} = 18V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed drain current	240	A	Pulse width tp limited by T_J,max	Fig.19
P_D	Power dissipation	349	W	T_C = 25˚C, T_J = 175˚C	Fig.17
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	-	0.34	0.43	℃/W	Note1
		-	0.5	-		Note2
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 *9mm)	-	-	1.3	N·m	

Note1：R_{th-JC} for SiC MOS

Note2：R_{th-JC} for SiC SBD

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	3.6	V	V_{DS} = V_{GS}, I_D = 28mA	Fig.11
		-	2.0	-	V	V_{DS} = V_{GS}, I_D = 28mA, 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	-	17	21	mΩ	V_{GS} = 15V, I_D = 100A	Fig.4,5,6
		-	28	-		V_{GS} = 15V, I_D =100A, T_J = 175°C	
		-	14	18		V_{GS} = 18V, I_D = 100A	
		-	24	-		V_{GS} = 18V, I_D =100A, T_J = 175°C	
g_{fs}	Transconductance	-	72	-	S	V_{DS} = 20V, I_D = 100A	Fig.7
		-	57	-		V_{DS} = 20V, I_D =100A, T_J = 175°C	
$R_{g,int}$	Internal gate resistance	-	0.9	-	Ω	V_{AC} = 25mV, f = 1MHz, open drain	
V_{SD}	Diode forward voltage	-	4.0	-	V	V_{GS} = -4V, I_{SD} = 50A	Fig.8,9,10
		-	3.5	-		V_{GS} = -4V, I_{SD} = 5A，T_J = 175°C	
C_{iss}	Input capacitance	-	5521	-	pF	V_{DS} = 1000V, V_{GS} = 0V T_J = 25°C, V_{AC} = 25mV f = 100kHz	Fig.14,15
C_{oss}	Output capacitance	-	247	-			
C_{rss}	Reverse capacitance	-	22	-			
E_{oss}	Coss stored energy	-	158	-	μJ		13
Q_{gs}	Gate source charge	-	54	-	nC	V_{DS} = 800V, V_{GS} = -4/+18V I_D = 100A	Fig.12
Q_{gd}	Gate drain charge	-	45	-			
Q_g	Gate charge	-	230	-			

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*	-			

* By estimated

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	-	134	-	A	Tc = 25℃	
		-	64	-		Tc = 135 ℃	
		-	40	-		Tc = 155 ℃	
I_{FSM}	Non-Repetitive Peak Forward Surge Current	-	300	-	A	T_p=10ms, Half Sine Pulse	
V_F	Forward Voltage	-	1.4	1.8	V	I_{DS}=40A	
		-	1.9	2.5		I_{DS}=40A, T_j=175℃	
I_R	Reverse Current	-	2	200	μA	V_R=1200V	
			20	500		V_R=1200V, T_j=175℃	
Q_c	Total Capacitive Charge	-	228	-	nC	V_R=800V, I_F=40A di/dt=200A/μs	
C	Total Capacitance	-	4240	-	pF	V_R=0V, f=1MHz	
		-	208	-		V_R=400V, f=1MHz	
		-	152	-		V_R=800V, f=1MHz	

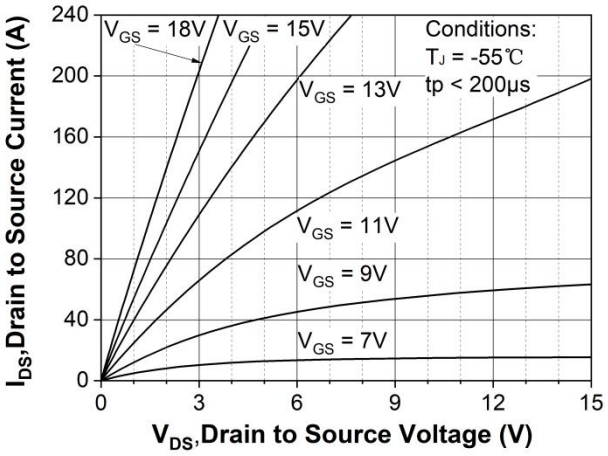

Figure 1. Output characteristics T_J = -55 ºC

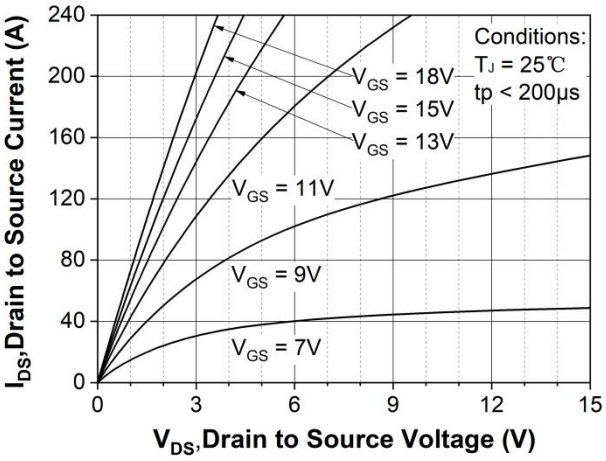

Figure 2. Output characteristics T_J = 25 ºC

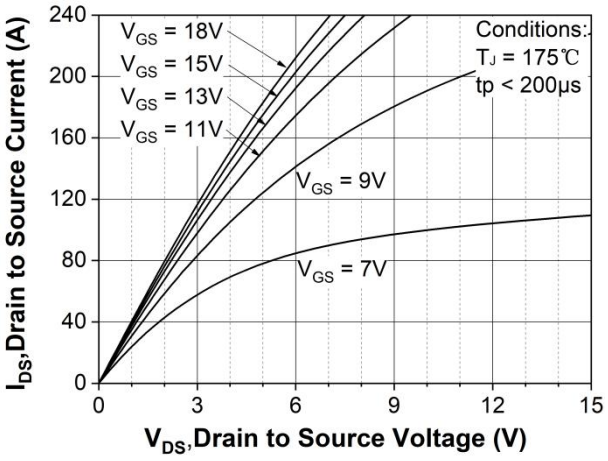

Figure 3. Output characteristics T_J = 175 ºC

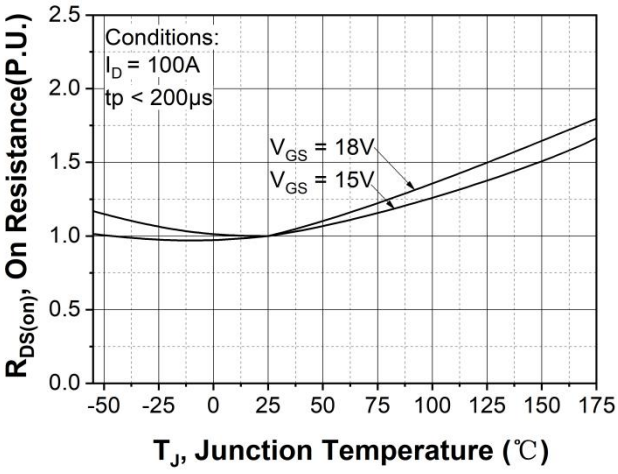

Figure 4. Normalized on-resistance vs. temperature

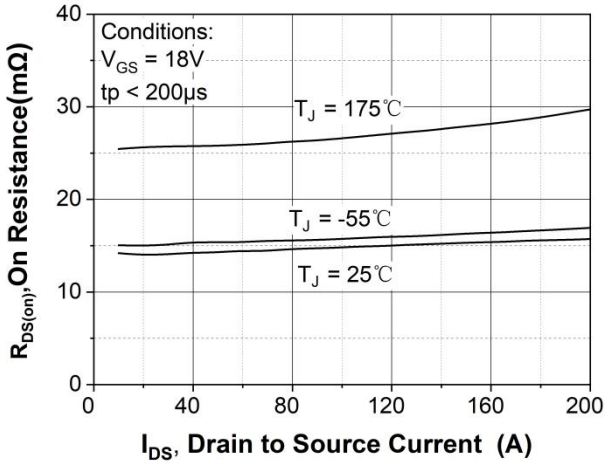

Figure 5. On-resistance vs. drain current for various temperatures

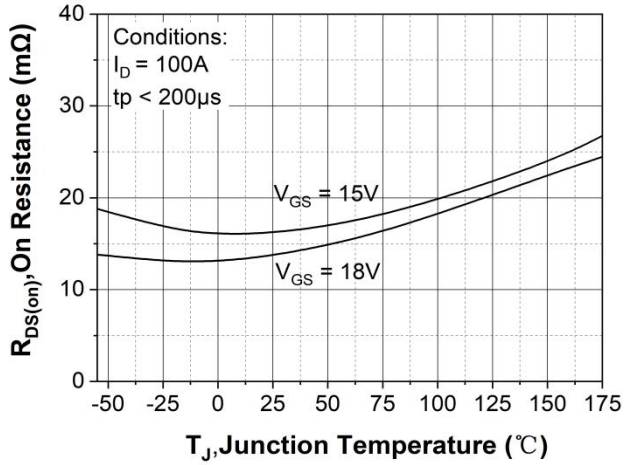

Figure 6. On-resistance vs. temperature for various gate voltage

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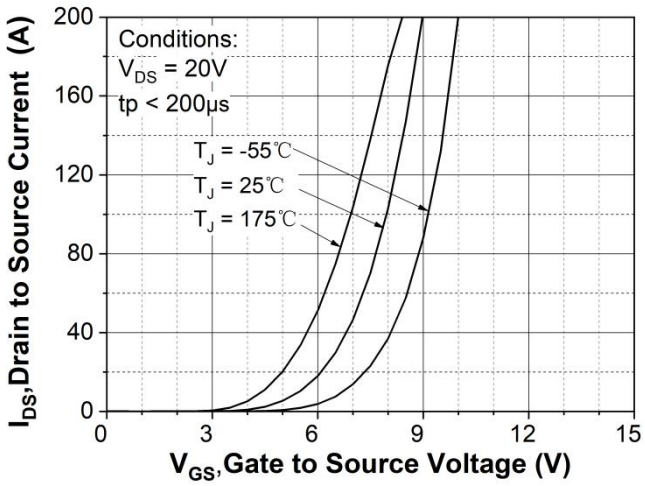


Figure 7. Transfer characteristic for various junction temperatures

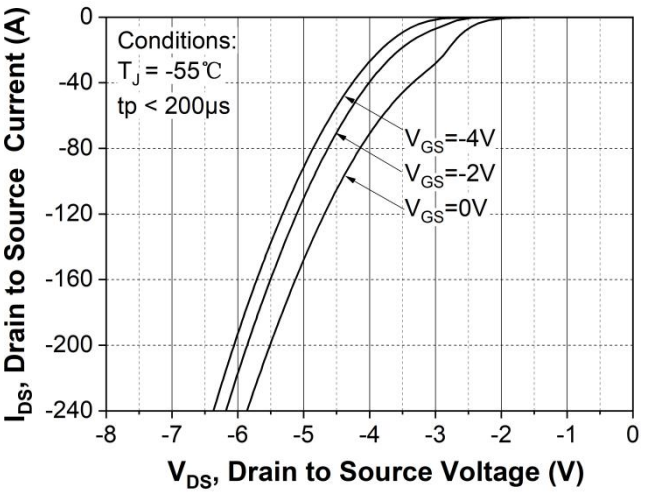


Figure 8. Body diode characteristic at T_J = -55 ºC

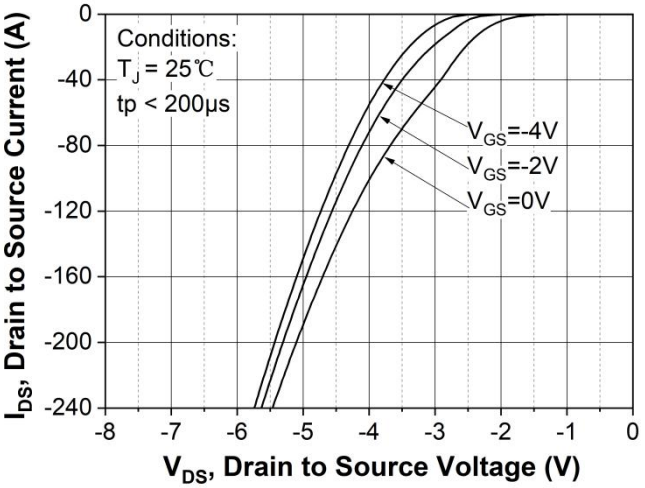


Figure 9. Body diode characteristic at T_J = 25 ºC

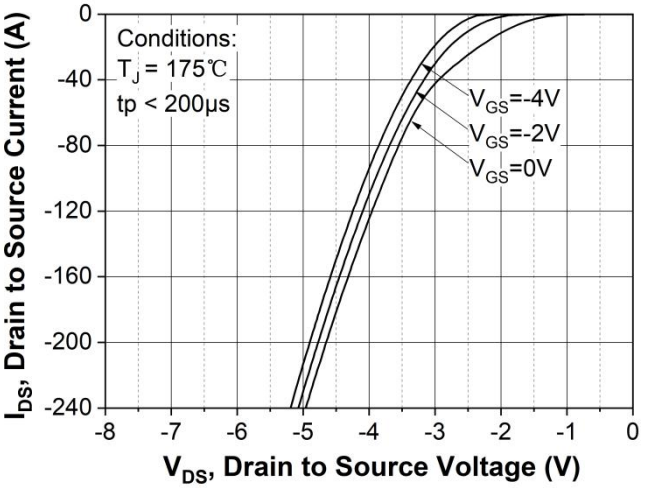


Figure 10. Body diode characteristic at T_J = 175ºC

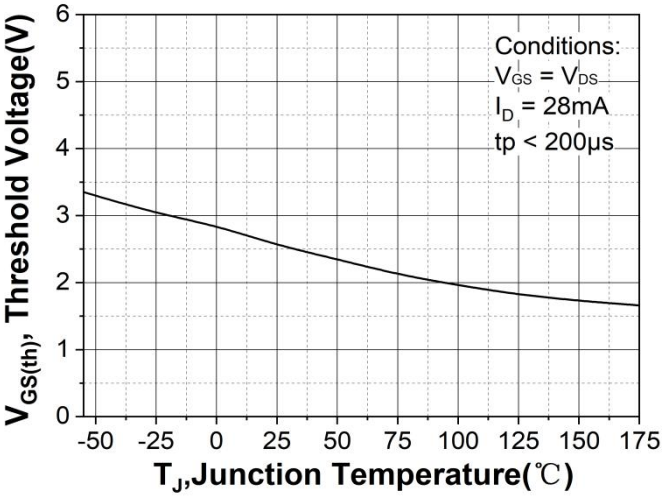


Figure 11. Threshold voltage vs. temperature

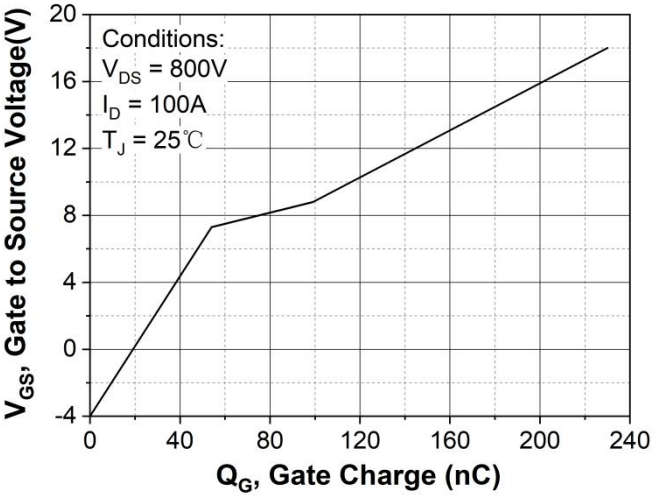


Figure 12. Gate charge characteristic

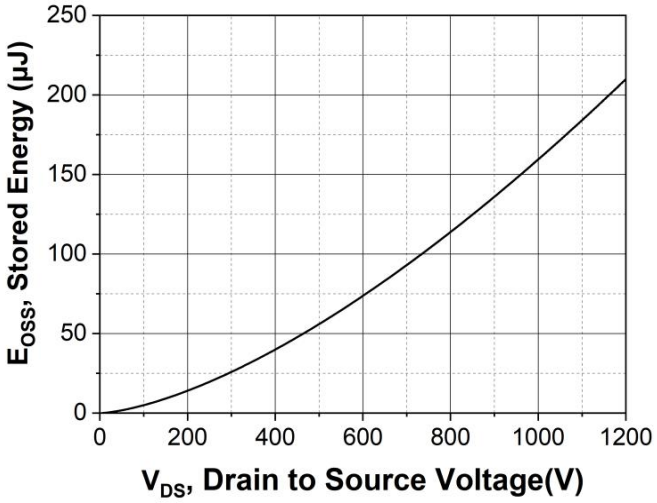


Figure 13. Output capacitor stored energy

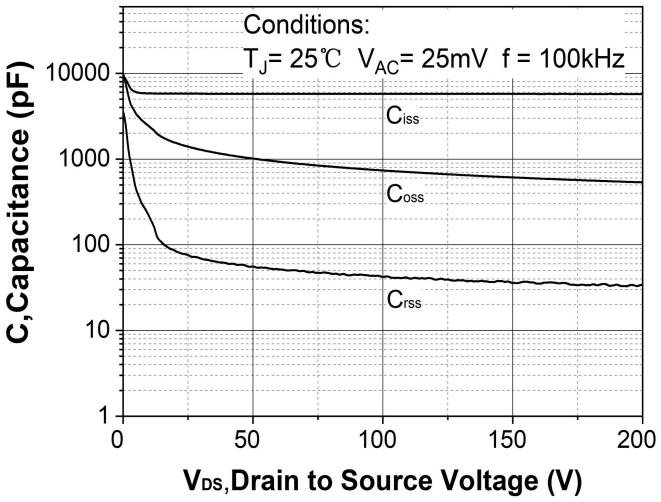


Figure 14. Capacitances vs. drain-source voltage (0 - 200V)

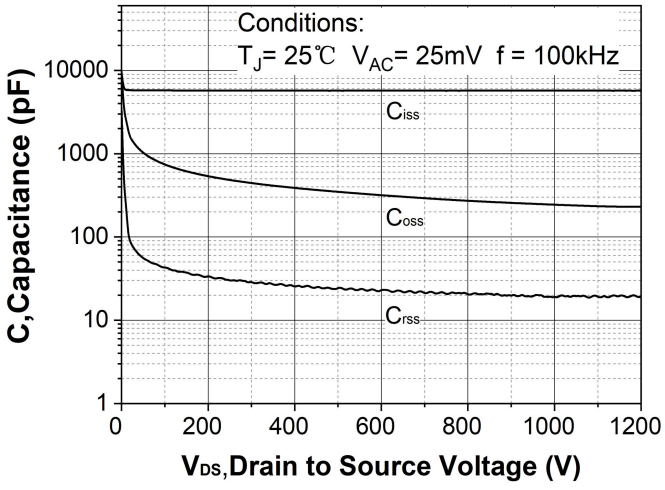


Figure 15. Capacitances vs. drain-source voltage (0 - 1200V)

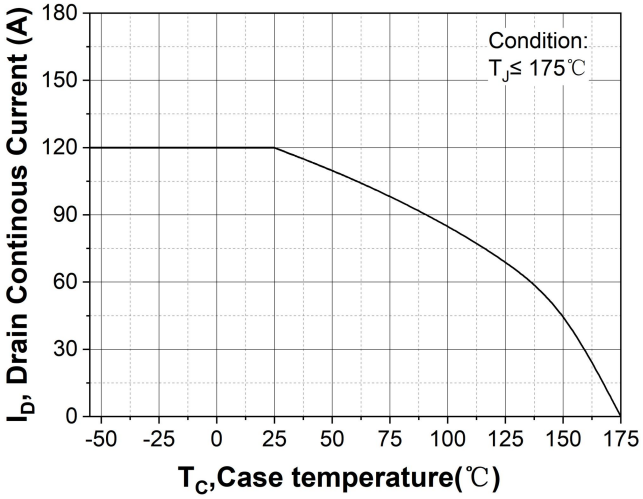


Figure 16. Continuous drain current derating vs. case temperature

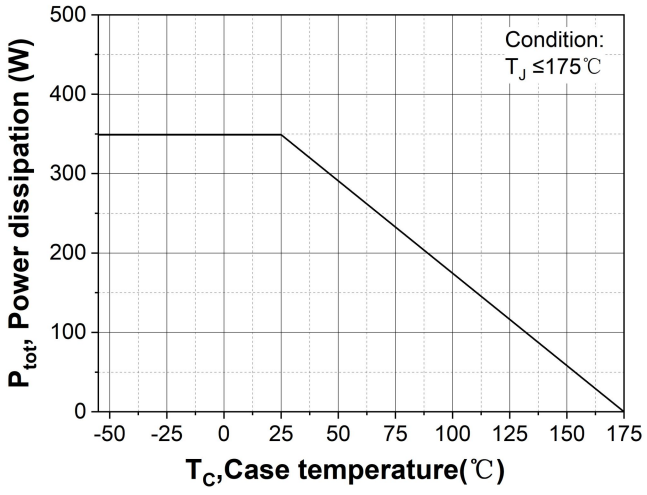


Figure 17. Maximum power dissipation derating vs. case temperature

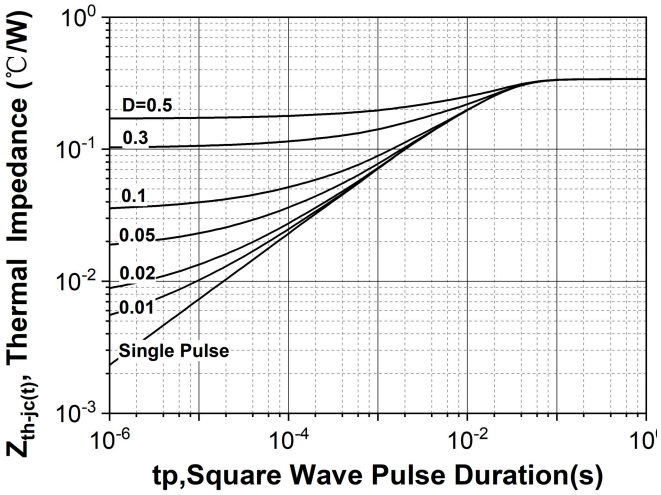


Figure 18. Transient thermal impedance (junction - case)

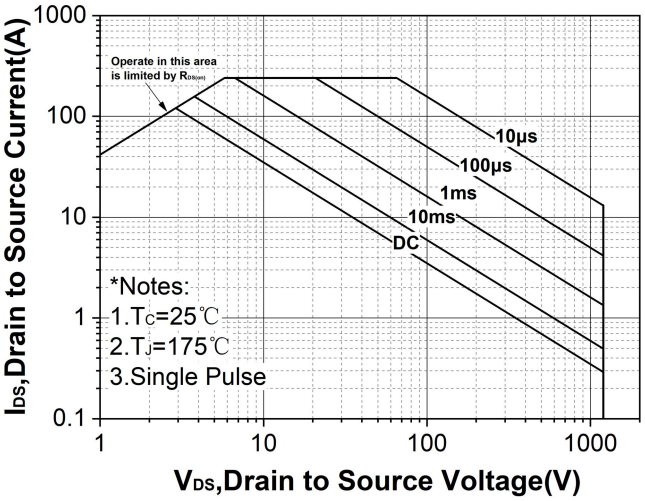
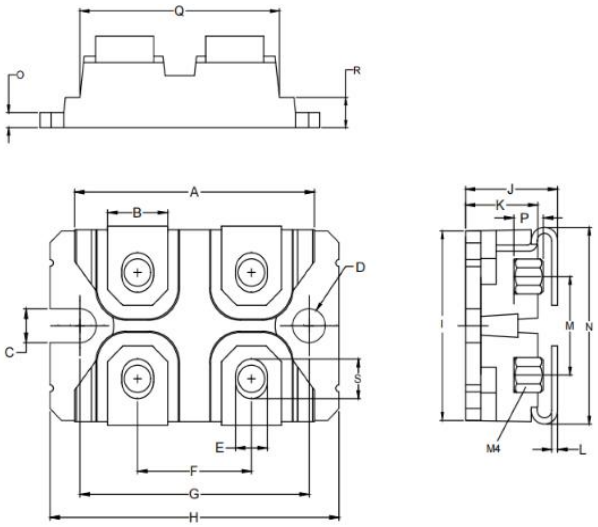


Figure 19. Safe operating area

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

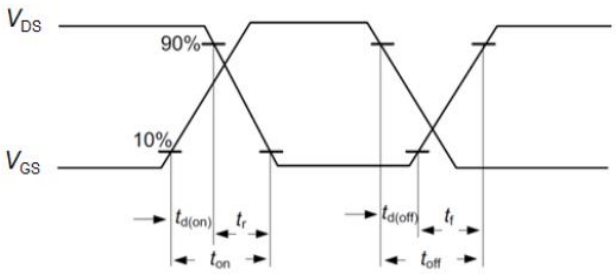


Figure A. Definition of switching times

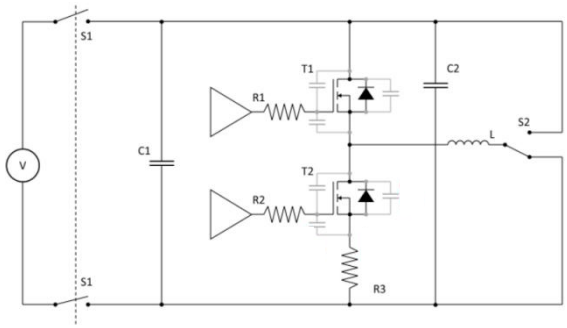


Figure B. Dynamic test circuit

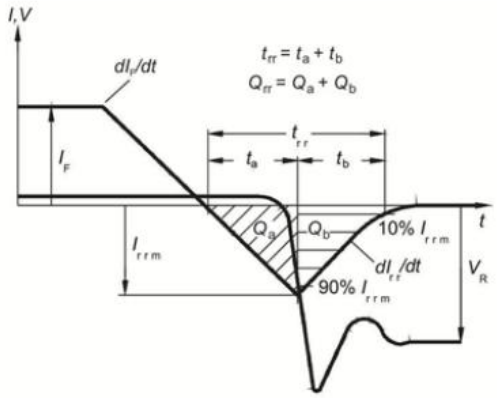


Figure C. Definition of body diode switching characteristics

Revision history

Document version	Date of release	Description of changes	
V01_00	2024-02-21	Target	
V01_00	2024-07-26	——	

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**

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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4. Any information given in this documents subject to customer's compliance with its obligations and any applicable legal requirements, norms and standards concerning any use of the product of Sichain in any customer's applications.

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6. Due to technical requirements products may contain dangerous substances. For information on the types in question please contact Sichain office.

7. Except as otherwise explicitly approved by Sichain in a written document signed by authorized representatives of Sichain, Sichain' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

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.