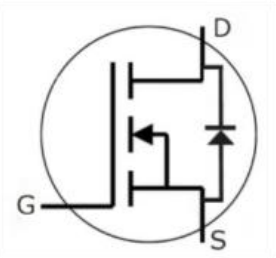
SG1M160120B

TriQSiC™ 1200V Silicon Carbide Power MOSFET G1 （ N Channel Enhancement ）

Features

- High speed switching
- Very low switching losses
- High blocking voltage with low on-resistance
- Temperature independent turn-off switching losses
- Halogen free, RoHS compliant



Benefits

- Cooling effort reduction
- Efficiency improvement
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency

Part number	Die size（W x L）mm
SG1M160120B	1.850 * 2.645

Applications

- EV motor drive
- Solar inverters
- High voltage DC/DC converters
- Switch mode power supplies

Table 1 Key performance and package parameters

Type	V_{DS}	I_{DS} (T_C = 25℃, $R_{th\ (j\text{-}c),max}$ ≤ 1.23 °C/W)	$R_{DS(on),\ typ}$ (V_{GS} = 15V, I_D = 8.5A, T_J = 25℃)	$T_{J,max}$
SG1M160120B	1200V	20A	160mΩ	175℃

Table of contents

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 /+19	V	Absolute maximum values	Note1
V_{GSop}	Gate source voltage	-4 /+15	V	Recommended operational values	
I_D	Continuous drain current	20	A	V_{GS} = 15V, T_C = 25°C	
		14		V_{GS} = 15V, T_C = 100°C	
$I_{D(pulse)}$	Pulsed drain current	40	A	Pulse width t_P limited by $T_{J,max}$	
T_J , T_{stg}	Operating Junction and storage temperature	-55 to +175	°C		

Note 1：when using MOSFET Body Diode $V_{GS,max}$ = -4 / +19V

2、Electrical characteristics

2.1 Static characteristics

Table 3 Static 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 = 2.33mA	Fig.11
		-	2.0	-	V	V_{DS} = V_{GS}, I_D = 2.33mA, 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} = 15V, V_{DS} = 0V	
$R_{DS(on)}$	Current drain-source on-state resistance	-	160	200	mΩ	V_{GS} = 15V, I_D = 8.5A	Fig.4,5,6
		-	290	-		V_{GS} = 15V, I_D = 8.5A, T_J = 175°C	
gfs	Transconductance	-	6	-	S	V_{DS} = 20V, I_D = 8.5A	Fig.7
		-	4.4	-		V_{DS} = 20V, I_D = 8.5A, T_J = 175°C	
$R_{g,int}$	Internal gate resistance	-	7.5	-	Ω	V_{AC} = 25mV, f = 1MHz, open drain	

2.2 Dynamic characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
C_{iss}	Input capacitance	-	590	-	pF	V_{DS} = 1000V, V_{GS} = 0V T_J = 25°C, V_{AC} = 25mV f = 100Hz	Fig.17,18
C_{oss}	Output capacitance	-	33	-			
C_{rss}	Reverse capacitance	-	2.2	-			
E_{oss}	Coss stored energy	-	17	-	μJ		Fig.16

Q_{gs}	Gate source charge	-	8	-	nC	V_{DS} = 800V, V_{GS} =-4/+15V I_D =8.5A	Fig.12
Q_{gd}	Gate drain charge	-	12	-			
Q_g	Gate charge	-	26	-			

2.3 Switching characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
E_{on}	Turn on switching energy	-	90	-	μJ	V_{DS} = 800V, V_{GS} = -4/+15V I_D = 8.5A, Rg = 2.5Ω, L = 120μH	
E_{off}	Turn off switching energy	-	26	-			
$t_{d(on)}$	Turn on delay time	-	14	-	ns		
t_r	Rise time	-	9	-			
$t_{d(off)}$	Turn off delay time	-	14	-			
t_f	Fall time	-	12	-			

Table 6 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} = 6A	Fig.8,9, 10
		-	3.4	-	V	V_{GS} = -4V, I_{SD} = 6A T_J = 175°C	
I_S	Continuous diode forward current	-	20	-	A	V_{GS} = -4V, Tc = 25°C	Note2
t_{rr}	Reverse recovery time	-	27	-	ns	V_R = 800V, V_{GS} = -4V I_D = 8.5A di/dt = 2037A/μS T_J = 175°C	
Q_{rr}	Reverse recovery charge	-	180	-	nC		
I_{rrm}	Peak reverse recovery current	-	11	-	A		

Note2 : When using SiC Body Diode the maximum recommended V_{GS} = -4 V

3、Electrical characteristic diagrams

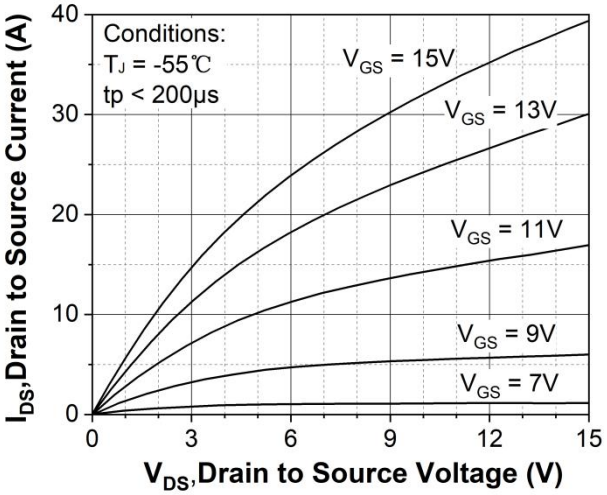


Figure 1. Output characteristics T_J = -55 ºC

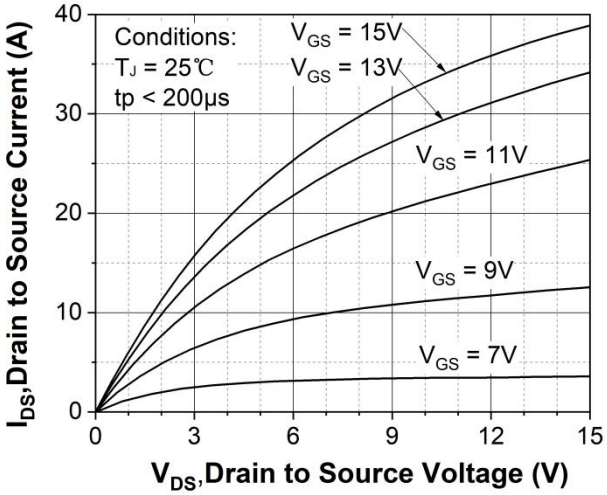


Figure 2. Output characteristics T_J = 25 ºC

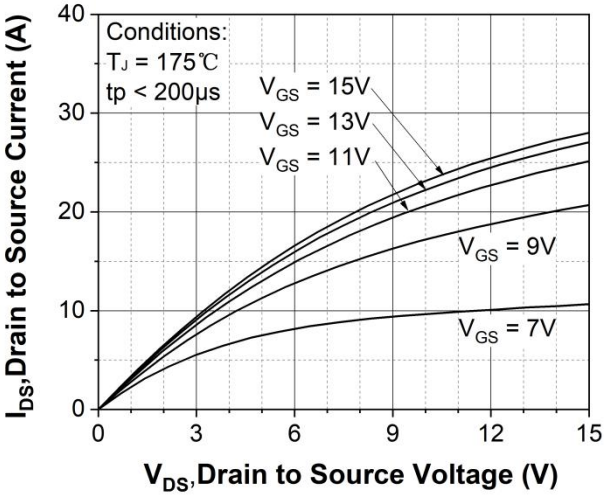


Figure 3. Output characteristics T_J = 175 ºC

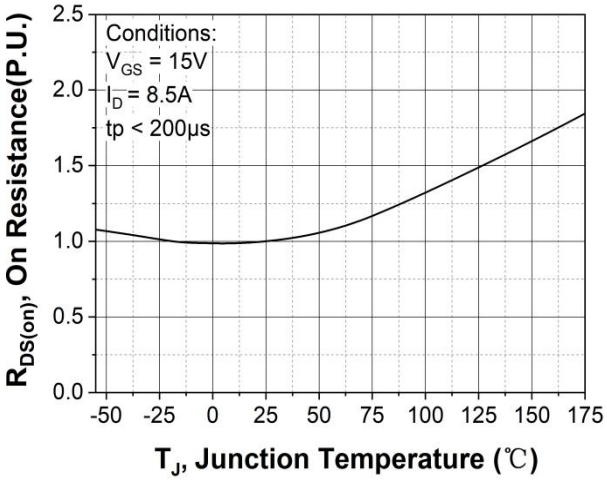


Figure 4. Normalized on-resistance vs. temperature

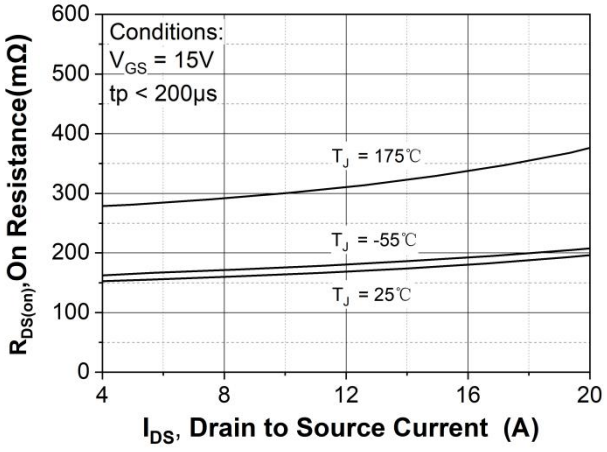


Figure 5. On-resistance vs. drain current for various temperatures

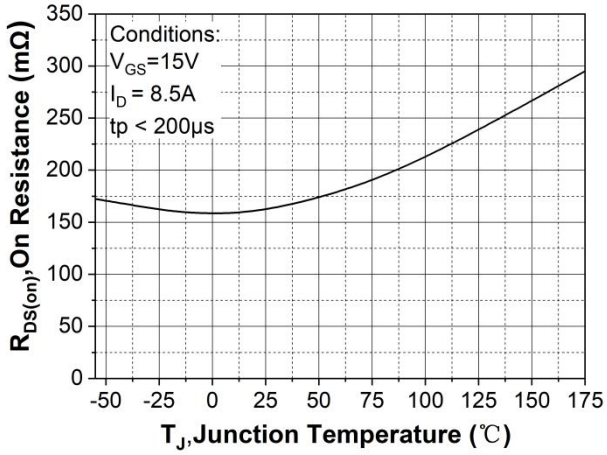


Figure 6. On-resistance vs. Temperature

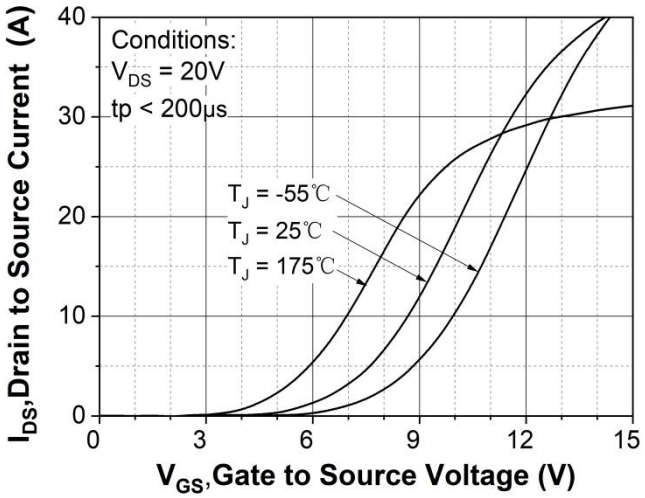


Figure 7. Transfer characteristic for various junction temperatures

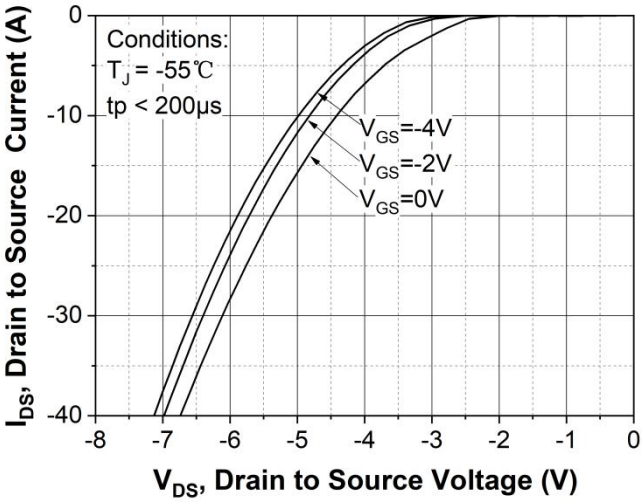


Figure 8. Body diode characteristic at T_J = -55 ºC

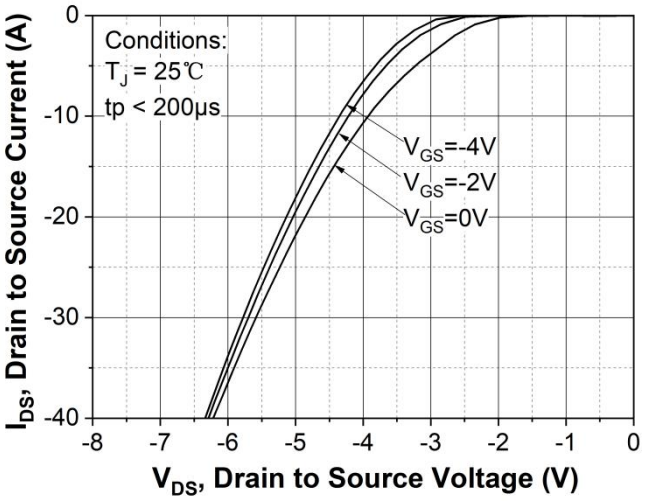


Figure 9. Body diode characteristic at T_J = 25 ºC

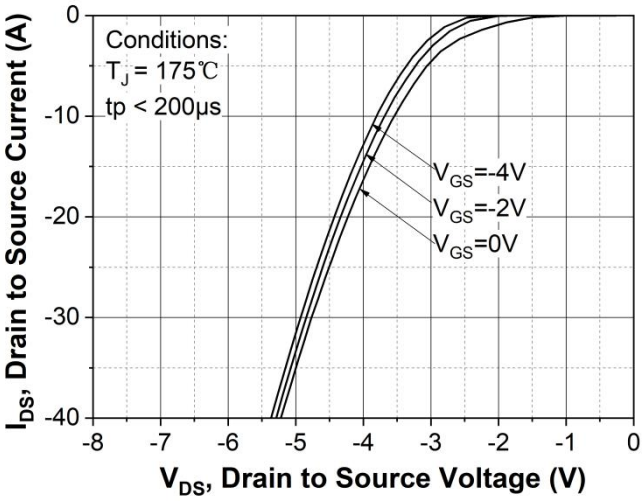


Figure 10. Body diode characteristic at T_J = 175ºC

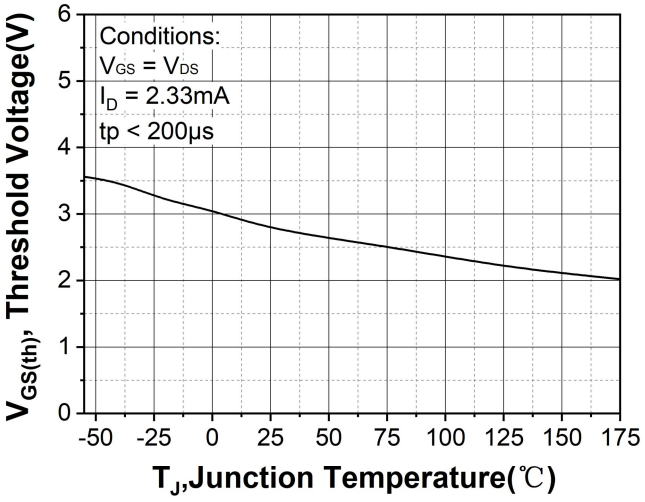


Figure 11. Threshold voltage vs. temperature

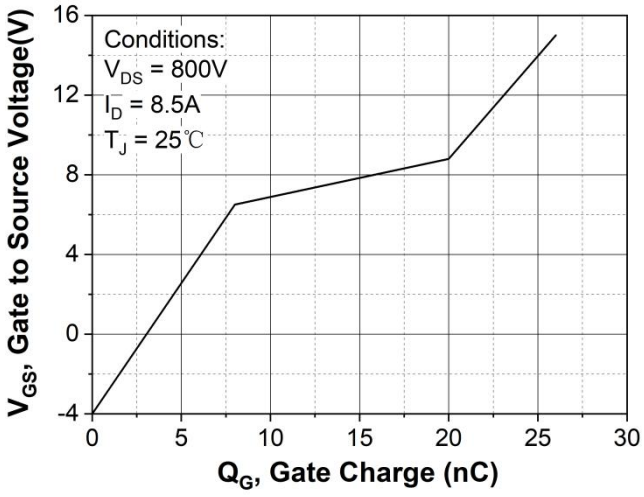


Figure 12. Gate charge characteristic

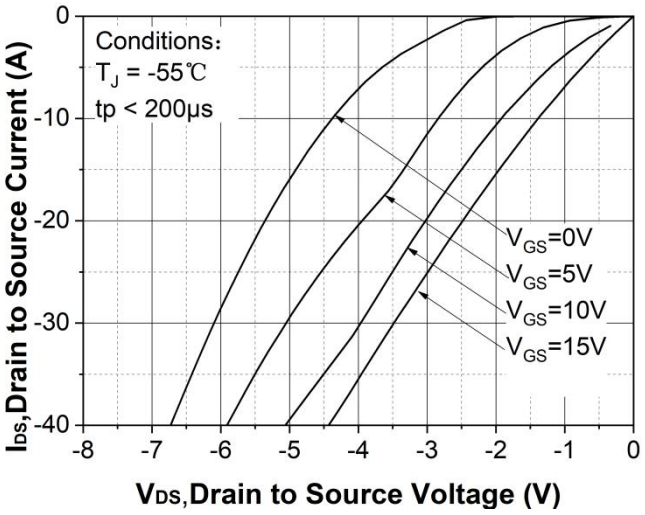


Figure 13. 3rd quadrant characteristic at T_J = -55 ºC

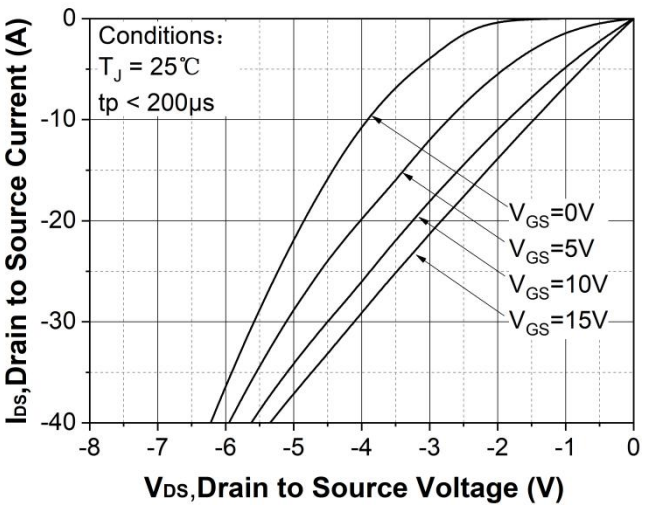


Figure 14. 3rd quadrant characteristic at T_J = 25 ºC

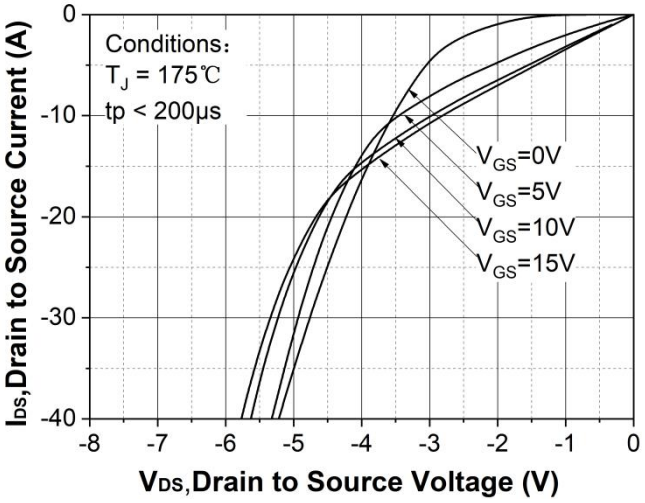


Figure 15. 3rd quadrant characteristic at T_J = 175 ºC

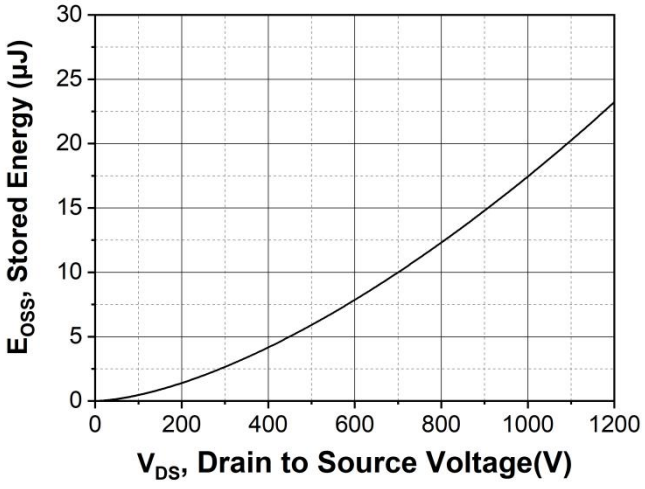


Figure 16. Output capacitor stored energy

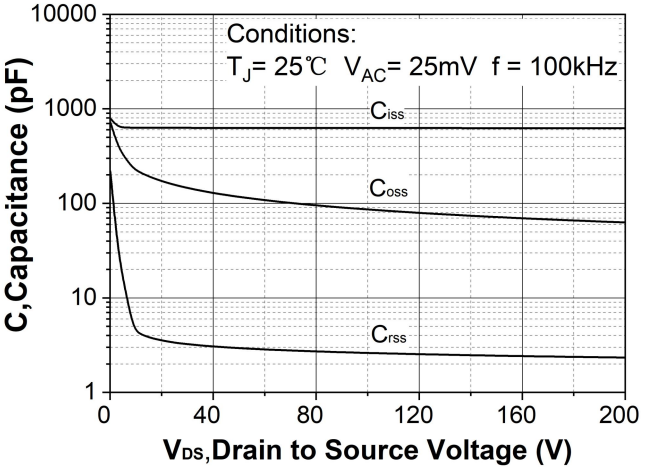


Figure 17. Capacitances vs. drain-source voltage (0 - 200V)

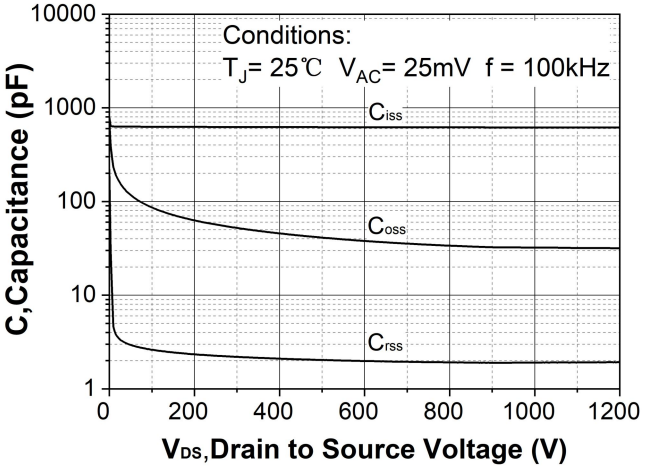


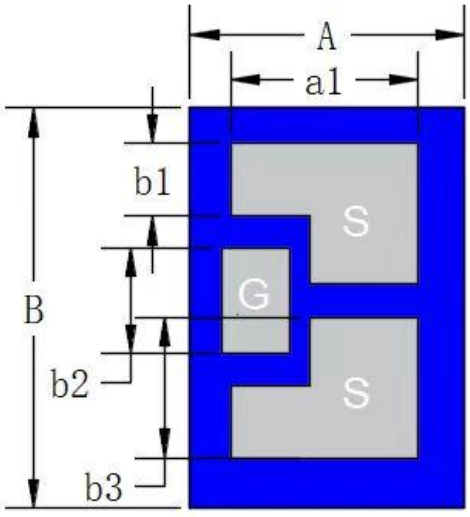
Figure 18. Capacitances vs. drain-source voltage (0 - 1200V)

4、Mechanical parameters

4.1 Dimensions and metallization

Parameter	Typical value	Unit	Metallization
Die size（W x L）	1.850 * 2.645	mm	
Gate pad size（W x L）	0.449 * 0.749	mm	
Die thickness	180	μm	
Top side（source gate）metallization	4	μm	Ti/Al
Back side （drain）metallization	1	μm	Ti/Ni/Ag

4.2 Layout



Symbol	Dimension / mm
B	2.645
b1	0.478
b2	0.749
b3	0.900
A	1.850
a1	1.249

5、Test conditions

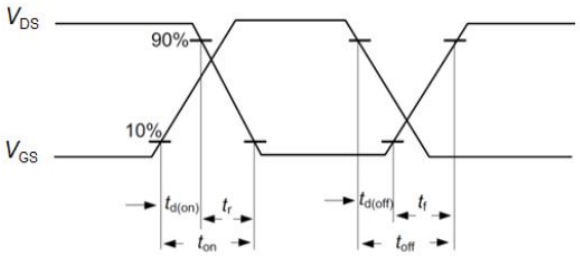


Figure A. Definition of switching times

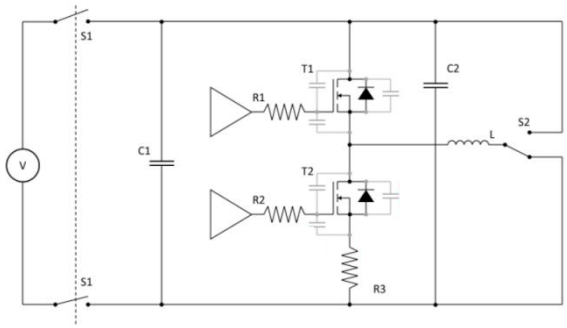


Figure B. Dynamic test circuit

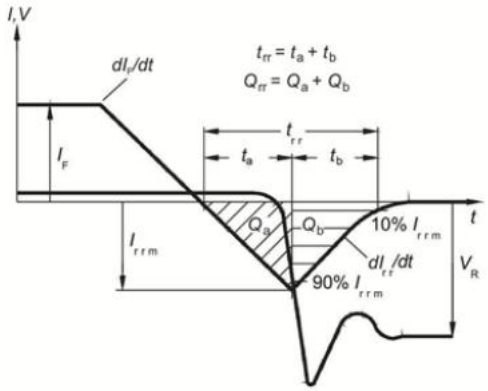


Figure C. Definition of body diode switching characteristics

Revision history

Document version	Date of release	Description of changes
V01_00	2024-01-04	——
V02_00	2024-10-25	——

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.

3. With respect to information regarding the application of the product, Sichain hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

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.

5. Specifications of any and all products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance,characteristics,and functions of the described products as mounted in the customer's products or equipment.

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.