

General Description

FSMOS[®] MOSFET is based on Oriental Semiconductor's unique device design to achieve low $R_{DS(ON)}$, low gate charge, fast switching and excellent avalanche characteristics. The high V_{th} series is specially designed to use in power supply systems with driving voltage of more than 10V.

Features

- Low $R_{DS(ON)}$ & FOM
- Extremely low switching loss
- Excellent reliability and uniformity
- Fast switching and soft recovery



Applications

- PD charger
- Motor driver
- Switching voltage regulator
- DC-DC convertor
- Switching mode power supply

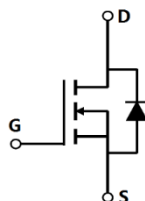
Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
I_D , pulse	960	A
$R_{DS(ON), max}$ @ $V_{GS}=10V$	0.75	m Ω
Q_g	227	nC
PD	400	W

Marking Information

Product Name	Package	Marking
SFS04R009K7NF	TO263-6L	SFS04R009K7N

Package & Pin information



Absolute Maximum Ratings at $T_j=25^{\circ}\text{C}$ unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	40	V
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current ¹⁾ , $T_C=25^{\circ}\text{C}$	I_D	300	A
Pulsed drain current ²⁾ , $T_C=25^{\circ}\text{C}$	$I_{D, pulse}$	960	A
Continuous diode forward current ¹⁾ , $T_C=25^{\circ}\text{C}$	I_S	300	A
Diode pulsed current ²⁾ , $T_C=25^{\circ}\text{C}$	$I_{S, pulse}$	960	A
Power dissipation ³⁾ , $T_C=25^{\circ}\text{C}$	P_D	400	W
Single pulsed avalanche energy ⁵⁾	E_{AS}	889	mJ
Operation and storage temperature	T_{stg}, T_j	-55 to 175	$^{\circ}\text{C}$

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	0.37	$^{\circ}\text{C/W}$
Thermal resistance, junction-ambient ⁴⁾	$R_{\theta JA}$	62	$^{\circ}\text{C/W}$

Electrical Characteristics at $T_j=25^{\circ}\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	BV_{DSS}	40			V	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	2		4	V	$V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$
Drain-source on-state resistance	$R_{DS(ON)}$		0.6	0.75	m Ω	$V_{GS}=10\text{ V}, I_D=50\text{ A}$
Gate-source leakage current	I_{GSS}			100	nA	$V_{GS}=20\text{ V}$
				-100		$V_{GS}=-20\text{ V}$
Drain-source leakage current	I_{DSS}			1	μA	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}$
Gate resistance	R_G		1.8		Ω	$f=1\text{ MHz}$, Open drain

Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		16400		pF	$V_{GS}=0\text{ V}$, $V_{DS}=25\text{ V}$, $f=100\text{ kHz}$
Output capacitance	C_{oss}		4120		pF	
Reverse transfer capacitance	C_{rss}		287		pF	
Turn-on delay time	$t_{d(on)}$		32		ns	$V_{GS}=10\text{ V}$, $V_{DS}=20\text{ V}$, $R_G=2\ \Omega$, $I_D=20\text{ A}$
Rise time	t_r		19		ns	
Turn-off delay time	$t_{d(off)}$		116		ns	
Fall time	t_f		46		ns	

Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		227		nC	$V_{GS}=10\text{ V}$, $V_{DS}=20\text{ V}$, $I_D=20\text{ A}$
Gate-source charge	Q_{gs}		57		nC	
Gate-drain charge	Q_{gd}		41		nC	
Gate plateau voltage	$V_{plateau}$		4		V	

Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	V_{SD}			1.3	V	$I_S=50\text{ A}$, $V_{GS}=0\text{ V}$
Reverse recovery time	t_{rr}		89		ns	$V_R=20\text{ V}$, $I_S=20\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		153		nC	
Peak reverse recovery current	I_{rrm}		2.8		A	

Note

- 1) Calculated continuous current based on maximum allowable junction temperature.
- 2) Repetitive rating; pulse width limited by max. junction temperature.
- 3) P_d is based on max. junction temperature, using junction-case thermal resistance.
- 4) The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_a=25\text{ }^\circ\text{C}$.
- 5) $V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $L=0.3\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

Electrical Characteristics Diagrams

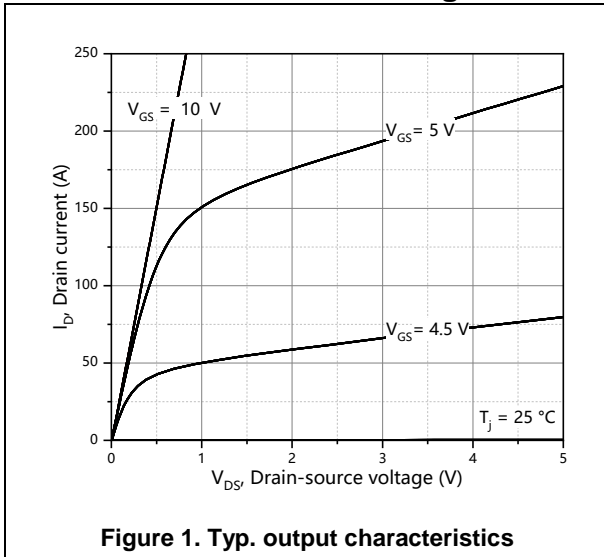


Figure 1. Typ. output characteristics

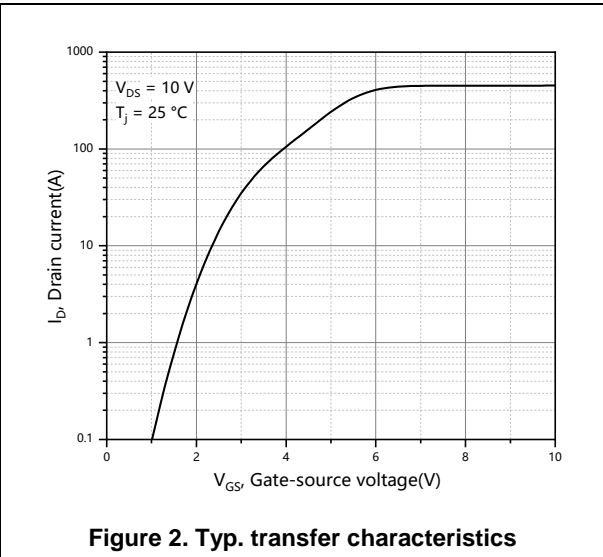


Figure 2. Typ. transfer characteristics

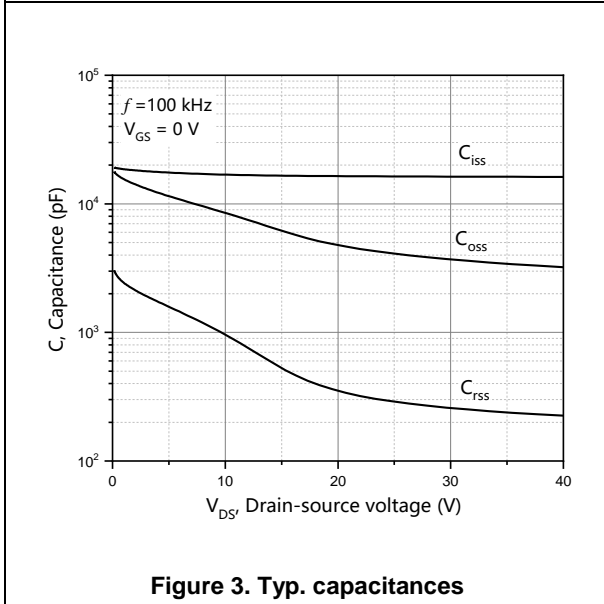


Figure 3. Typ. capacitances

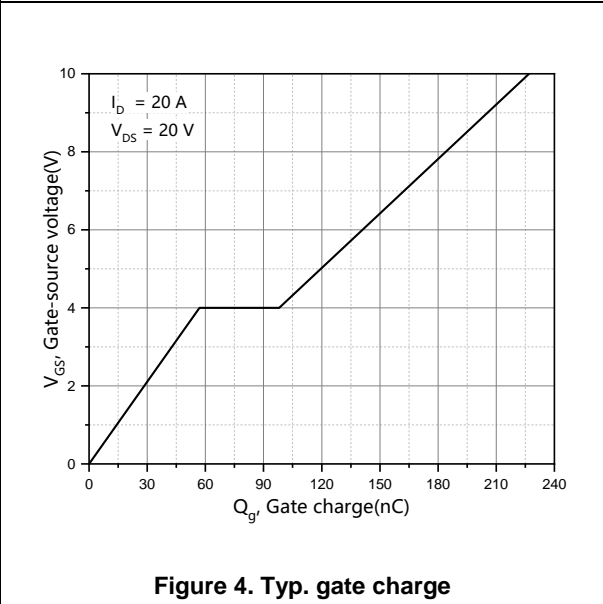


Figure 4. Typ. gate charge

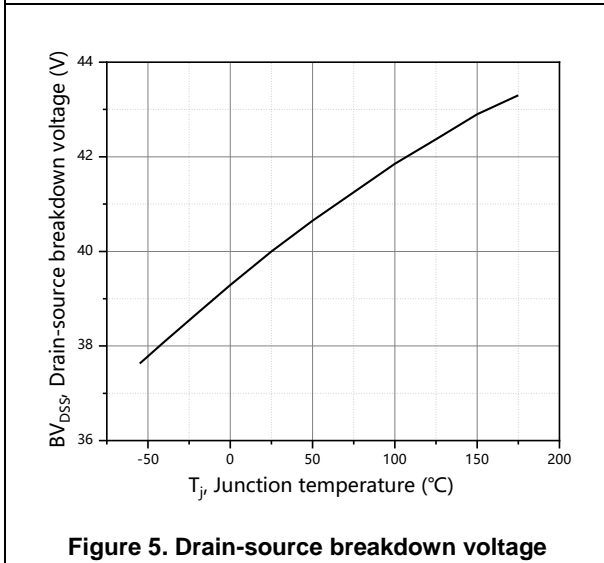


Figure 5. Drain-source breakdown voltage

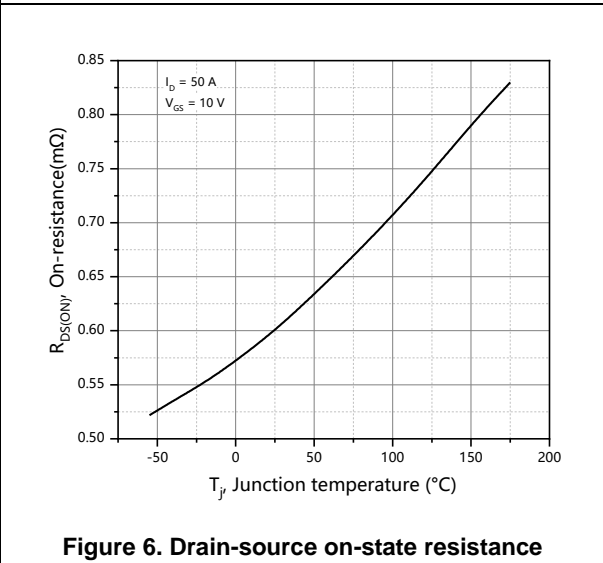
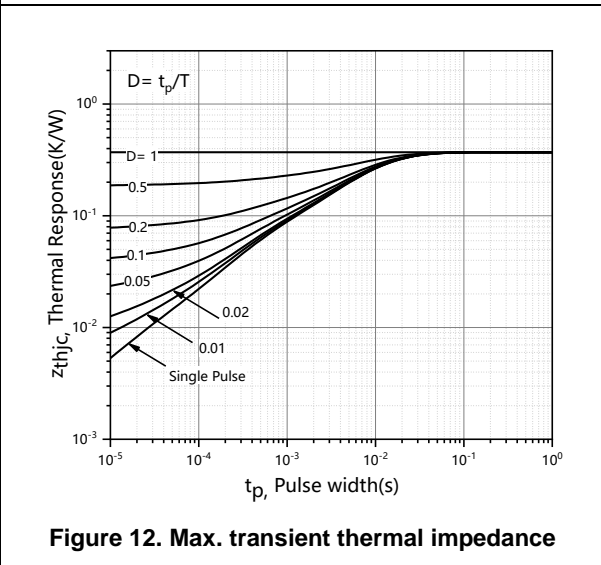
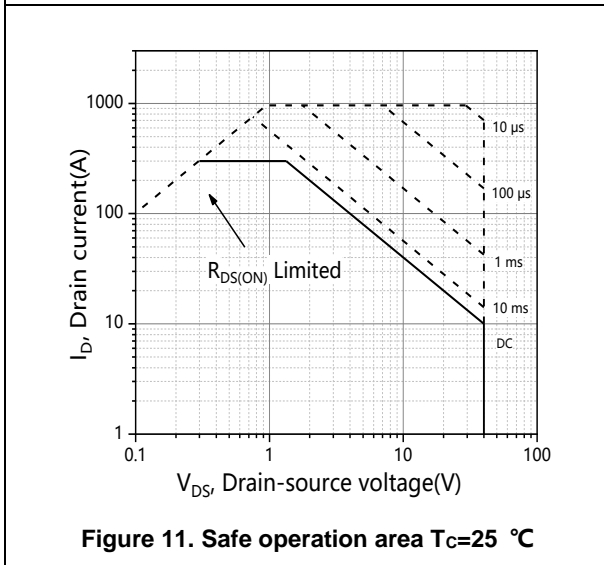
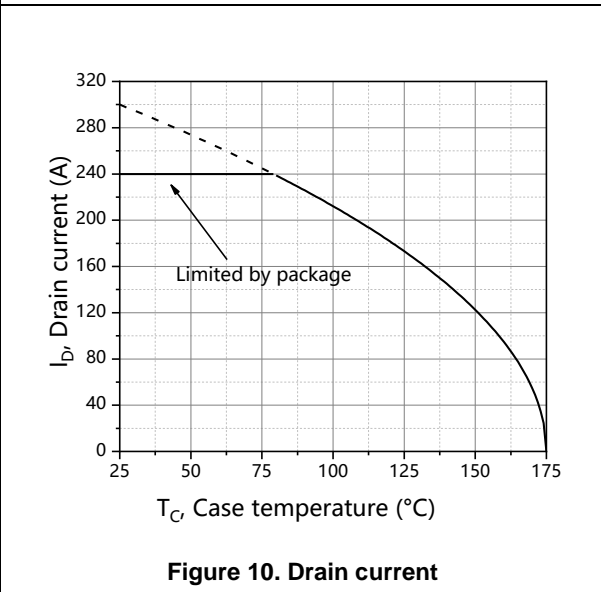
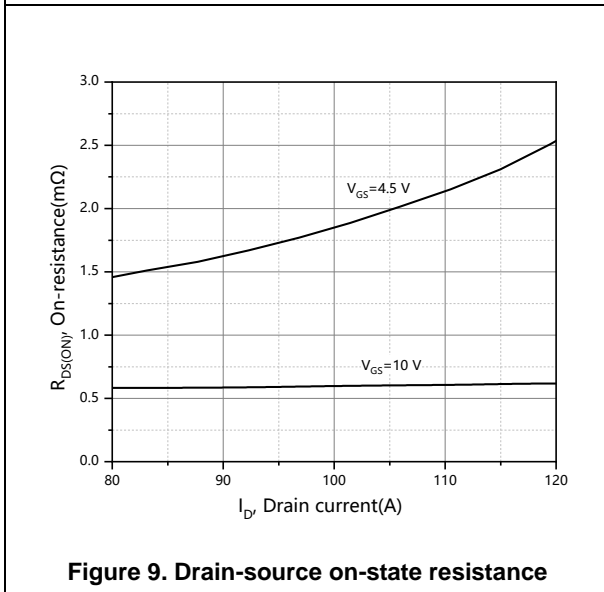
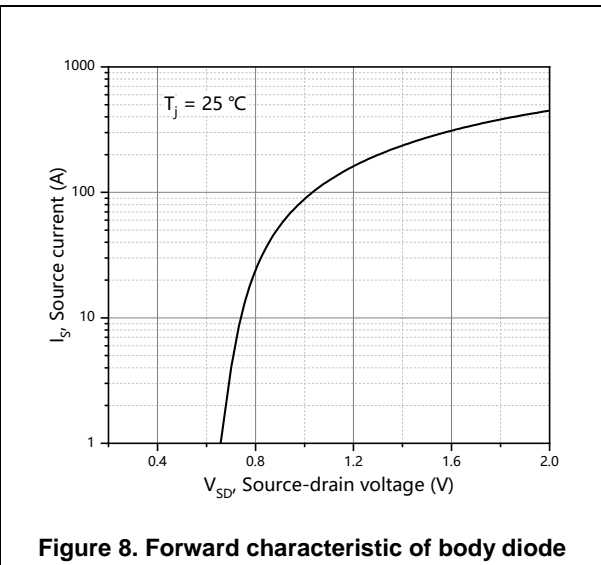
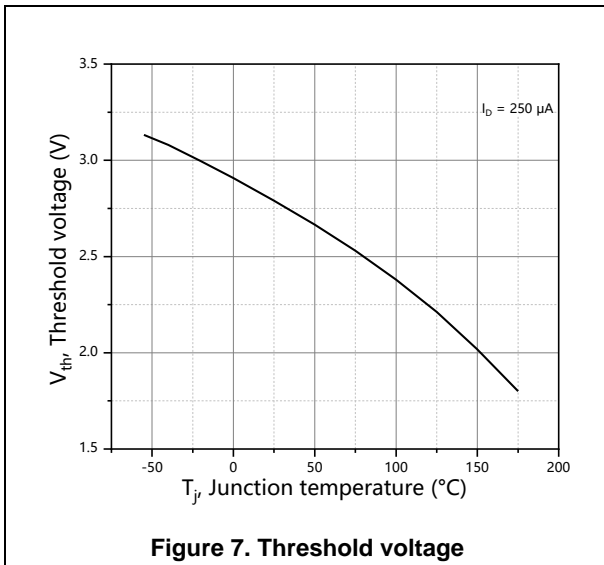


Figure 6. Drain-source on-state resistance



Test circuits and waveforms



Figure 1. Gate charge test circuit & waveform



Figure 2. Switching time test circuit & waveforms

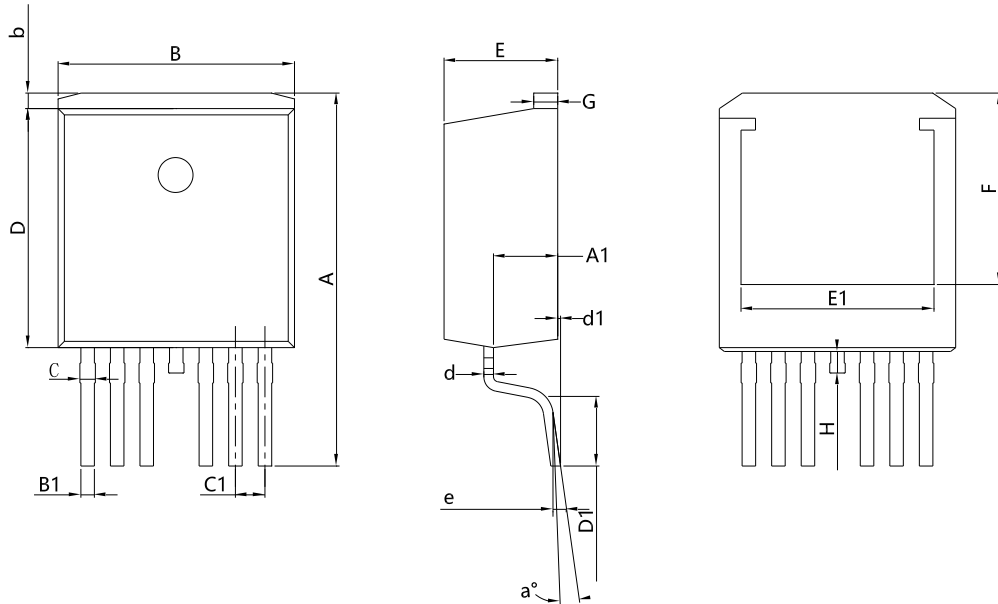


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms



Figure 4. Diode reverse recovery test circuit & waveforms

Package Information



Symbol	mm		
	Min	Nom	Max
A	14.65	15.00	15.35
A1	2.25	2.40	2.55
B	9.80	10.00	10.20
B1	0.50	0.60	0.70
b	0.80	1.00	1.20
C	0.58	0.68	0.84
C1	1.27 BSC		
D	9.05	9.25	9.45
D1	2.40	2.70	3.00
d	0.40	0.50	0.60
d1	0.01	0.13	0.25
E	4.25	4.40	4.55
E1	7.25	-	-
F	6.90	-	-
e	0.25 BSC		
G	1.20	1.30	1.40
a	2°	5°	8°
H	0.85	1.00	1.15

Version : TO263-6L-P package outline dimension

Ordering Information

Package Type	Units/ Reel	Reels/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO263-6L-P	800	1	800	5	4000

Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SFS04R009K7NF	TO263	yes	yes	yes

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Revision History

Version	Revision History	Date
V1.0	Initial release	2023-03-24