

## General Description

FSMOS<sup>®</sup> 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 motor control 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

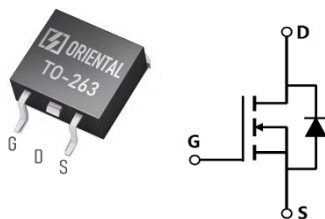
## Key Performance Parameters

Parameter	Value	Unit
$V_{DS}$	40	V
$I_{D, pulse}$	800	A
$R_{DS(ON), max @ V_{GS}=10V}$	2.3	$m\Omega$
$Q_g$	76	nC
PD	203	W

## Marking Information

Product Name	Package	Marking
SFS04R02KNF	TO263	SFS04R02KN

## 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	$V_{GS}$	$\pm 20$	V
Continuous drain current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$	$I_D$	210	A
Pulsed drain current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$	$I_{D, pulse}$	800	A
Continuous diode forward current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$	$I_S$	210	A
Diode pulsed current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$	$I_{S, pulse}$	800	A
Power dissipation <sup>3)</sup> , $T_C=25^{\circ}\text{C}$	$P_D$	203	W
Single pulsed avalanche energy <sup>5)</sup>	$E_{AS}$	240	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	$R_{\theta JC}$	0.74	$^{\circ}\text{C/W}$
Thermal resistance, junction-ambient <sup>4)</sup>	$R_{\theta JA}$	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	$R_{DS(ON)}$		1.9	2.3	m $\Omega$	$V_{GS}=10\text{ V}, I_D=20\text{ A}$
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	$\mu\text{A}$	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}$
Gate resistance	$R_G$		3.5		$\Omega$	$f=1\text{ MHz}$ , Open drain

### Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	$C_{iss}$		5750		pF	$V_{GS}=0\text{ V}$ , $V_{DS}=25\text{ V}$ , $f=100\text{ kHz}$
Output capacitance	$C_{oss}$		1460		pF	
Reverse transfer capacitance	$C_{rss}$		82.7		pF	
Turn-on delay time	$t_{d(on)}$		17.5		ns	$V_{GS}=10\text{ V}$ , $V_{DS}=40\text{ V}$ , $R_G=2\ \Omega$ , $I_D=40\text{ A}$
Rise time	$t_r$		25.2		ns	
Turn-off delay time	$t_{d(off)}$		48.2		ns	
Fall time	$t_f$		25.7		ns	

### Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	$Q_g$		76		nC	$V_{GS}=10\text{ V}$ , $V_{DS}=40\text{ V}$ , $I_D=40\text{ A}$
Gate-source charge	$Q_{gs}$		25		nC	
Gate-drain charge	$Q_{gd}$		15		nC	
Gate plateau voltage	$V_{plateau}$		4.9		V	

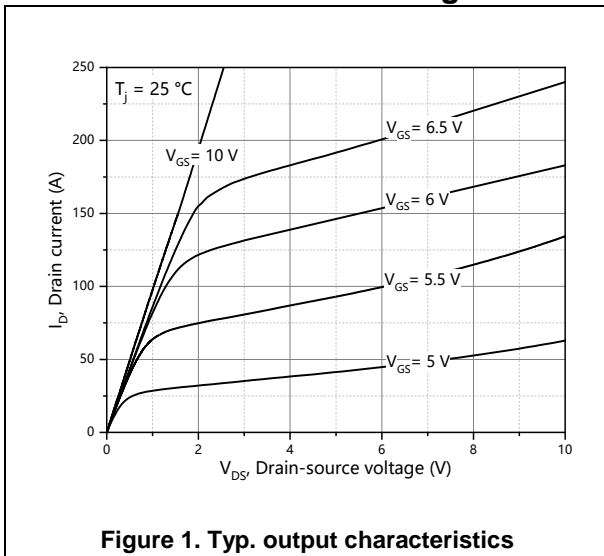
### Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	$V_{SD}$			1.1	V	$I_S=20\text{ A}$ , $V_{GS}=0\text{ V}$
Reverse recovery time	$t_{rr}$		61		ns	$V_R=40\text{ V}$ , $I_S=40\text{ A}$ , $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		86		nC	
Peak reverse recovery current	$I_{rrm}$		2.7		A	

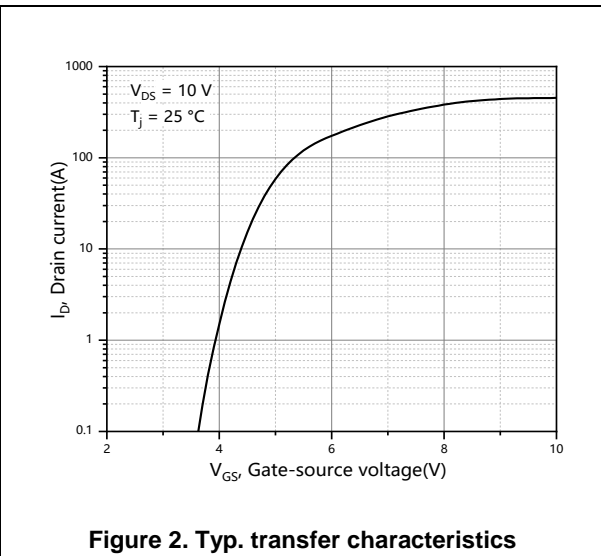
### Note

- 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 in<sup>2</sup> 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  $T_j=25\text{ }^\circ\text{C}$ .

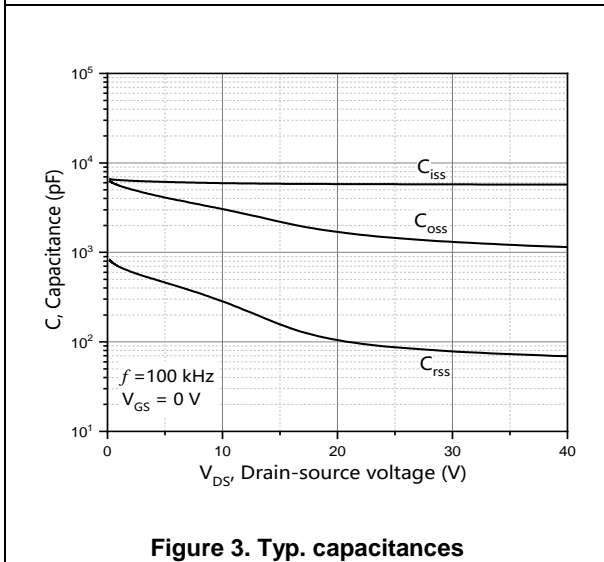
**Electrical Characteristics Diagrams**



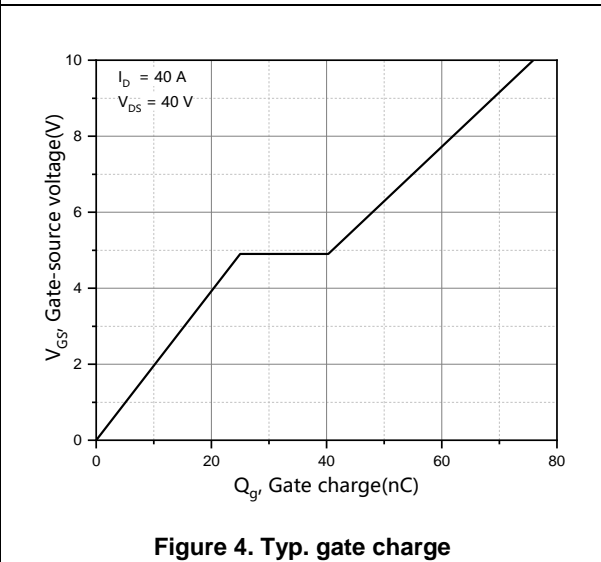
**Figure 1. Typ. output characteristics**



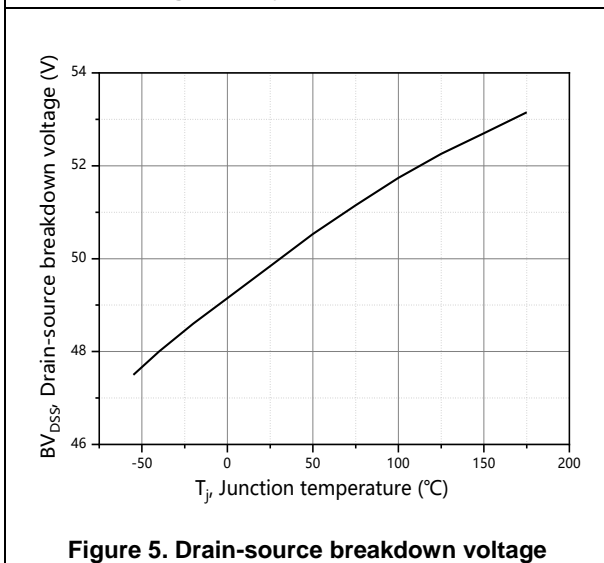
**Figure 2. Typ. transfer characteristics**



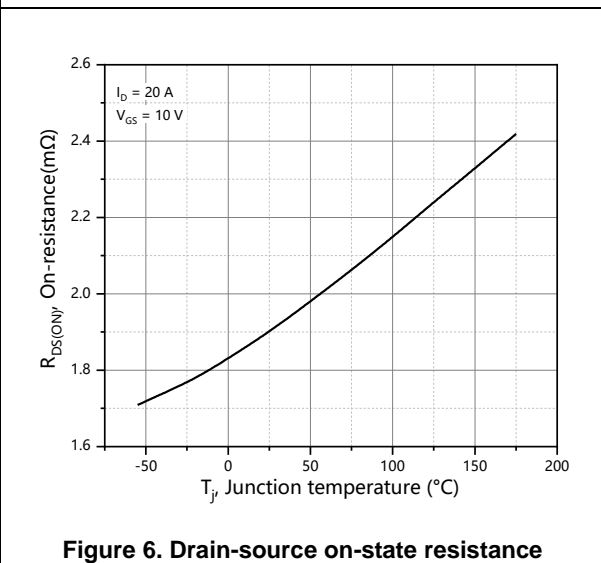
**Figure 3. Typ. capacitances**



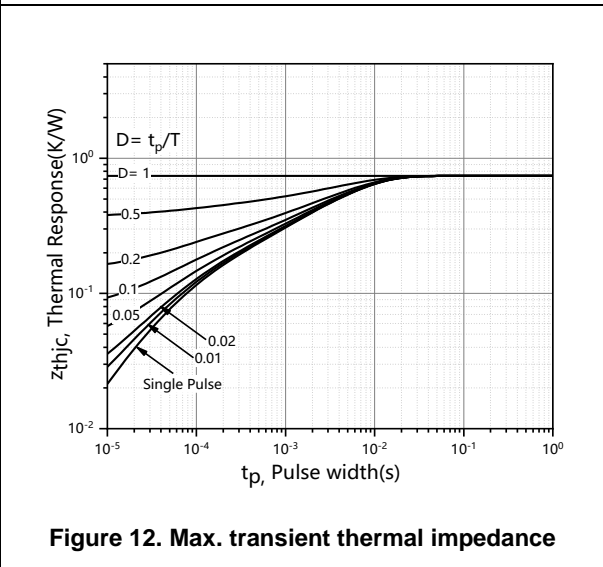
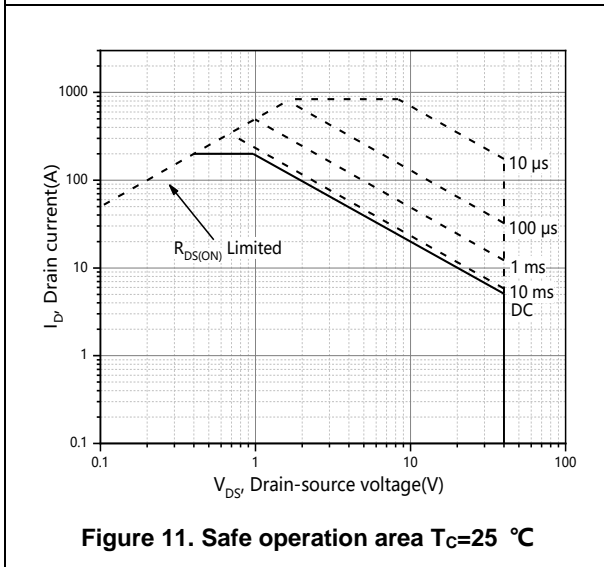
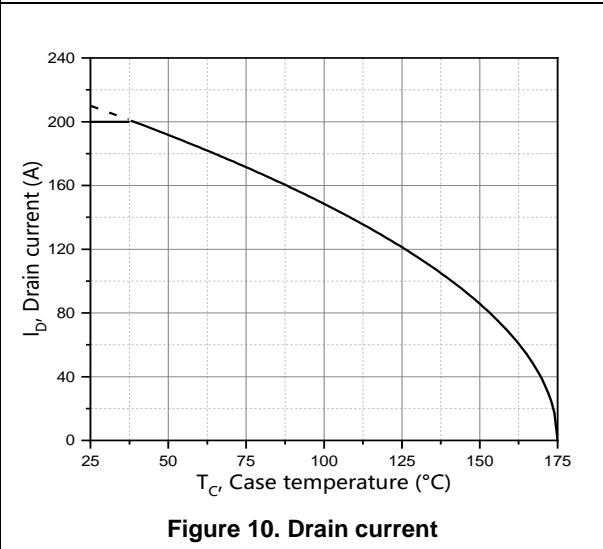
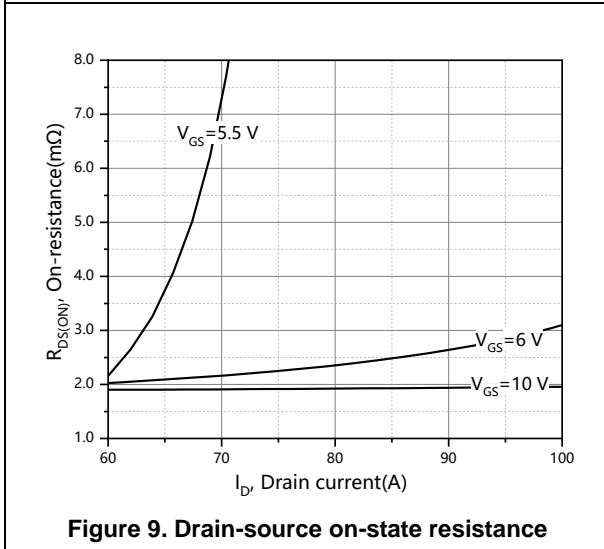
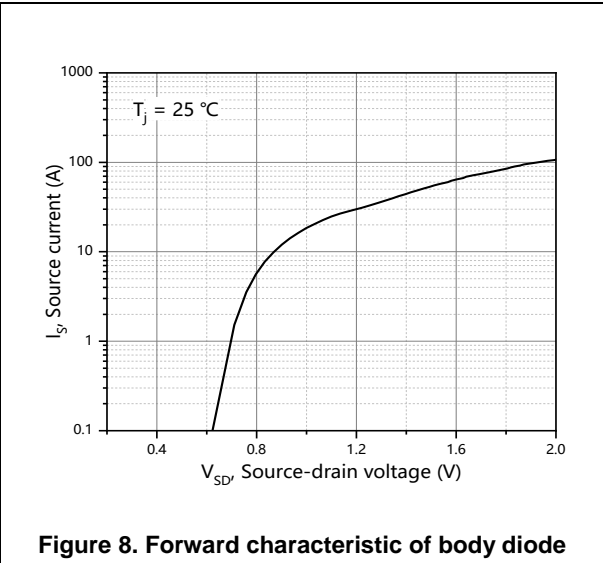
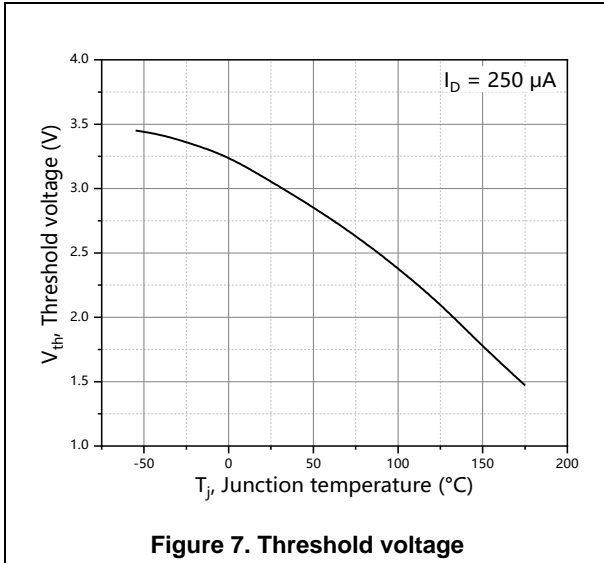
**Figure 4. Typ. gate charge**



**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**

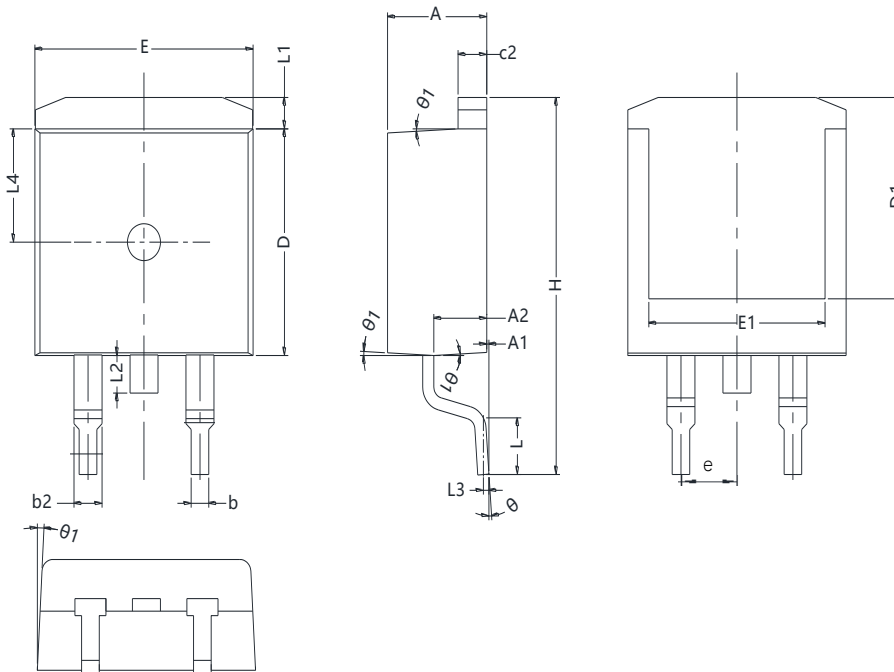


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



**Figure 4. Diode reverse recovery test circuit & waveforms**

**Package Information**



Symbol	mm		
	Min	Nom	Max
A	4.40	4.50	4.60
A1	0.00	0.10	0.25
A2	2.20	2.40	2.60
b	0.76	-	0.89
b2	1.23	-	1.37
c2	1.25	1.30	1.35
D	9.10	9.20	9.30
D1	8.00	-	-
E	9.80	9.90	10.00
E1	7.80	-	-
e	2.54 BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	-	-	1.75
L3	0.25 BSC		
L4	4.60 REF		
theta	0°	-	8°
theta1	1°	3°	5°

Version 1: TO263-J package outline dimension

### Ordering Information

Package Type	Units/ Reel	Reels/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO263-J	800	1	800	10	8000

### Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SFS04R02KNF	TO263	yes	yes	yes

### Legal Disclaimer

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