



## 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

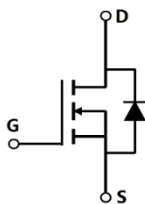
## Key Performance Parameters

| Parameter                     | Value | Unit       |
|-------------------------------|-------|------------|
| $V_{DS}$                      | 100   | V          |
| $I_{D, pulse}$                | 520   | A          |
| $R_{DS(ON) max @ V_{GS}=10V}$ | 3.9   | m $\Omega$ |
| $Q_g$                         | 108   | nC         |
| PD                            | 180   | W          |

## Marking Information

| Product Name | Package | Marking    |
|--------------|---------|------------|
| SFS130N10KF  | TO263   | SFS130N10K |

## Package & Pin information



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

| PARAMETER                                                                 | SYMBOL                | VALUE      | UNIT               |
|---------------------------------------------------------------------------|-----------------------|------------|--------------------|
| Drain source voltage                                                      | $V_{DS}$              | 100        | V                  |
| Gate source voltage                                                       | $V_{GS}$              | $\pm 20$   | V                  |
| Continuous drain current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$         | $I_D$                 | 130        | A                  |
| Pulsed drain current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$             | $I_{D, \text{pulse}}$ | 520        | A                  |
| Continuous diode forward current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$ | $I_S$                 | 130        | A                  |
| Diode pulsed current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$             | $I_{S, \text{Pulse}}$ | 520        | A                  |
| Power dissipation <sup>3)</sup> , $T_C=25^{\circ}\text{C}$                | $P_D$                 | 180        | W                  |
| Single pulsed avalanche energy <sup>5)</sup>                              | $E_{AS}$              | 590        | mJ                 |
| Operation and storage temperature                                         | $T_{\text{stg}}, T_j$ | -55 to 150 | $^{\circ}\text{C}$ |

**Thermal Characteristics**

| PARAMETER                                          | SYMBOL          | VALUE | UNIT                 |
|----------------------------------------------------|-----------------|-------|----------------------|
| Thermal resistance, junction-case                  | $R_{\theta JC}$ | 0.7   | $^{\circ}\text{C/W}$ |
| 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   | $BV_{DSS}$   | 100  |      |      | V                | $V_{GS}=0\text{ V}, I_D=250\text{ }\mu\text{A}$ |
| Gate threshold voltage           | $V_{GS(th)}$ | 2    |      | 4    | V                | $V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$     |
| Drain-source on-state resistance | $R_{DS(ON)}$ |      | 3.5  | 3.9  | $\text{m}\Omega$ | $V_{GS}=10\text{ V}, I_D=15\text{ A}$           |
| 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    | $\mu\text{A}$    | $V_{DS}=100\text{ V}, V_{GS}=0\text{ V}$        |
| Gate resistance                  | $R_G$        |      | 2.1  |      | $\Omega$         | $f=1\text{ MHz}$ , Open drain                   |

### Dynamic Characteristics

| PARAMETER                    | SYMBOL       | MIN. | TYP. | MAX. | UNIT | TEST CONDITION                                                                             |
|------------------------------|--------------|------|------|------|------|--------------------------------------------------------------------------------------------|
| Input capacitance            | $C_{iss}$    |      | 7940 |      | pF   | $V_{GS}=0\text{ V}$ ,<br>$V_{DS}=25\text{ V}$ ,<br>$f=100\text{ kHz}$                      |
| Output capacitance           | $C_{oss}$    |      | 2130 |      | pF   |                                                                                            |
| Reverse transfer capacitance | $C_{rss}$    |      | 237  |      | pF   |                                                                                            |
| Turn-on delay time           | $t_{d(on)}$  |      | 27   |      | ns   | $V_{GS}=10\text{ V}$ ,<br>$V_{DS}=50\text{ V}$ ,<br>$R_G=2\ \Omega$ ,<br>$I_D=50\text{ A}$ |
| Rise time                    | $t_r$        |      | 22   |      | ns   |                                                                                            |
| Turn-off delay time          | $t_{d(off)}$ |      | 47   |      | ns   |                                                                                            |
| Fall time                    | $t_f$        |      | 20   |      | ns   |                                                                                            |

### Gate Charge Characteristics

| PARAMETER            | SYMBOL        | MIN. | TYP. | MAX. | UNIT | TEST CONDITION                                                        |
|----------------------|---------------|------|------|------|------|-----------------------------------------------------------------------|
| Total gate charge    | $Q_g$         |      | 108  |      | nC   | $V_{GS}=10\text{ V}$ ,<br>$V_{DS}=50\text{ V}$ ,<br>$I_D=50\text{ A}$ |
| Gate-source charge   | $Q_{gs}$      |      | 42   |      | nC   |                                                                       |
| Gate-drain charge    | $Q_{gd}$      |      | 25   |      | nC   |                                                                       |
| Gate plateau voltage | $V_{plateau}$ |      | 5.6  |      | V    |                                                                       |

### Body Diode Characteristics

| PARAMETER                     | SYMBOL    | MIN. | TYP. | MAX. | UNIT | TEST CONDITION                                                                 |
|-------------------------------|-----------|------|------|------|------|--------------------------------------------------------------------------------|
| Diode forward voltage         | $V_{SD}$  |      |      | 1.3  | V    | $I_S=30\text{ A}$ ,<br>$V_{GS}=0\text{ V}$                                     |
| Reverse recovery time         | $t_{rr}$  |      | 85   |      | ns   | $V_R=50\text{ V}$ ,<br>$I_S=50\text{ A}$ ,<br>$di/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge       | $Q_{rr}$  |      | 122  |      | nC   |                                                                                |
| Peak reverse recovery current | $I_{rrm}$ |      | 2.3  |      | 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

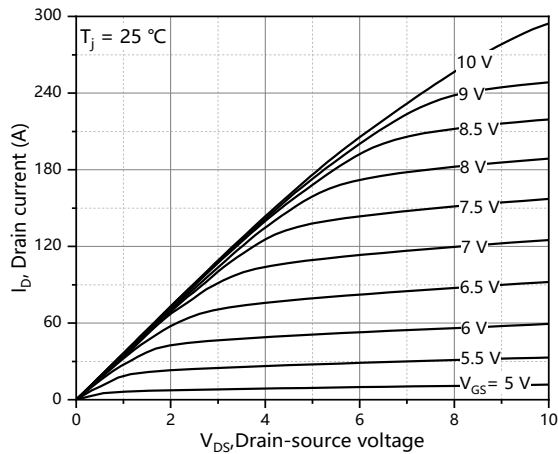


Figure 1. Typ. output characteristics

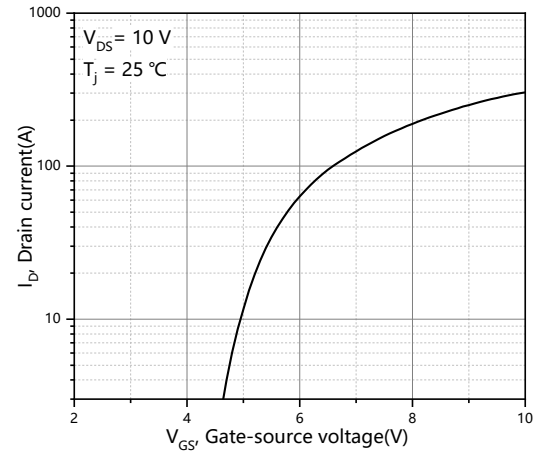


Figure 2. Typ. transfer characteristics

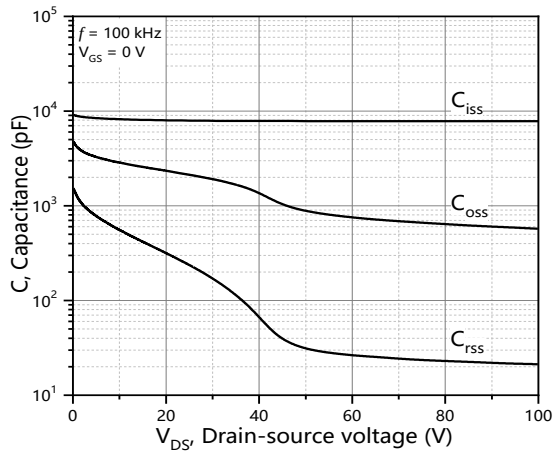


Figure 3. Typ. capacitances

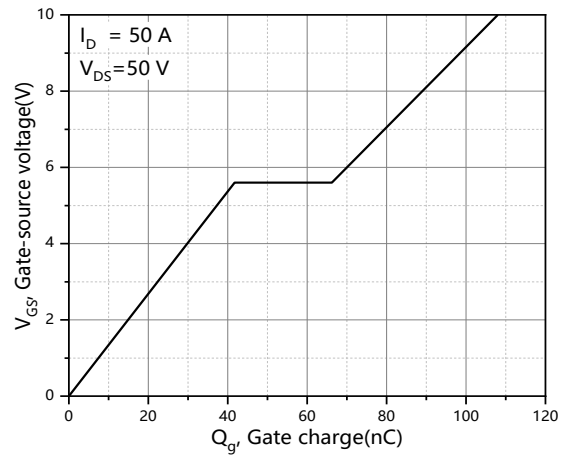


Figure 4. Typ. gate charge

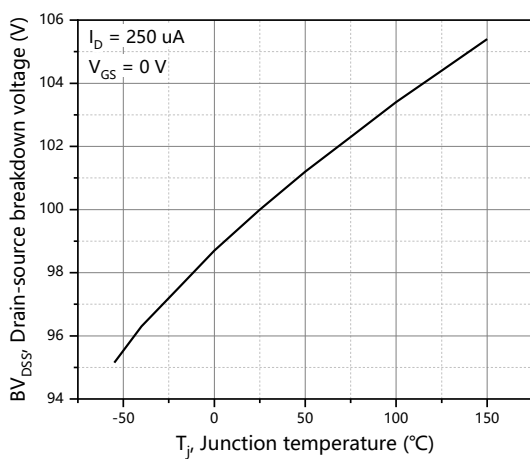


Figure 5. Drain-source breakdown voltage

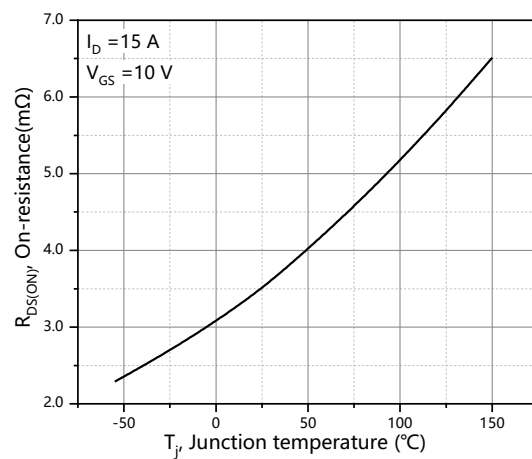
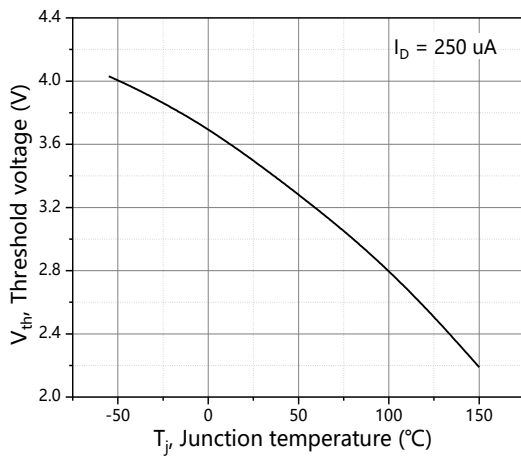
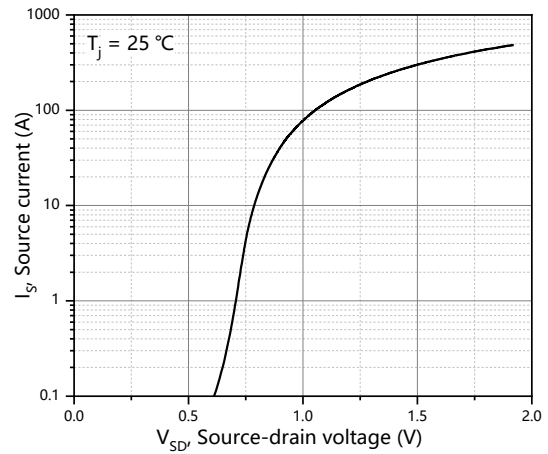


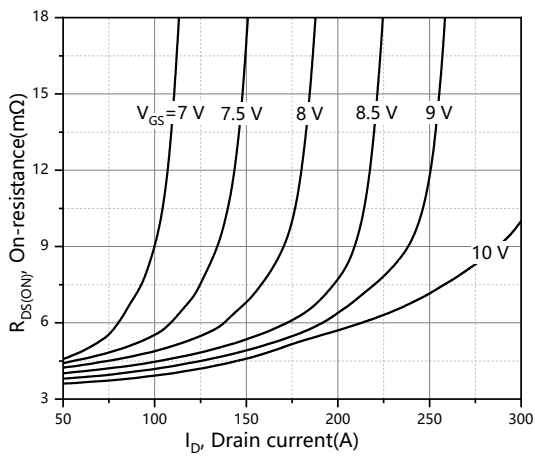
Figure 6. Drain-source on-state resistance



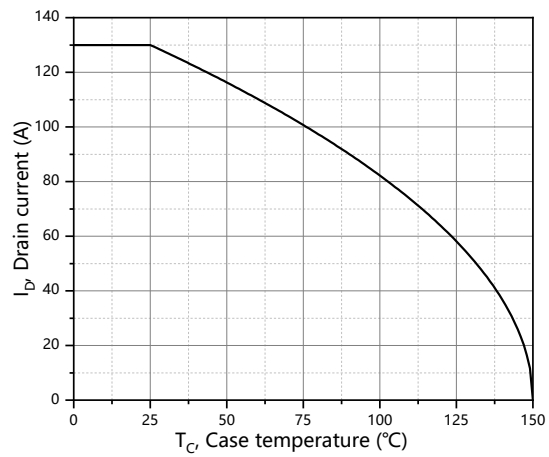
**Figure 7. Threshold voltage**



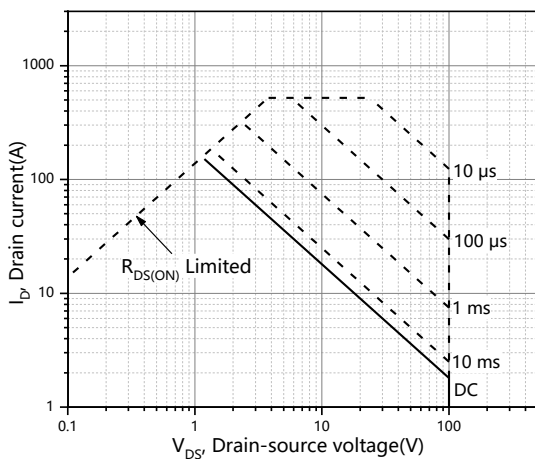
**Figure 8. Forward characteristic of body diode**



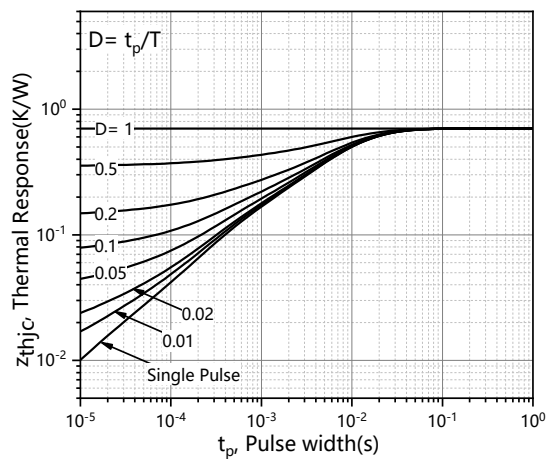
**Figure 9. Drain-source on-state resistance**



**Figure 10. Drain current**



**Figure 11. Safe operation area  $T_c=25^\circ\text{C}$**



**Figure 12. Max transient thermal impedance**

## Test circuits and waveforms



**Figure 1. Gate charge test circuit & waveform**



**Figure 2. Switching time test circuit & waveforms**

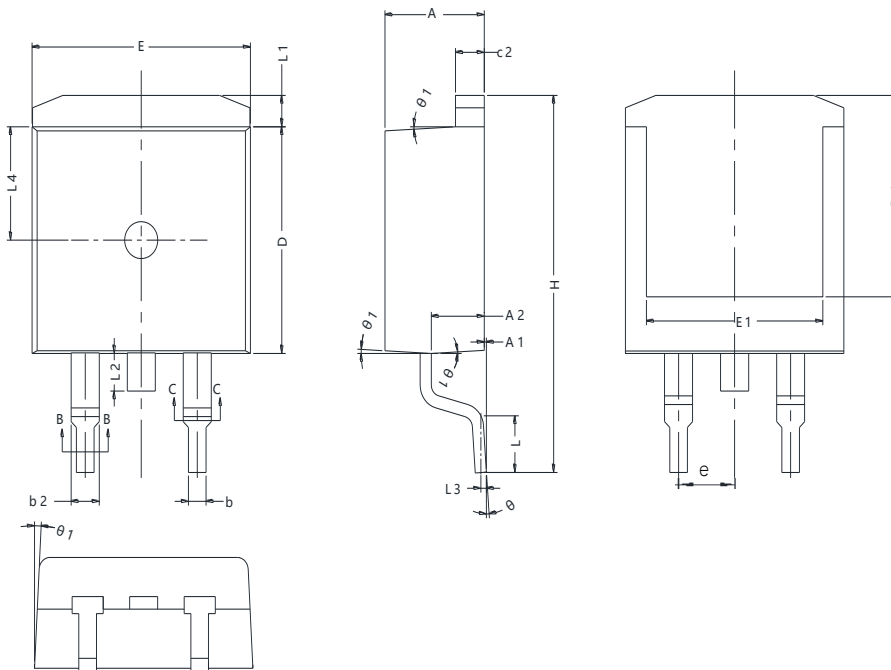


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



**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: 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 |
|-------------|---------|---------|------|--------------|
| SFS130N10KF | TO263   | yes     | yes  | yes          |

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