

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 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

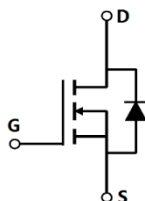
Key Performance Parameters

Parameter	Value	Unit
V_{DS}	100	V
$I_{D, pulse}$	560	A
$R_{DS(ON), max} @ V_{GS}=10V$	4.5	m Ω
Q_g	57	nC
PD	170	W

Marking Information

Product Name	Package	Marking
SFS10R04FNF_NB	TO220F-NL	SFS10R04FN

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}	± 20	V
Continuous drain current ¹⁾ , $T_C=25^{\circ}\text{C}$	I_D	140	A
Pulsed drain current ²⁾ , $T_C=25^{\circ}\text{C}$	$I_{D, \text{pulse}}$	560	A
Continuous diode forward current ¹⁾ , $T_C=25^{\circ}\text{C}$	I_S	140	A
Diode pulsed current ²⁾ , $T_C=25^{\circ}\text{C}$	$I_{S, \text{pulse}}$	560	A
Power dissipation ³⁾ , $T_C=25^{\circ}\text{C}$	P_D	170	W
Single pulsed avalanche energy ⁴⁾	E_{AS}	194	mJ
Operation and storage temperature	T_{stg}, T_j	-55 to 150	$^{\circ}\text{C}$

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	0.73	$^{\circ}\text{C/W}$
Thermal resistance, junction-ambient	$R_{\theta JA}$	62.5	$^{\circ}\text{C/W}$

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	$R_{DS(ON)}$		3.7	4.5	m Ω	$V_{GS}=10\text{ V}, I_D=20\text{ A}$
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	μA	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V}$
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}		3990		pF	$V_{GS}=0\text{ V}$, $V_{DS}=25\text{ V}$, $f=100\text{ kHz}$
Output capacitance	C_{oss}		2080		pF	
Reverse transfer capacitance	C_{rss}		144		pF	
Turn-on delay time	$t_{d(on)}$		17		ns	$V_{GS}=10\text{ V}$, $V_{DS}=50\text{ V}$, $R_G=2\ \Omega$, $I_D=25\text{ A}$
Rise time	t_r		10		ns	
Turn-off delay time	$t_{d(off)}$		33		ns	
Fall time	t_f		11		ns	

Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		57		nC	$V_{GS}=10\text{ V}$, $V_{DS}=50\text{ V}$, $I_D=25\text{ A}$
Gate-source charge	Q_{gs}		16		nC	
Gate-drain charge	Q_{gd}		13		nC	
Gate plateau voltage	$V_{plateau}$		4.5		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}		74		ns	$V_R=50\text{ V}$, $I_S=25\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		140		nC	
Peak reverse recovery current	I_{rrm}		3.2		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) $V_{DD}=50\text{ V}$, $V_{GS}=10\text{ V}$, $L=0.3\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

Electrical Characteristics Diagrams

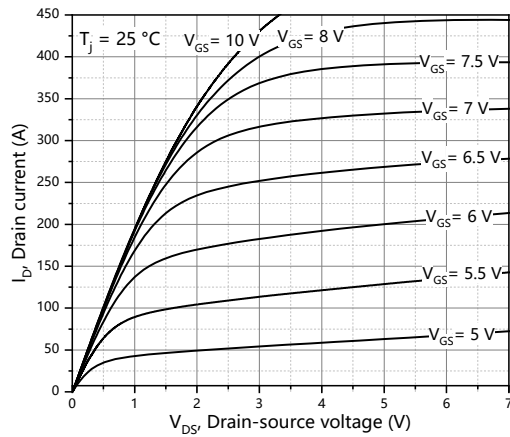


Figure 1. Typ. output characteristics

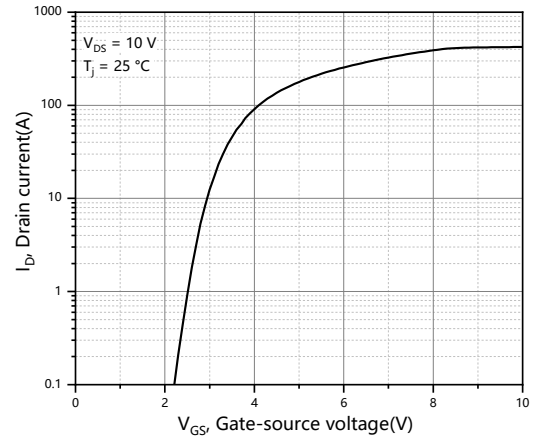


Figure 2. Typ. transfer characteristics

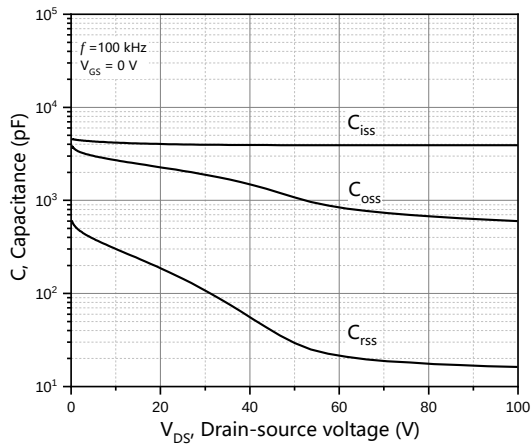


Figure 3. Typ. capacitances

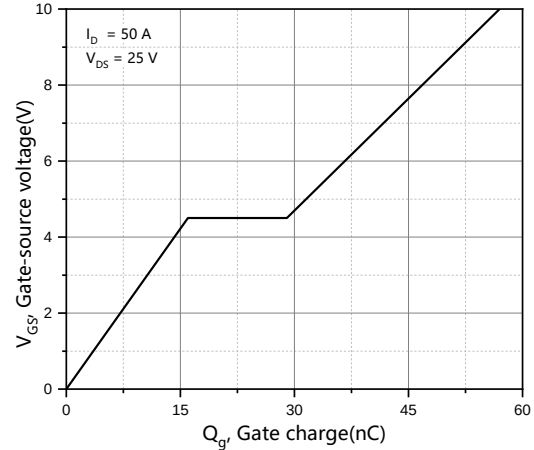


Figure 4. Typ. gate charge

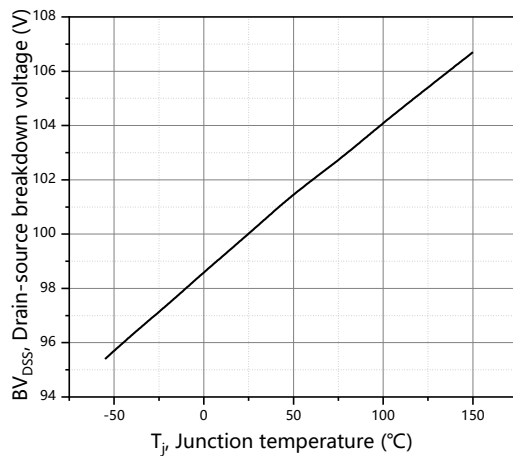


Figure 5. Drain-source breakdown voltage

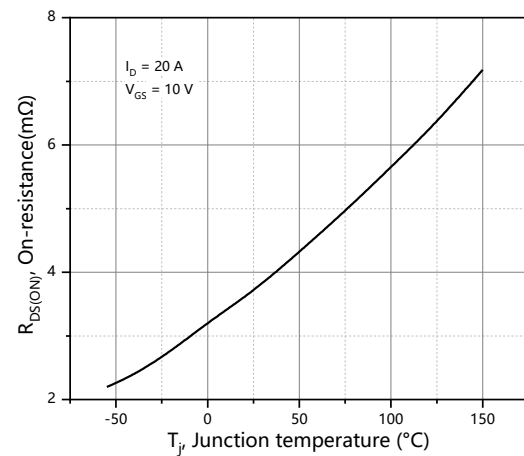


Figure 6. Drain-source on-state resistance

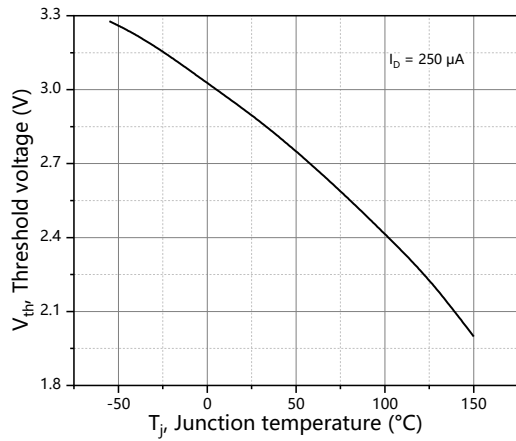


Figure 7. Threshold voltage

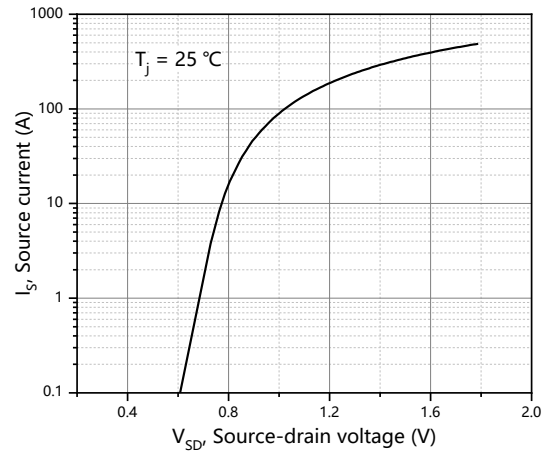


Figure 8. Forward characteristic of body diode

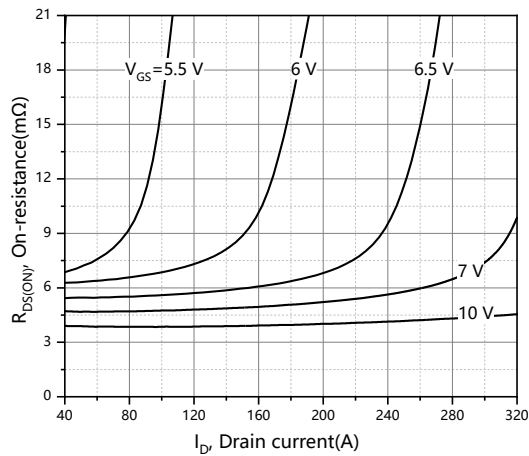


Figure 9. Drain-source on-state resistance

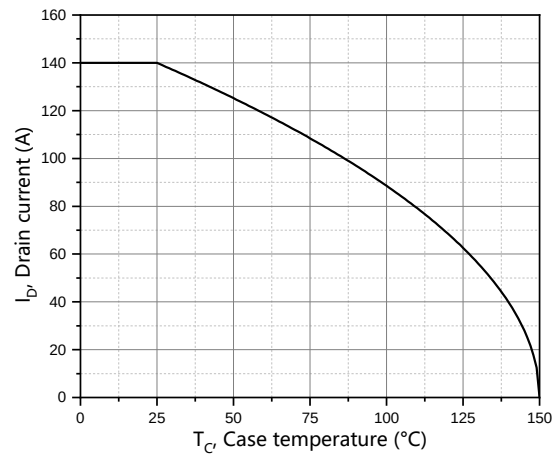


Figure 10. Drain current

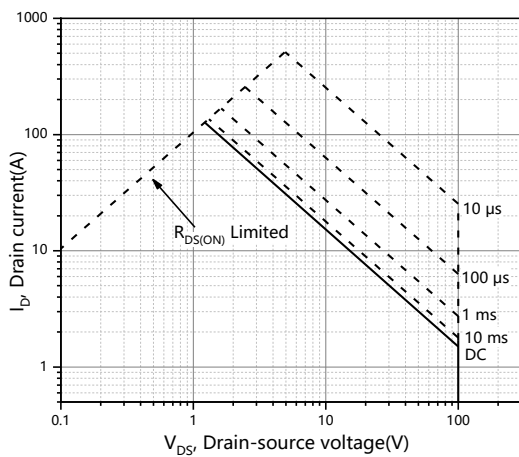


Figure 11. Safe operation area $T_c=25^\circ\text{C}$

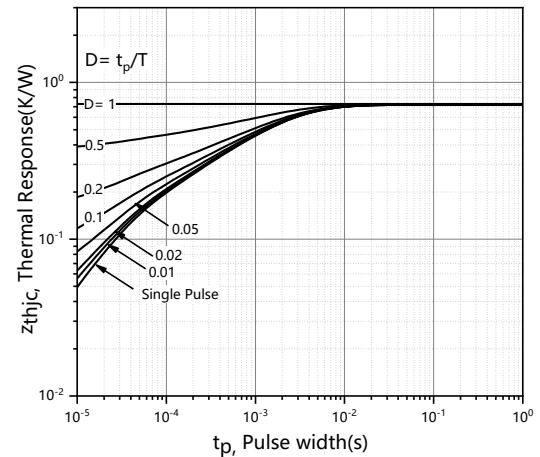


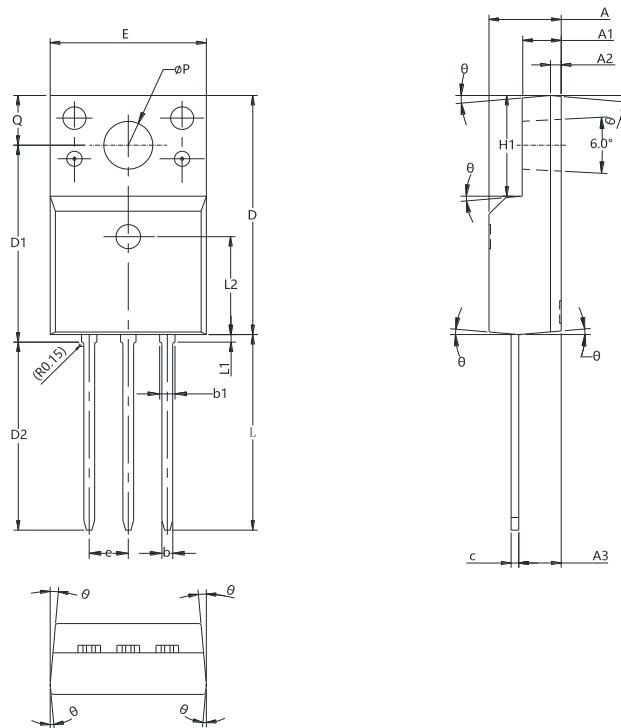
Figure 12. Max. transient thermal impedance

Figure 1 consists of two parts. The left part is a schematic diagram of the experimental setup. It shows a half-bridge circuit with two MOSFETs (DUT) connected to a VDC source. The gate of the MOSFETs is driven by a Vgs signal, and the drain is connected to a Vds source. The gate current Ig is also indicated. The right part is a graph of Vgs versus Charge. It shows a trapezoidal pulse with a plateau at 10V. The regions are labeled Qgs (charging), Qg (plateau), and Qgd (discharging).

Figure 1 consists of a schematic diagram and a set of waveforms. The schematic shows a MOSFET (DUT) switching an inductive load (L) from a VDD source. A current source I_g is used to generate a gate voltage V_{gs} . The drain voltage V_{ds} is measured. The waveforms show V_{gs} , V_{ds} , and I_{ds} during the switching transient. The switching loss is calculated as $Q_{rr} = \int I_{dt}$, where I_{dt} is the integral of the drain current I_{ds} during the reverse recovery phase.

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Package Information



Symbol	mm		
	Min	Nom	Max
A	4.5	4.7	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.6	-	0.8
b1	0.9	-	1.1
c	0.45	0.5	0.6
D	15.67	15.87	16.07
D1	12.87	13.07	13.27
D2	12.28	12.48	12.68
E	9.96	10.16	10.36
e	2.54 BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	0.85
L2	6.50 REF		
ϕP	3.08	3.18	3.28
Q	3.20	-	3.40
θ	1°	3°	5°

Version 1: TO220F-NL-J package outline dimension

Ordering Information

Package Type	Units/ Tube	Tubes/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO220F-NL-J	50	20	1000	5	5000

Product Information

Product	Package	Pb Free	RoHS	Halogen Free
SFS10R04FNF_NB	TO220F-NL	yes	yes	yes

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