

# SPICE Device Model SUM09N20-270 Vishay Siliconix

### N-Channel 200-V (D-S), 175°C MOSFET

#### **CHARACTERISTICS**

- N-Channel Vertical DMOS
- Macro Model (Subcircuit Model)
- Level 3 MOS

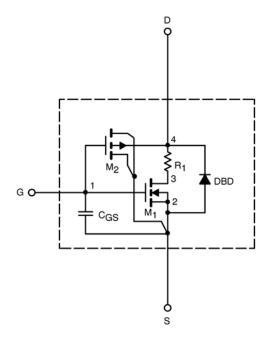
- Apply for both Linear and Switching Application
- Accurate over the -55 to 125°C Temperature Range
- Model the Gate Charge, Transient, and Diode Reverse Recovery Characteristics

#### **DESCRIPTION**

The attached spice model describes the typical electrical characteristics of the n-channel vertical DMOS. The subcircuit model is extracted and optimized over the -55 to  $125^{\circ}$ C temperature ranges under the pulsed 0-V to 10-V gate drive. The saturated output impedance is best fit at the gate bias near the threshold voltage.

A novel gate-to-drain feedback capacitance network is used to model the gate charge characteristics while avoiding convergence difficulties of the switched  $C_{gd}$  model. All model parameter values are optimized to provide a best fit to the measured electrical data and are not intended as an exact physical interpretation of the device.

#### SUBCIRCUIT MODEL SCHEMATIC



This document is intended as a SPICE modeling guideline and does not constitute a commercial product data sheet. Designers should refer to the appropriate data sheet of the same number for guaranteed specification limits.

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SPECIFICATIONS (T <sub>J</sub> = 25°C UNLESS OTHERWISE NOTED)					
Parameter	Symbol	Test Condition	Simulated Data	Measured Data	Unit
Static			-		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.3		V
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	25		Α
Drain-Source On-State Resistance <sup>a</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A	0.19	0.22	Ω
		V <sub>GS</sub> = 6 V, I <sub>D</sub> = 5 A	0.22	0.24	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 125°C	0.31		
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 175°C	0.38		
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = 10 A, V <sub>GS</sub> = 0 V	0.87	0.90	V
Dynamic <sup>b</sup>					
Input Capacitance	C <sub>iss</sub>	$V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz	564	580	pF
Output Capacitance	C <sub>oss</sub>		70	75	
Reverse Transfer Capacitance	C <sub>rss</sub>		33	30	
Total Gate Charge <sup>c</sup>	$Q_g$	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A	11.3	11	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$		2.7	2.7	
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$		4	4	
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	$V_{DD}$ = 100 V, $R_{L}$ = 10 Ω $I_{D}$ $\cong$ 10 A, $V_{GEN}$ = 10 V, $R_{G}$ = 2.5 Ω $I_{F}$ = 10 A, di/dt = 100 A/μs	13	10	ns
Rise Time <sup>c</sup>	t <sub>r</sub>		24	35	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>		21	25	
Fall Time <sup>c</sup>	t <sub>f</sub>		11	40	
Source-Drain Reverse Recovery Time	t <sub>rr</sub>		90	100	

#### Notes

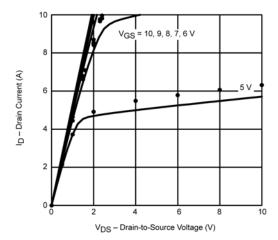
- Pulse test; pulse width  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2%. Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

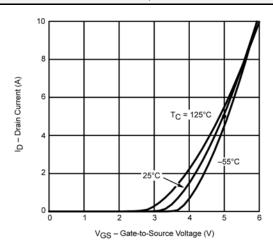


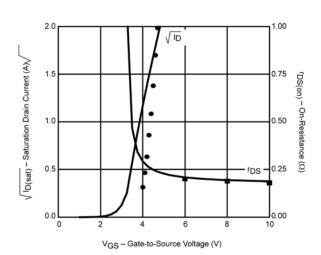
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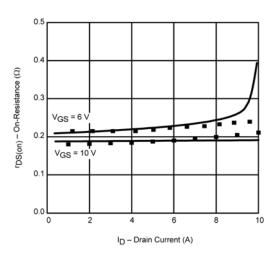
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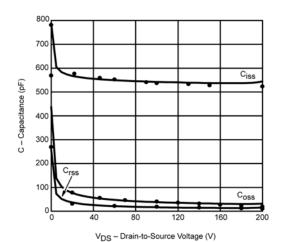
### COMPARISON OF MODEL WITH MEASURED DATA (TJ=25°C UNLESS OTHERWISE NOTED)

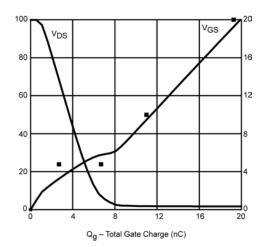












Note: Dots and squares represent measured data.



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Document Number: 91000 Revision: 18-Jul-08

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