



### P-Channel 60-V (D-S) MOSFET

#### CHARACTERISTICS

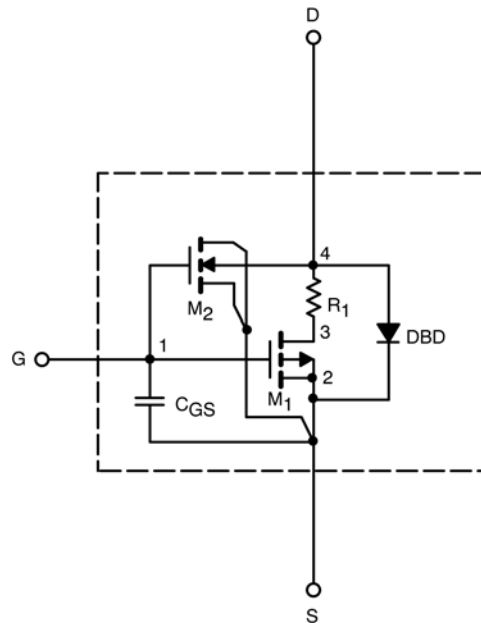
- P-Channel Vertical DMOS
- Macro Model (Subcircuit Model)
- Level 3 MOS
- Apply for both Linear and Switching Application
- Accurate over the -55 to 125°C Temperature Range
- Model the Gate Charge, Transient, and Diode Reverse Recovery Characteristics

#### DESCRIPTION

The attached spice model describes the typical electrical characteristics of the p-channel vertical DMOS. The subcircuit model is extracted and optimized over the -55 to 125°C temperature ranges under the pulsed 0-V to 5-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.

# SPICE Device Model Si2309DS



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SPECIFICATIONS ( $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)				
Parameter	Symbol	Test Condition	Typical	Unit
<b>Static</b>				
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$	2.01	V
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq -4.5 \text{ V}, V_{GS} = -10 \text{ V}$	14	A
		$V_{DS} \geq -4.5 \text{ V}, V_{GS} = -4.5 \text{ V}$	4.1	
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = -10 \text{ V}, I_D = -1.25 \text{ A}$	0.030	$\Omega$
		$V_{GS} = -4.5 \text{ V}, I_D = -1 \text{ A}$	0.040	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -4.5 \text{ V}, I_D = -1 \text{ A}$	1.82	S
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = -1.25 \text{ A}, V_{GS} = 0 \text{ V}$	7.6	V
<b>Dynamic<sup>b</sup></b>				
Total Gate Charge	$Q_g$	$V_{DS} = -30 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -1.25 \text{ A}$	5.4	nC
Gate-Source Charge	$Q_{gs}$		1.15	
Gate-Drain Charge	$Q_{gd}$		0.9	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30 \text{ V}, R_L = 30 \Omega$ $I_D \cong -1 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_G = 6 \Omega$	11	ns
Rise Time	$t_r$		9	
Turn-Off Delay Time	$t_{d(off)}$		9.4	
Fall Time	$t_f$		7.6	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = -1.25 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	29	

### Notes

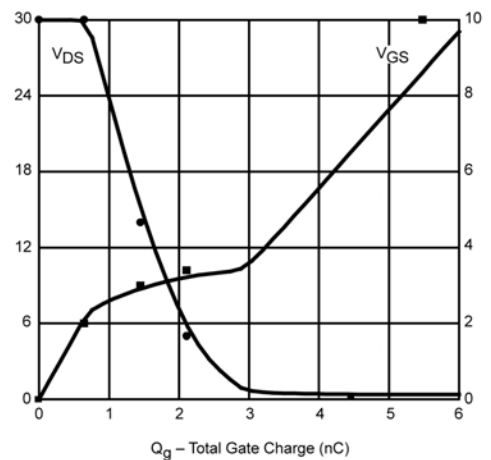
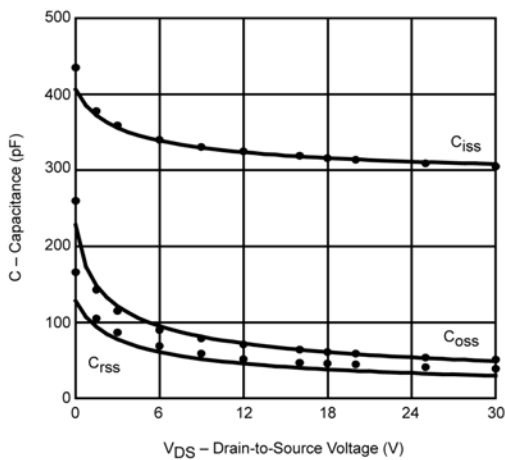
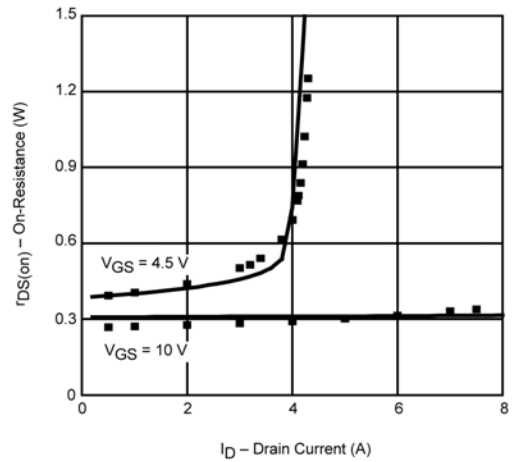
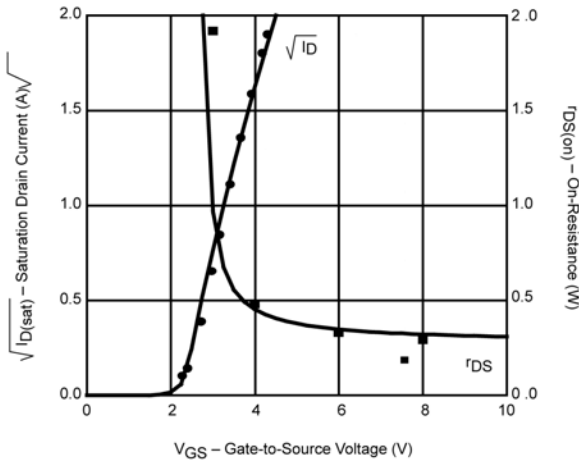
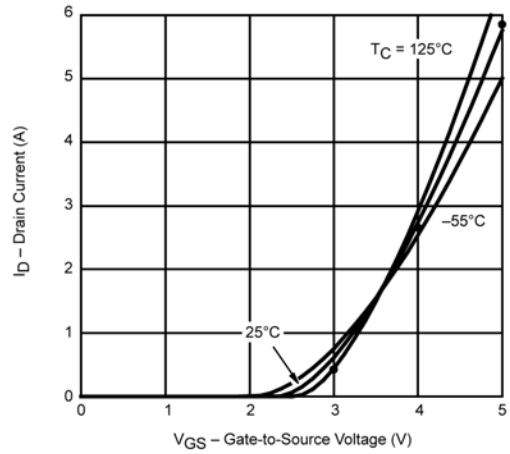
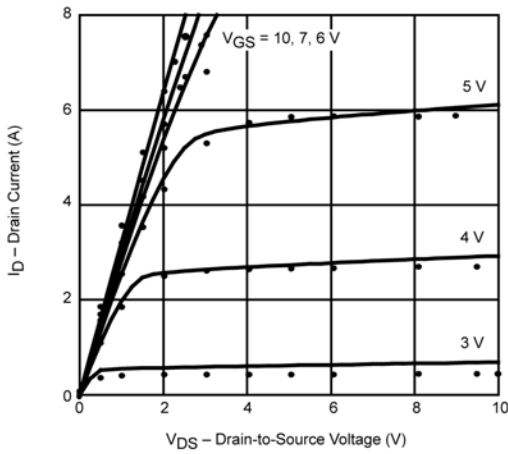
- a. Pulse test; pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.



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COMPARISON OF MODEL WITH MEASURED DATA ( $T_J=25^\circ\text{C}$  UNLESS OTHERWISE NOTED)



Note: Dots and squares represent measured data.



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