



## P-Channel 1.8-V (G-S) MOSFET

### CHARACTERISTICS

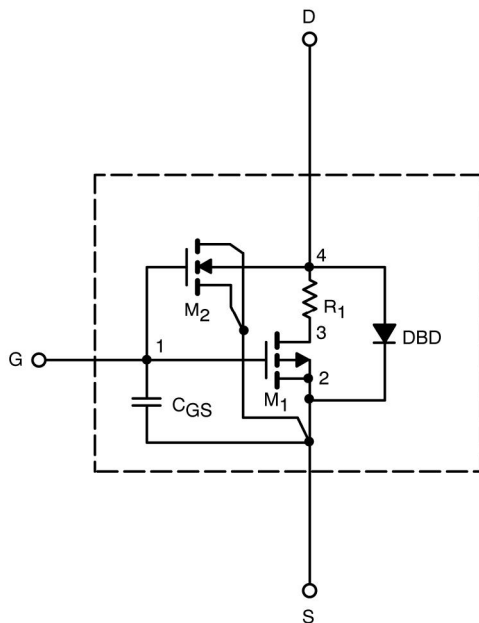
- P-Channel Vertical DMOS
- Macro Model (Subcircuit Model)
- Level 3 MOS
- Apply for both Linear and Switching Application
- Accurate over the  $-55$  to  $125^{\circ}\text{C}$  Temperature Range
- Model the Gate Charge, Transient, and Diode Reverse Recovery Characteristics

### 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  $125^{\circ}\text{C}$  temperature ranges under the pulsed 0 to 5V 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.



SPECIFICATIONS ( $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)					
Parameter	Symbol	Test Conditions	Simulated Data	Measured Data	Unit
<b>Static</b>					
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\ \mu\text{A}$	0.72		V
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\ \text{V}$ , $V_{GS} = -4.5\ \text{V}$	94		A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = -4.5\ \text{V}$ , $I_D = -3.6\ \text{A}$	0.035	0.038	$\Omega$
		$V_{GS} = -2.5\ \text{V}$ , $I_D = -3.2\ \text{A}$	0.046	0.049	
		$V_{GS} = -1.8\ \text{V}$ , $I_D = -2.7\ \text{A}$	0.062	0.070	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -5\ \text{V}$ , $I_D = -3.6\ \text{A}$	14	3	S
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = -1.6\ \text{V}$ , $V_{GS} = 0\ \text{V}$	-0.80		V
<b>Dynamic<sup>b</sup></b>					
Total Gate Charge	$Q_g$	$V_{DS} = -6\ \text{V}$ , $V_{GS} = -4.5\ \text{V}$ , $I_D = -3.6\ \text{A}$	8.2	9	nC
Gate-Source Charge	$Q_{gs}$		1.3	1.3	
Gate-Drain Charge	$Q_{gd}$		2.5	2.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -6\ \text{V}$ , $R_L = 6\ \Omega$ $I_D \cong -1\ \text{A}$ , $V_{GEN} = -10\ \text{V}$ , $R_G = 6\ \Omega$	20	20	ns
Rise Time	$t_r$		21	35	
Turn-Off Delay Time	$t_{d(off)}$		66	65	
Fall Time	$t_f$		15	50	

### Notes

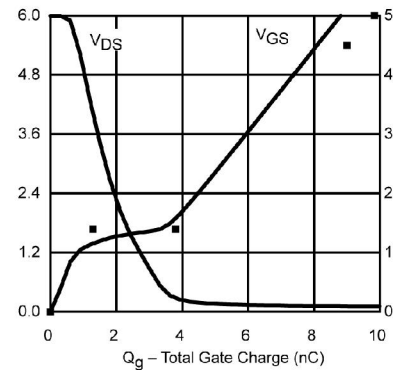
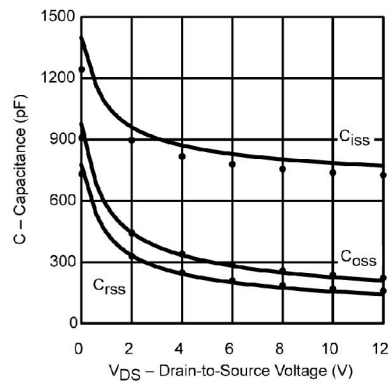
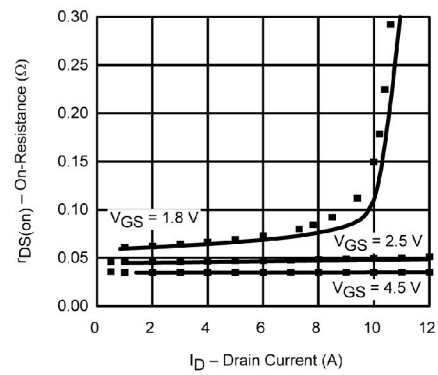
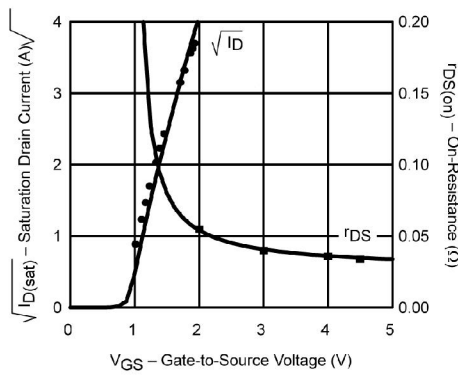
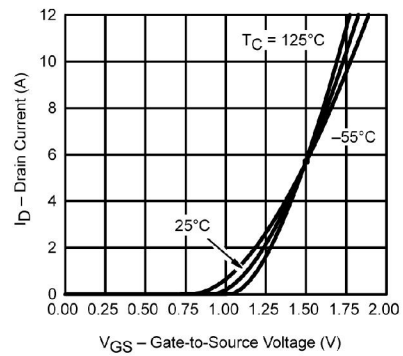
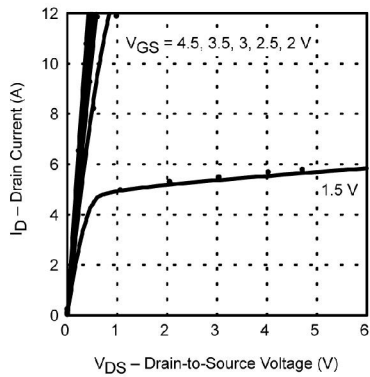
- Pulse test; pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.



# SPICE Device Model Si2331DS

Vishay Siliconix

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



Note: Dots and squares represent measured data.