



# SPICE Device Model TN0201K

## Vishay Siliconix

### N-Channel 20-V (D-S) MOSFET

#### CHARACTERISTICS

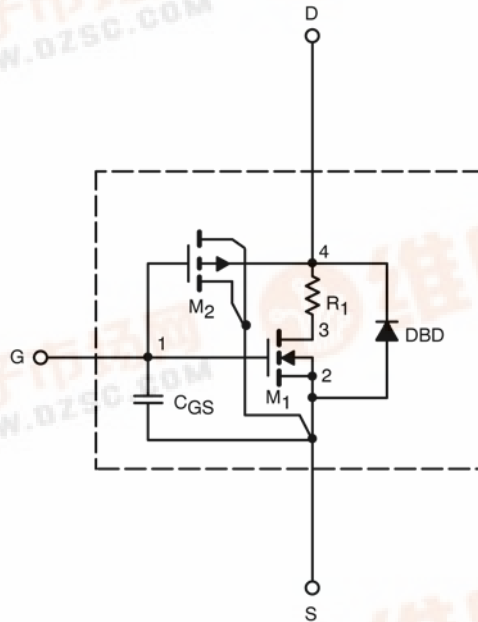
- N-Channel Vertical DMOS
- Macro Model (Subcircuit Model)
- Level 3 MOS
- Apply for both Linear and Switching Application
- Accurate over the -55 to 125°C Temperature Range
- Model the Gate Charge, Transient, and Diode Reverse Recovery Characteristics

#### 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°C temperature ranges under the pulsed 0 to 10V 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



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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	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2.2	2	V
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = 10 \text{ V}, V_{GS} = 10 \text{ V}$	8.9		A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = 10 \text{ V}, I_D = 0.30 \text{ A}$	0.47	0.47	$\Omega$
		$V_{GS} = 4.5 \text{ V}, I_D = 0.10 \text{ A}$	0.81	0.80	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10 \text{ V}, I_D = 0.30 \text{ A}$	569	550	mS
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = 0.30 \text{ A}, V_{GS} = 0 \text{ V}$	0.77	0.85	V
<b>Dynamic<sup>b</sup></b>					
Total Gate Charge	$Q_g$	$V_{DS} = 16 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 0.30 \text{ A}$	776	1000	pC
Gate-Source Charge	$Q_{gs}$		205	205	
Gate-Drain Charge	$Q_{gd}$		200	200	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15 \text{ V}, R_L = 50 \Omega$ $I_D \cong 0.30 \text{ A}, V_{GEN} = 10 \text{ V}, R_G = 6 \Omega$	4	4.5	ns
Rise Time	$t_r$		10	8	
Turn-Off Delay Time	$t_{d(off)}$		8	9	
Fall Time	$t_f$		36	6.3	

**Notes**

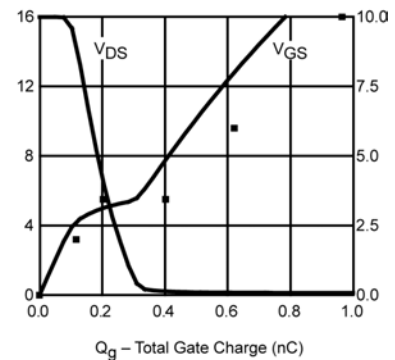
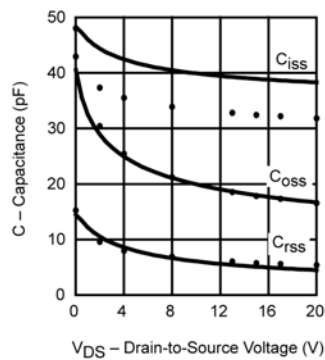
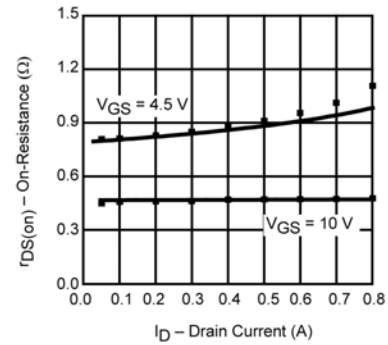
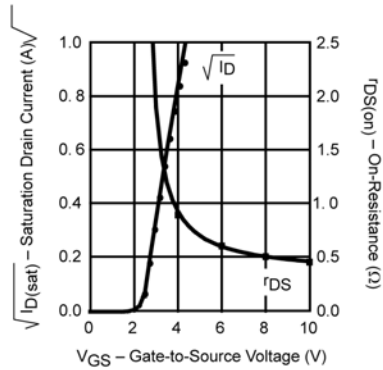
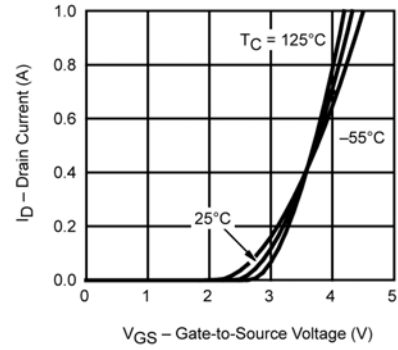
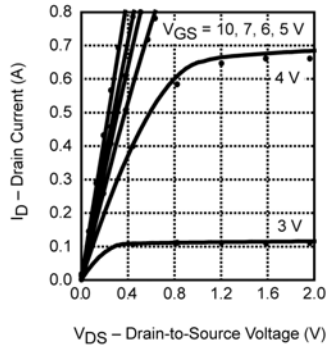
- a. Pulse test; pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.



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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.