Dual N-Channel 30-V (D-S) MOSFET with Schottky Diode

CHARACTERISTICS

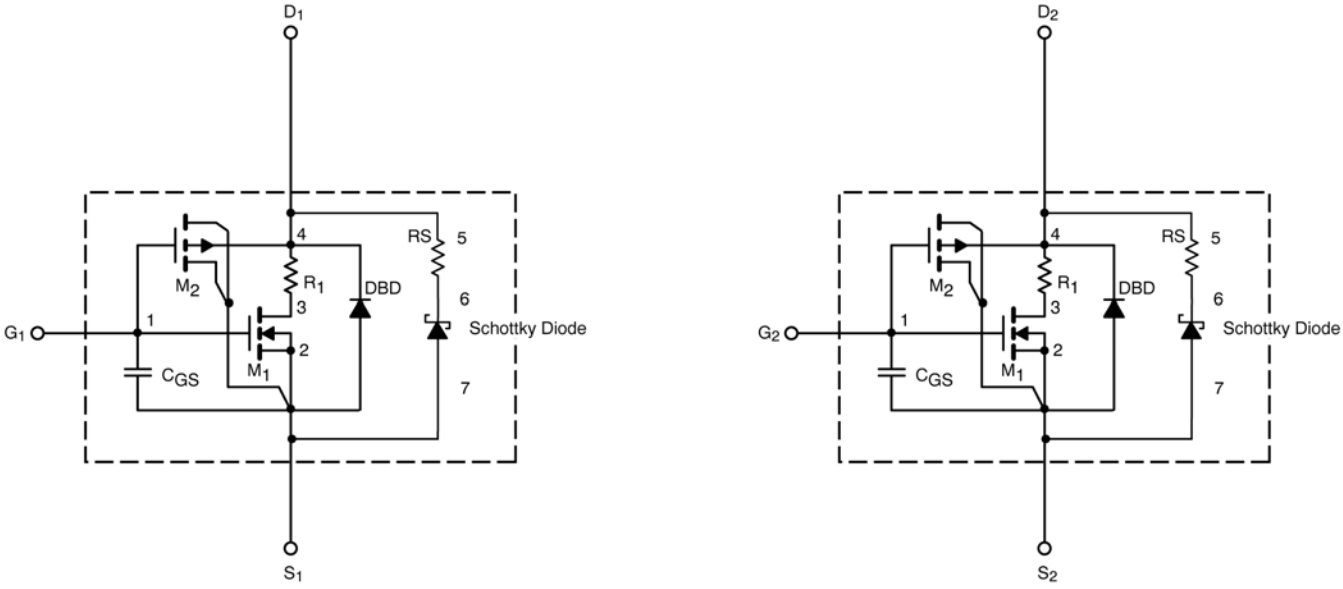
- N-Channel Vertical DMOS
- Macro Model (Subcircuit Model)
- Level 3 MOS
- Apply for both Linear and Switching Application
- Accurate over the −55 to 125°C Temperature Range
- Model the Gate Charge, Transient, and Diode Reverse Recovery Characteristics

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-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



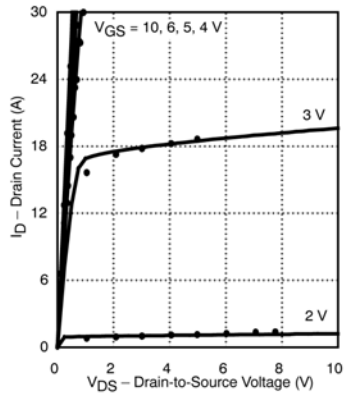
This document is intended as a SPICE modeling guideline and does not constitute a commercial product data sheet. Designers should refer to the appropriate data sheet of the same number for guaranteed specification limits.

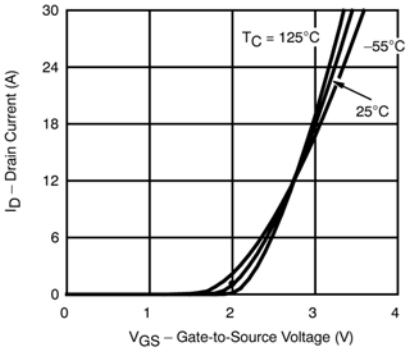
SPECIFICATIONS (T_J = 25°C UNLESS OTHERWISE NOTED)						
Parameter	**Symbol**	**Test Condition**		**Simulated Data**	**Measured Data**	**Unit**
Static						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	Ch-1	1.1		V
			Ch-2	1.93		
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 10 V	Ch-1	255		A
			Ch-2	431		
Drain-Source On-State Resistance[a]	$r_{DS(on)}$	V_{GS} = 10 V, I_D = 6.3 A	Ch-1	0.018	0.018	Ω
		V_{GS} = 10 V, I_D = 10 A	Ch-2	0.0107	0.0105	
		V_{GS} = 4.5 V, I_D = 5.4 A	Ch-1	0.023	0.024	
		V_{GS} = 4.5 V, I_D = 8.6 A	Ch-2	.014	0.015	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 6.3 A	Ch-1	17	17	S
		V_{DS} = 15 V, I_D = 10 A	Ch-2	35	28	
Diode Forward Voltage[a]	V_{SD}	I_S = 1.3 A, V_{GS} = 0 V	Ch-1	0.73	0.70	V
		I_S = 1 A, V_{GS} = 0 V	Ch-2	0.72	0.47	
Dynamic[b]						
Total Gate Charge	Q_g	Channel-1 V_{DS} = 15 V, V_{GS} = 5 V, I_D = 6.3 A Channel-2 V_{DS} = 15 V, V_{GS} = 5 V, I_D = 10 A		8.2	8	nC
				15	15	
Gate-Source Charge	Q_{gs}			1.75	1.75	
				5.3	5.3	
Gate-Drain Charge	Q_{gd}			3.2	3.2	
				4.6	4.6	
Turn-On Delay Time	$t_{d(on)}$	Channel-1 V_{DD} = 15 V, R_L = 15 Ω $I_D \cong$ 1 A, V_{GEN} = 10 V, R_G = 6 Ω Channel-2 V_{DD} = 15 V, R_L = 15 Ω $I_D \cong$ 1 A, V_{GEN} = 10 V, R_G = 6 Ω		10	10	ns
				16	15	
Rise Time	t_r			15	5	
				21	5	
Turn-Off Delay Time	$t_{d(off)}$			31	26	
				47	44	
Fall Time	t_f			46	8	
				68	12	
Source-Drain Reverse Recovery Time	t_{rr}	I_F = 1.3 A, di/dt = 100 A/μs	Ch-1	32	30	
		I_F = 2.2 A, di/dt = 100 A/μs	Ch-2	45	32	

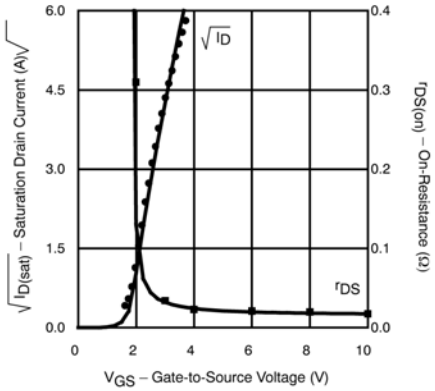
Notes
a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.

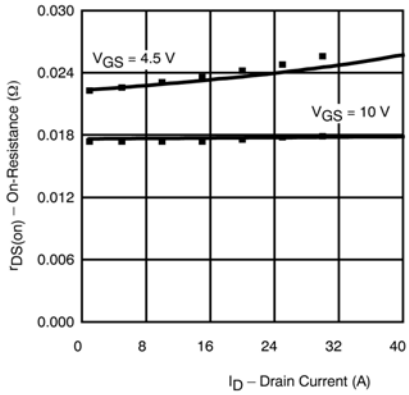
COMPARISON OF MODEL WITH MEASURED DATA (T_J=25°C UNLESS OTHERWISE NOTED)

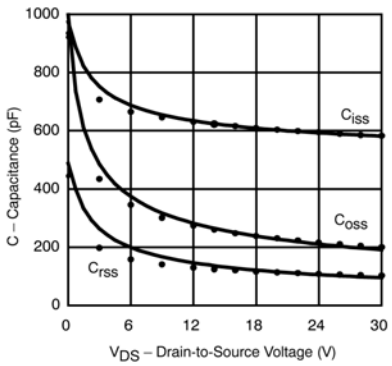
Channel-1

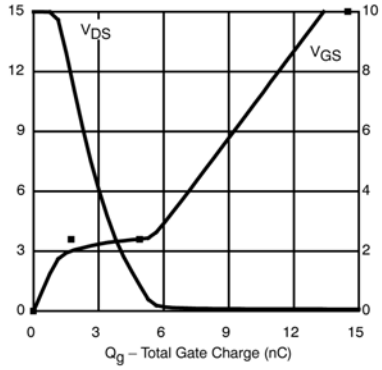






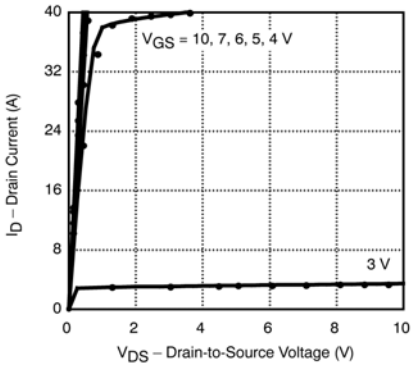


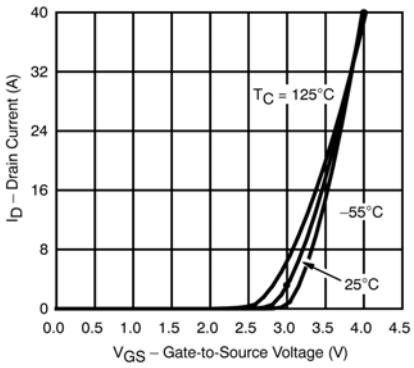


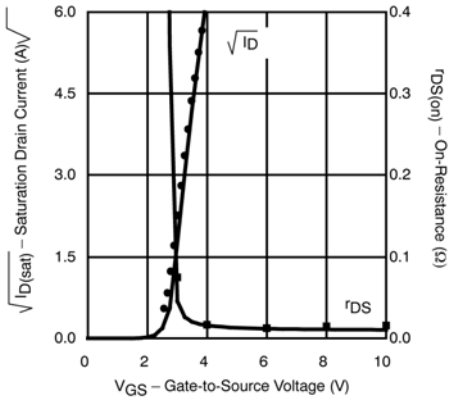


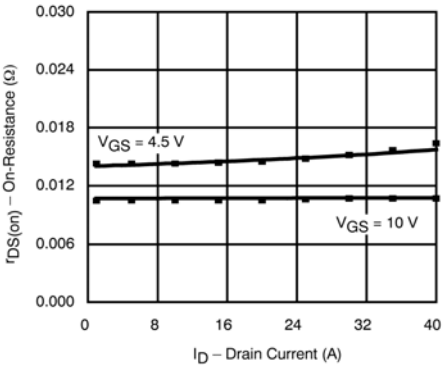
Note: Dots and squares represent measured data.

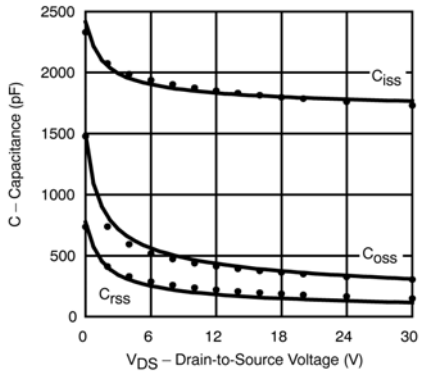
Channel-2

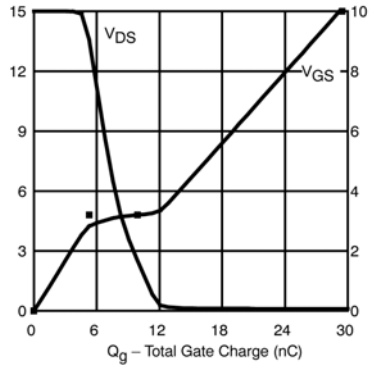












Note: Dots and squares represent measured data.

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