N- and P-Channel 60 V (D-S) MOSFET

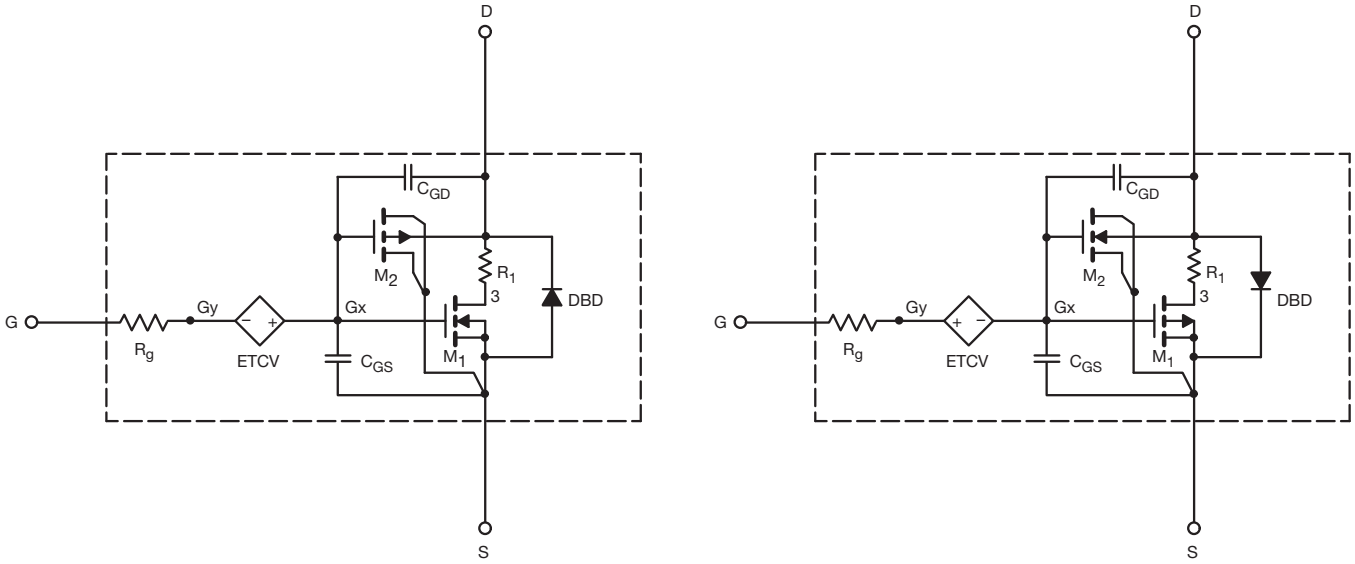
DESCRIPTION

The attached SPICE model describes the typical electrical characteristics of the N- and P-Channel vertical DMOS. The subcircuit model is extracted and optimized over the -55 °C to +150 °C temperature ranges under the pulsed -20 V to +20 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.

CHARACTERISTICS

- N-and P-Channel vertical DMOS
- Macro model (subcircuit model)
- Level 3 MOS
- Apply for both linear and switching application
- Accurate over the -55 °C to +150 °C temperature range
- Model the gate charge

SUBCIRCUIT MODEL SCHEMATIC



Note

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

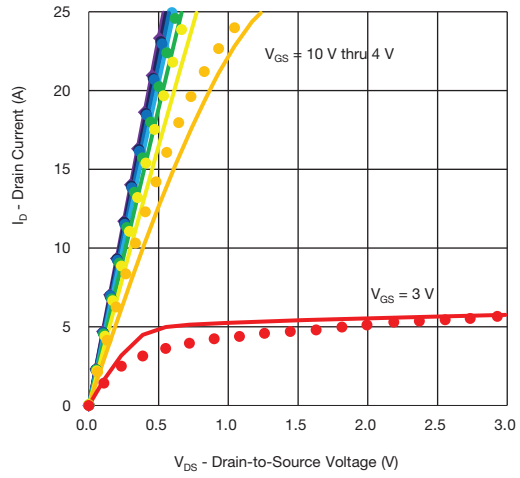
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**SIMULATED DATA**	**MEASURED DATA**	**UNIT**
Static						
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	1.9	-	V
		V_{DS} = V_{GS}, I_D = -250 µA	P-Ch	-2.1	-	V
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 5 A	N-Ch	0.022	0.022	Ω
		V_{GS} = -10 V, I_D = -3.1 A	P-Ch	0.090	0.100	
		V_{GS} = 4.5 V, I_D = 4 A	N-Ch	0.033	0.029	
		V_{GS} = -4.5 V, I_D = 3.1 A	P-Ch	0.130	0.126	
Forward transconductance [a]	g_{fs}	V_{DS} = 10 V, I_D = 10 A	N-Ch	21	23	S
		V_{DS} = -15 V, I_D = -3.1 A	P-Ch	7.8	8.5	
Dynamic [b]						
Input capacitance	C_{iss}	N-Channel V_{DS} = 30 V, V_{GS} = 0 V, f = 1 MHz P-Channel V_{DS} = -15 V, V_{GS} = 0 V, f = 1 MHz	N-Ch	421	420	pF
			P-Ch	621	650	
Output capacitance	C_{oss}		N-Ch	91	92	
			P-Ch	98	95	
Reverse transfer capacitance	C_{rss}		N-Ch	4	4	
			P-Ch	59	60	
Total gate charge	Q_g	V_{DS} = 30 V, V_{GS} = 10 V, I_D = 5 A	N-Ch	7.3	7.1	nC
		V_{DS} = -30 V, V_{GS} = -10 V, I_D = -3.1 A	P-Ch	14.2	14.5	
		V_{DS} = 30 V, V_{GS} = 4.5 V, I_D = 5 A	N-Ch	3.3	3.3	
		V_{DS} = -30 V, V_{GS} = -4.5 V, I_D = -3.1 A	P-Ch	7	8	
Gate-source charge	Q_{gs}	N-Channel V_{DS} = 30 V, V_{GS} = 4.5 V, I_D = 5 A P-Channel V_{DS} = -30 V, V_{GS} = -4.5 V, I_D = -3.1 A	N-Ch	1.4	1.7	
Gate-source charge	Q_{gs}		P-Ch	2.5	2.2	
Gate-drain charge	Q_{gd}		N-Ch	0.8	0.9	
Gate-drain charge	Q_{gd}		P-Ch	3.0	3.7	
Drain-source body diode characteristics						
Body diode voltage	V_{SD}	I_S = 2 A	N-Ch	0.8	0.8	V
Body diode voltage		I_S = -2 A	P-Ch	-0.79	-0.8	
Body diode reverse recovery time	t_{rr}	N-Channel I_F = 5 A di/dt = 100 A/µs, T_J = 25 °C P-Channel I_F = -2 A di/dt = 100 A/µs, T_J = 25 °C	N-Ch	14	14	ns
Body diode reverse recovery time			P-Ch	26	30	
Body diode reverse recovery charge	Q_{rr}		N-Ch	5	10	nC
Body diode reverse recovery charge			P-Ch	25	35	
Reverse recovery fall time	t_a		N-Ch	8	8	ns
Reverse recovery fall time			P-Ch	19	16	
Reverse recovery rise time	t_b		N-Ch	6	6	
Reverse recovery rise time			P-Ch	7	14	

Notes

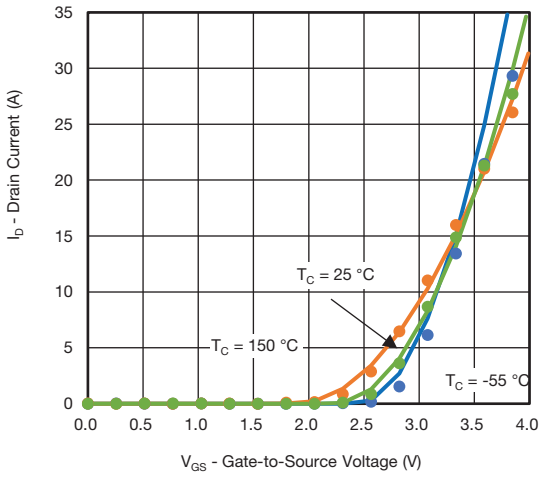
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %

b. Guaranteed by design, not subject to production testing

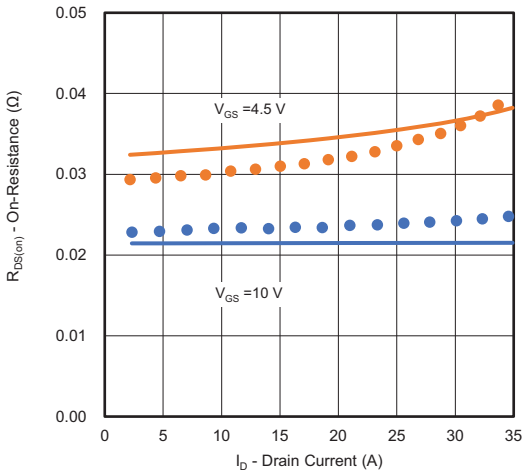
COMPARISON OF MODEL WITH MEASURED DATA (N-CHANNEL) (T_J = 25 °C, unless otherwise noted)



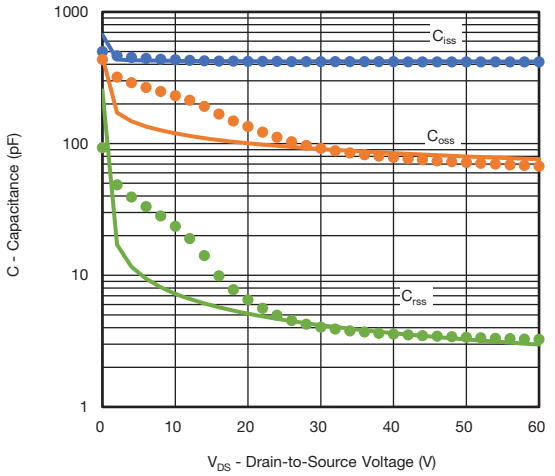
Output Characteristics



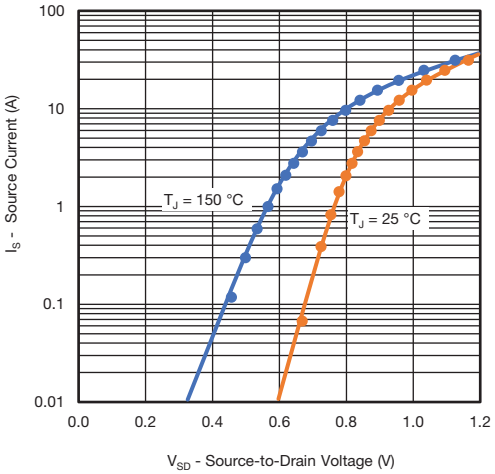
Transfer Characteristics



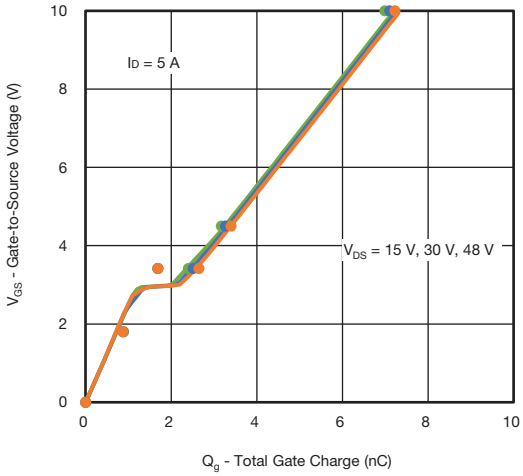
On-Resistance vs. Drain Current (A)



Capacitance

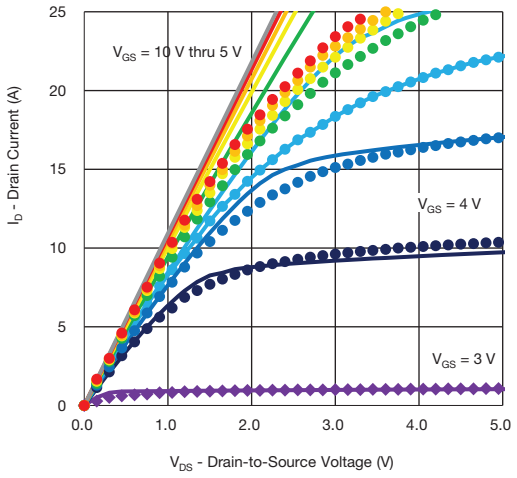


Source-Drain Diode Forward Voltage

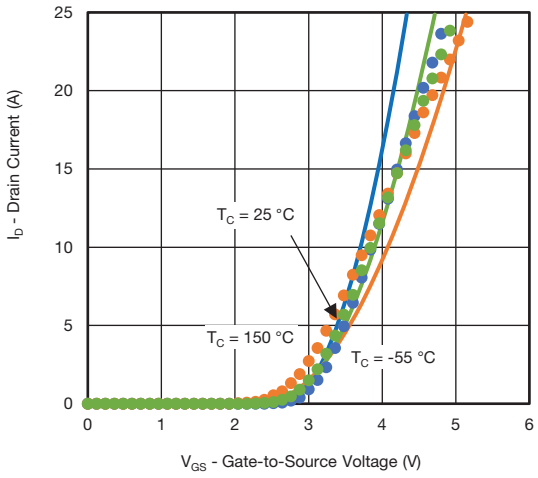


Gate Charge

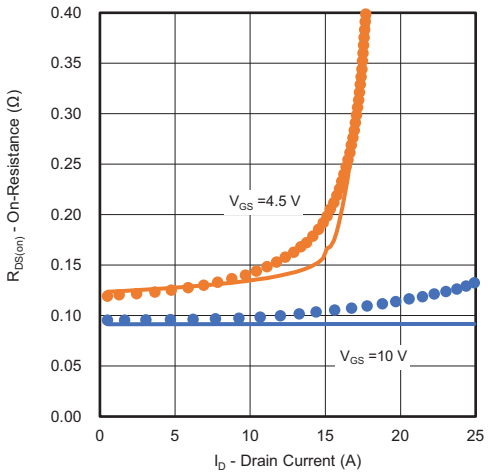
COMPARISON OF MODEL WITH MEASURED DATA (P-CHANNEL) (T_J = 25 °C, unless otherwise noted)



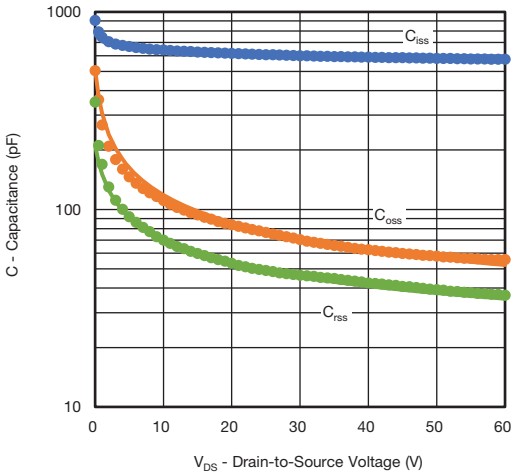
Output Characteristics



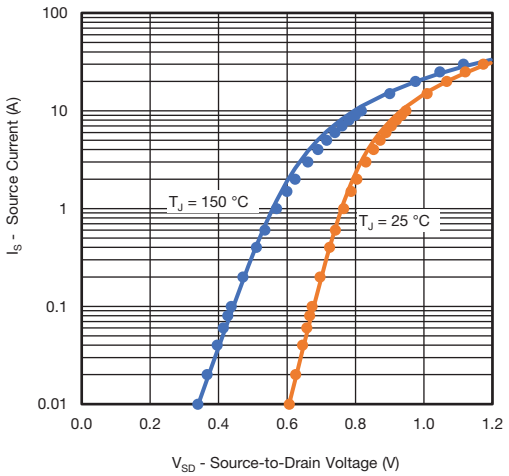
Transfer Characteristics



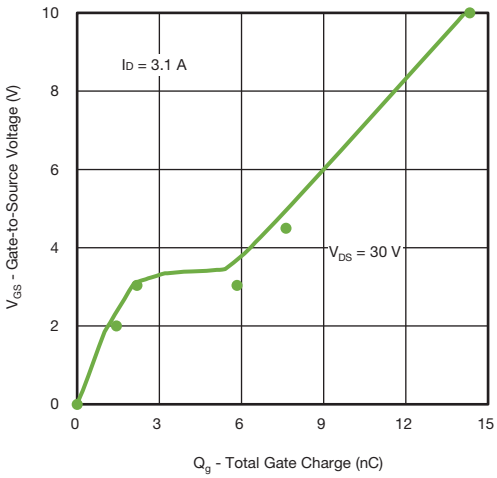
On-Resistance vs. Drain Current (A)



Capacitance



Source-Drain Diode Forward Voltage



Gate Charge

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