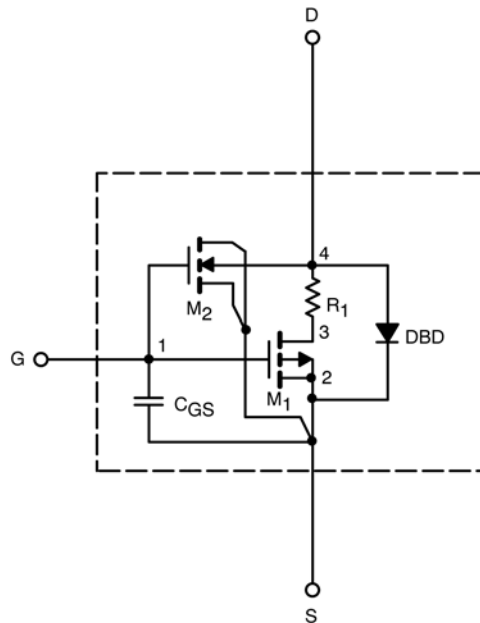# P-Channel 30-V (D-S) MOSFET

## 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 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

| 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 | 1.9 | | V |
| On-State Drain Current[a] | I$_{D(on)}$ | V$_{DS}$ = −5 V, V$_{GS}$ = −10 V | 309 | | A |
| Drain-Source On-State Resistance[a] | r$_{DS(on)}$ | V$_{GS}$ = −10 V, I$_D$ = −9.1 A | 0.015 | 0.015 | Ω |
| | | V$_{GS}$ = −4.5 V, I$_D$ = −6.9 A | 0.025 | 0.025 | |
| Forward Transconductance[a] | g$_{fs}$ | V$_{DS}$ = −10 V, I$_D$ = −9.1 A | 22 | 24 | S |
| Diode Forward Voltage[a] | V$_{SD}$ | I$_S$ = −2.1 A, V$_{GS}$ = 0 V | −0.81 | −0.80 | V |
| **Dynamic[b]** | | | | | |
| Total Gate Charge | Q$_g$ | V$_{DS}$ = −15 V, V$_{GS}$ = −10 V, I$_D$ = −9.1 A | 32 | 33 | nC |
| Gate-Source Charge | Q$_{gs}$ | | 5.8 | 5.8 | |
| Gate-Drain Charge | Q$_{gd}$ | | 8.6 | 8.6 | |
| Turn-On Delay Time | t$_{d(on)}$ | V$_{DD}$ = −15 V, R$_L$ = 15 Ω I$_D$ ≅ −1 A, V$_{GEN}$ = −10 V, R$_G$ = 6 Ω | 19 | 10 | ns |
| Rise Time | t$_r$ | | 14 | 15 | |
| Turn-Off Delay Time | t$_{d(off)}$ | | 184 | 110 | |
| Fall Time | t$_f$ | | 35 | 70 | |
| Source-Drain Reverse Recovery Time | t$_{rr}$ | I$_F$ = −2.1 A, di/dt = 100 A/µs | 55 | 60 | |

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)
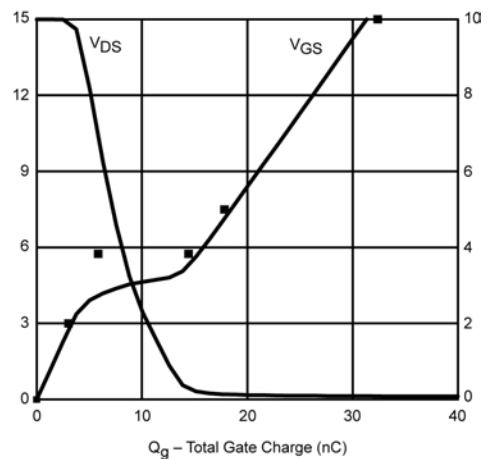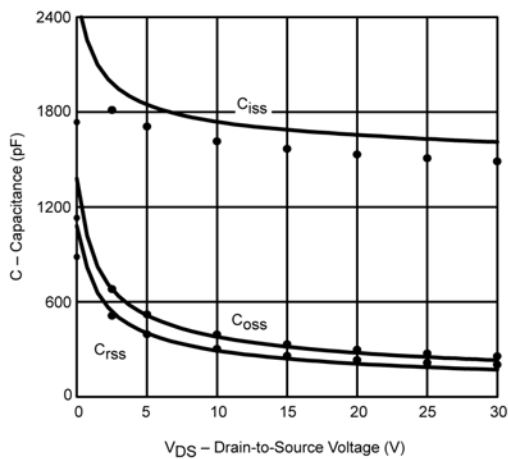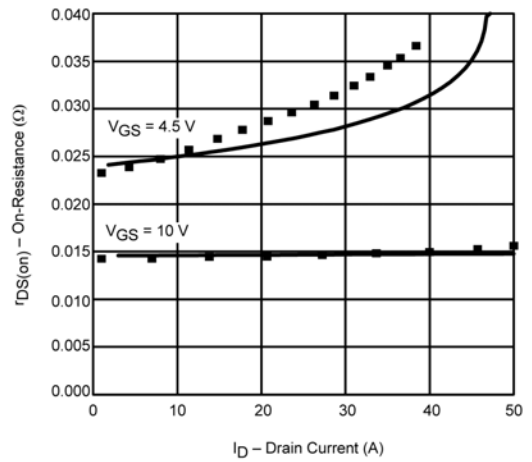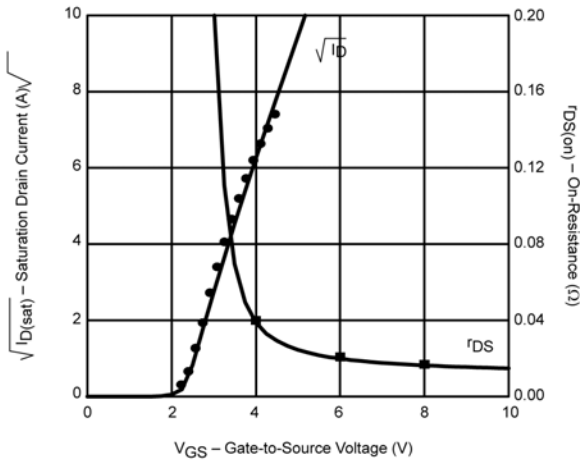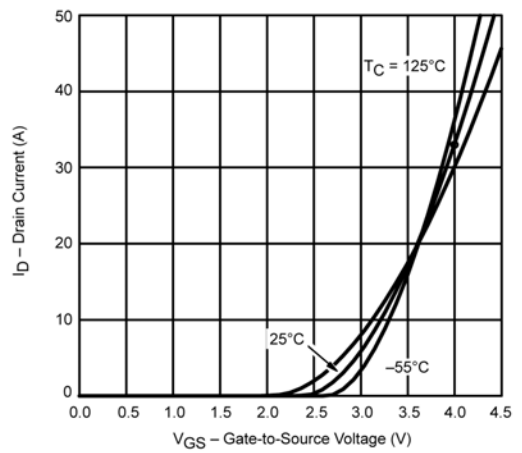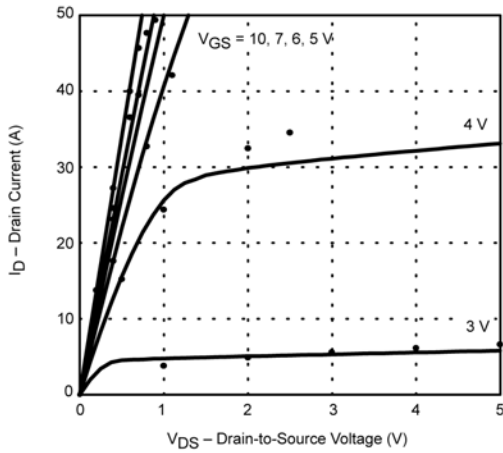
Note: Dots and squares represent measured data.