

## Automotive P-Channel 40 V (D-S) 175 °C MOSFET

### DESCRIPTION

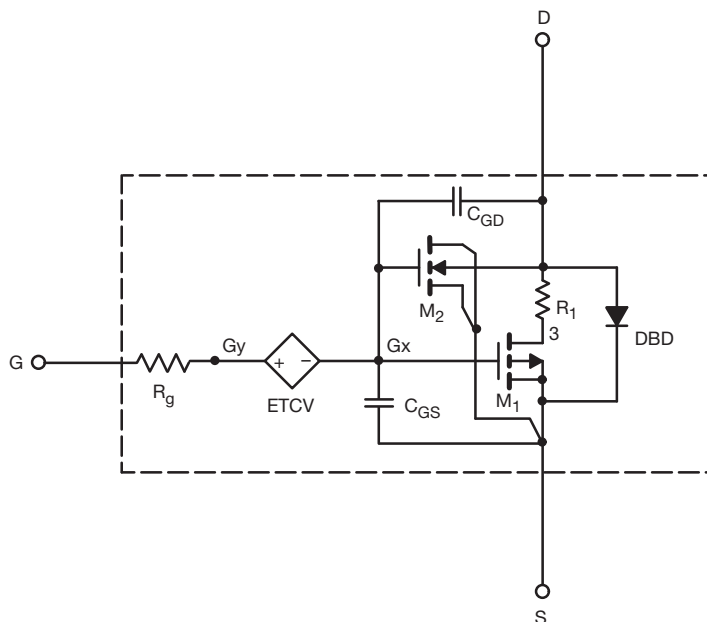
The attached SPICE model describes the typical electrical characteristics of the p-channel vertical DMOS. The subcircuit model is extracted and optimized over the -55 °C to 125 °C temperature ranges under the pulsed 0 V to 10 V gate drive. The saturated output impedance is best fit at the gate bias near 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.

### CHARACTERISTICS

- P-channel vertical DMOS
- Macro model (subcircuit model)
- Level 3 MOS
- Apply for both linear and switching application
- Accurate over the -55 °C to 125 °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



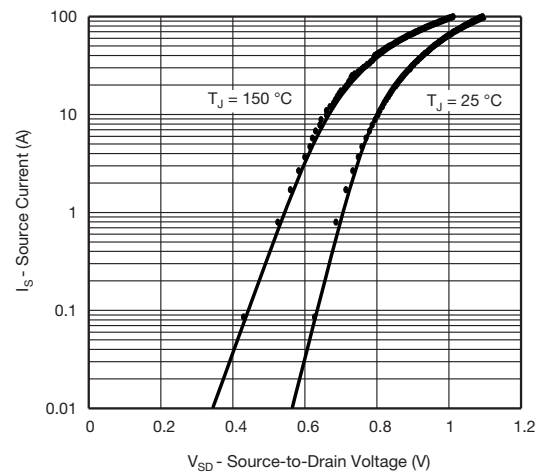
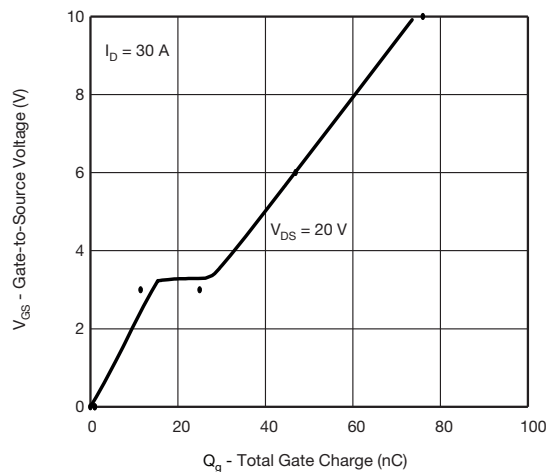
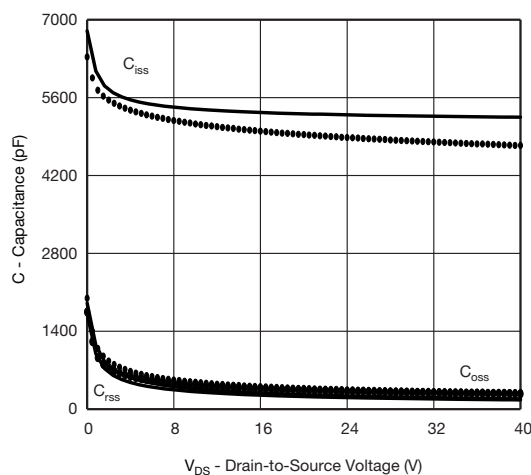
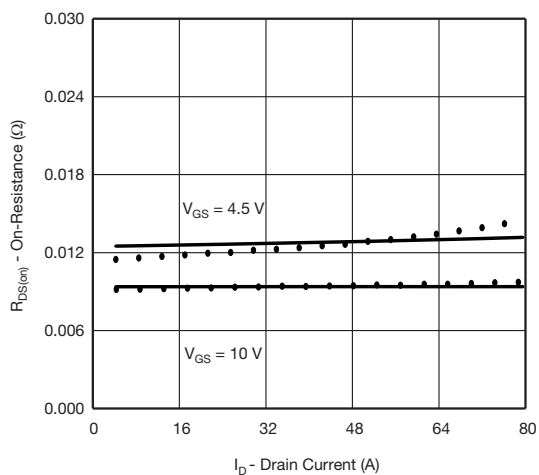
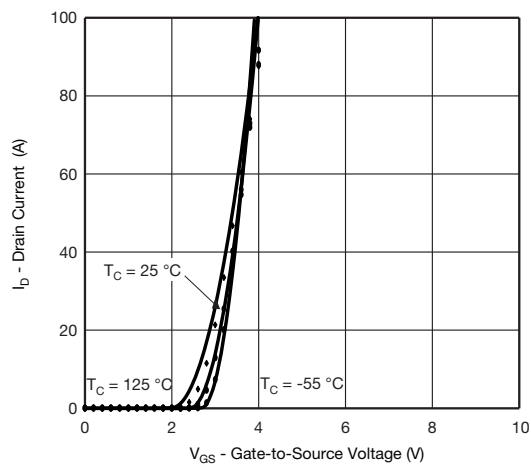
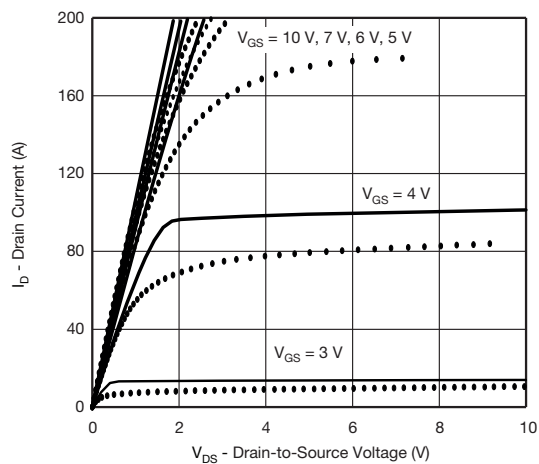
| <b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted) |              |  |                |               |          |
|--|--------------|--|----------------|---------------|----------|
| PARAMETER  | SYMBOL       | TEST CONDITIONS  | SIMULATED DATA | MEASURED DATA | UNIT     |
| <b>Static</b>  |              |  |                |               |          |
| Gate-source threshold voltage  | $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$                      | 2              | -             | V        |
| Drain-source on-state resistance <sup>a</sup>  | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}$ , $I_D = -30\text{ A}$                           | 0.0094         | 0.0095        | $\Omega$ |
|  |              | $V_{GS} = -4.5\text{ V}$ , $I_D = -25\text{ A}$                          | 0.0125         | 0.0121        |          |
| Forward transconductance <sup>a</sup>  | $g_{fs}$     | $V_{DS} = -15\text{ V}$ , $I_D = -30\text{ A}$                           | 70             | 71            | S        |
| Diode forward voltage  | $V_{SD}$     | $I_S = -30\text{ A}$   | -0.90          | -0.90         | V        |
| <b>Dynamic <sup>b</sup></b>  |              |  |                |               |          |
| Input capacitance  | $C_{iss}$    | $V_{DS} = -25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$     | 5200           | 4872          | pF       |
| Output capacitance   | $C_{oss}$    |  | 343            | 344           |          |
| Reverse transfer capacitance   | $C_{rss}$    |  | 316            | 316           |          |
| Total gate charge  | $Q_g$        | $V_{DS} = -20\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -30\text{ A}$ | 76             | 76            | nC       |
| Gate-source charge   | $Q_{gs}$     |  | 14             | 11.5          |          |
| Gate-drain charge  | $Q_{gd}$     |  | 14             | 13.5          |          |

**Notes**

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



## COMPARISON OF MODEL WITH MEASURED DATA ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)



### Note

- Dots and squares represent measured data

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