CHAPTER 7: Benchmark Test Results

A series of benchmark tests [26] have been performed to check the model robustness, accuracy and performance. Although not all the benchmark test results are included in this chapter, the most important ones are demonstrated.

7.1 Benchmark Test Types

Table 7-1 lists the various benchmark test conditions and associated figure number included in this section. Notice that for each plot, smooth transitions are apparent for current, transconductance, and source to drain resistance for all transition regions regardless of bias conditions.

Device Size	Bias Conditions	Notes	Figure Number
W/L=20/5	Ids vs. Vgs @ Vbs=0V; Vds=0.05, 3.3V	Log scale	7-1
W/L=20/5	Ids vs. Vgs @ Vbs=0V; Vds=0.05, 3.3V	Linear scale	7-2
W/L=20/0.5	Ids vs. Vgs @ Vbs=0V; Vds=0.05, 3.3V	Log scale	7-3
W/L=20/0.5	Ids vs. Vgs @ Vbs=0V; Vds=0.05, 3.3V	Linear scale	7-4
W/L=20/5	Ids vs. Vgs @ Vds=0.05V; Vbs=0 to -3.3V	Log scale	7-5
W/L=20/5	Ids vs. Vgs @ Vds=0.05V; Vbs=0 to -3.3V; W/L=20/5	Linear scale	7-6
W/L=20/0.5	Ids vs. Vgs @ Vds=0.05V; Vbs=0 to -3.3V	Log scale	7-7
W/L=20/0.5	Ids vs. Vgs @ Vds=0.05V; Vbs=0 to -3.3V	Linear scale	7-8
W/L=20/5	Gm/Ids vs. Vgs @ Vds=0.05V, 3-3V; Vbs=0V	Linear scale	7-9

Device Size	Bias Conditions	Notes	Figure Number
W/L=20/0.5	Gm/Ids vs. Vgs @ Vds=0.05V, 3-3V; Vbs=0V	Linear scale	7-10
W/L=20/5	Gm/Ids vs. Vgs @ Vds=0.05V; Vbs=0V to -3.3V	Linear scale	7-11
W/L=20/0.5	Gm/Ids vs. Vgs @ Vds=0.05V; Vbs=0V to -3.3V	Linear scale	7-12
W/L=20/0.5	Ids vs. Vds @Vbs=0V; Vgs=0.5V, 0.55V, 0.6V	Linear scale	7-13
W/L=20/5	Ids vs. Vds @Vbs=0V; Vgs=1.15V to 3.3V	Linear scale	7-14
W/L=20/0.5	Ids vs. Vds @Vbs=0V; Vgs=1.084V to 3.3V	Linear scale	7-15
W/L=20/0.5	Rout vs. Vds @ Vbs=0V; Vgs=1.084V to 3.3V	Linear scale	7-16

Table 7-1. Benchmark test information.

7.2 Benchmark Test Results

All of the figures listed in Table 7-1 are shown below. Unless otherwise indicated, symbols represent measurement data and lines represent the results of the model. All of these plots serve to demonstrate the robustness and continuous behavior of the unified model expression for not only I_{ds} but G_m, G_m/I_{ds}, and R_{out} as well.

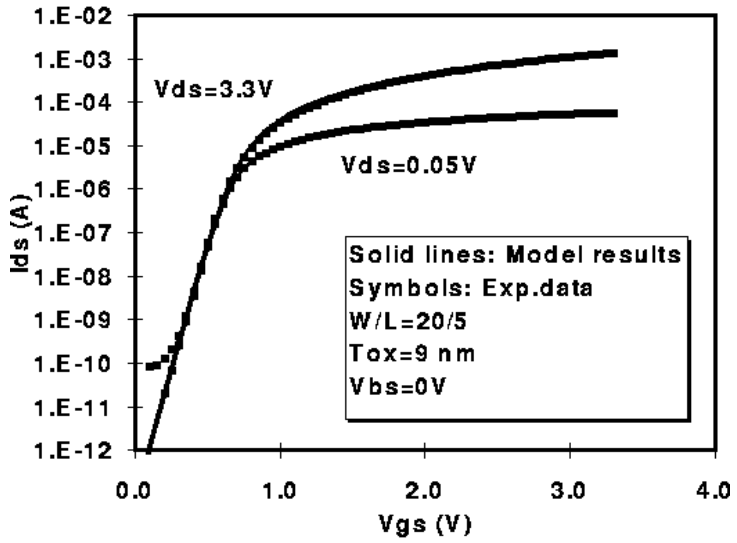

Figure 7-1. Continuity from subthreshold to strong inversion (log scale).

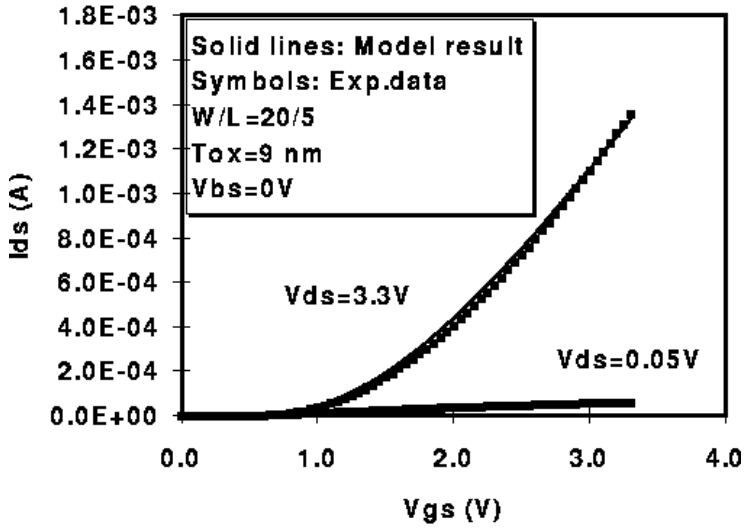

Figure 7-2. Continuity from subthreshold to strong inversion (linear scale).

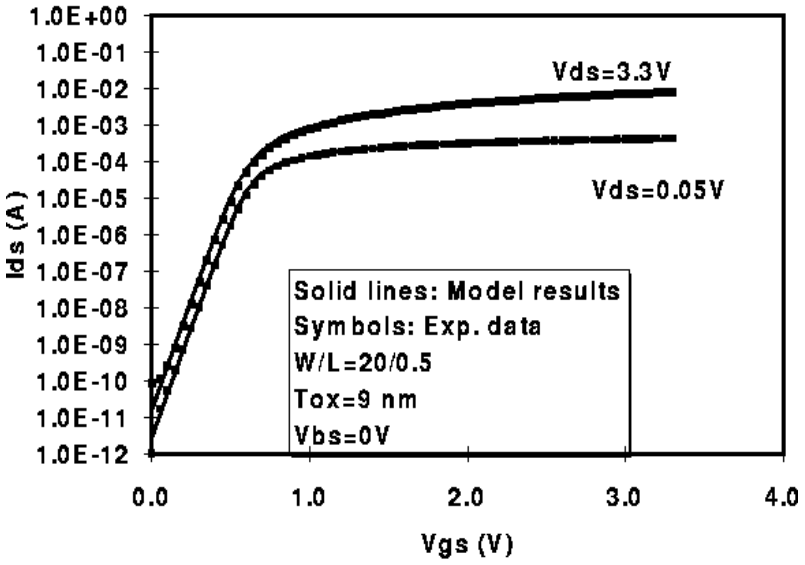

Figure 7-3. Same as Figure 7-1 but for a short channel device.

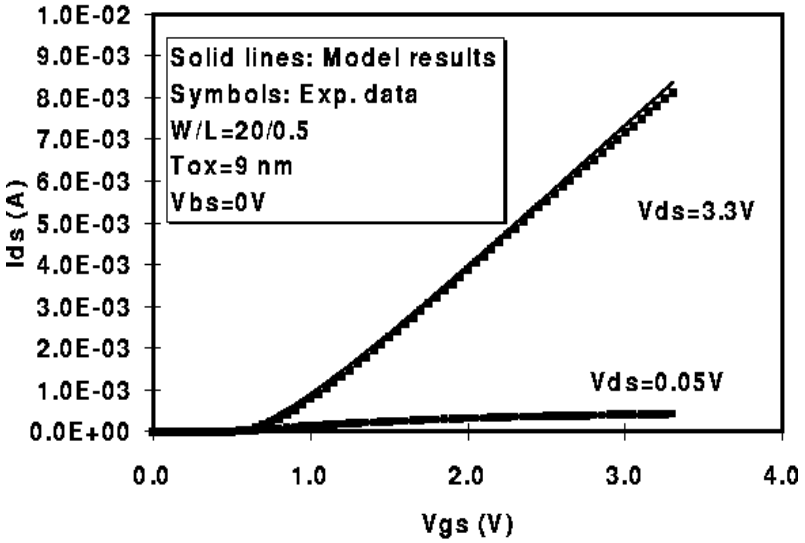

Figure 7-4. Same as Figure 7-2 but for a short channel device.

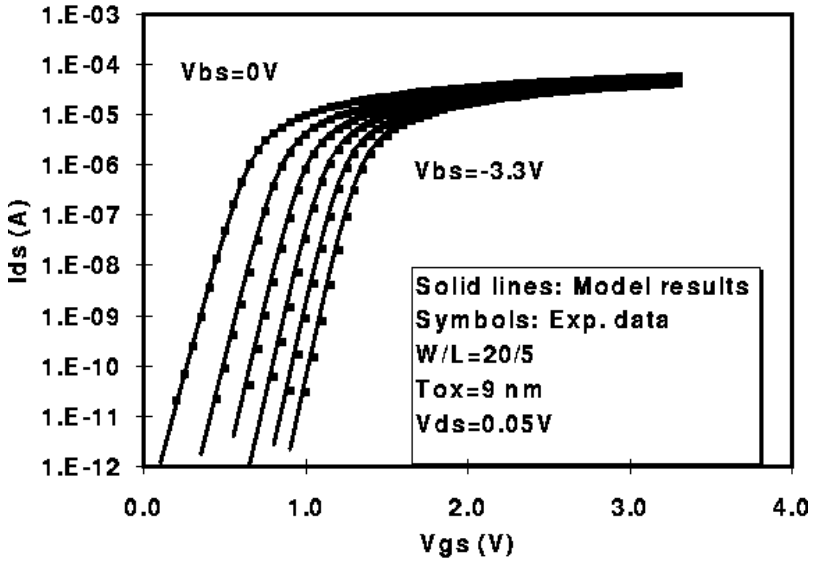

Figure 7-5. Subthreshold to strong inversion continuity as a function of V_{bs}.

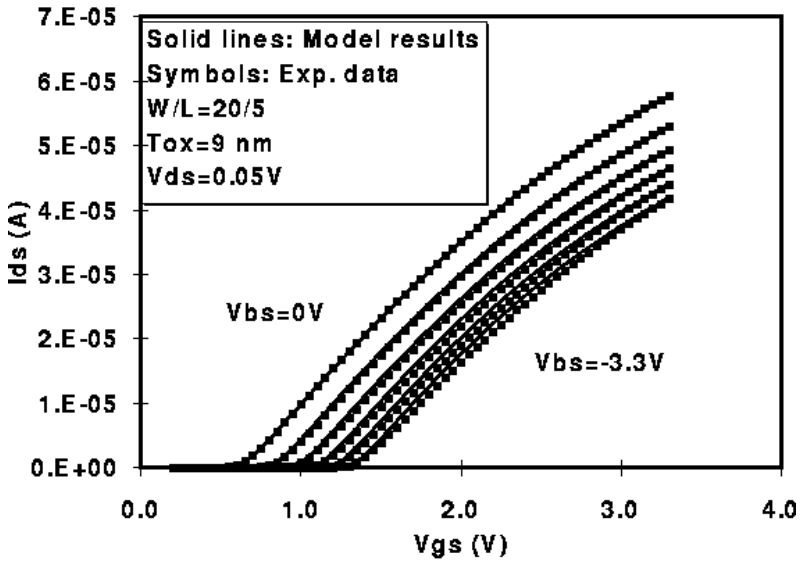

Figure 7-6. Subthreshold to strong inversion continuity as a function of V_{bs}.

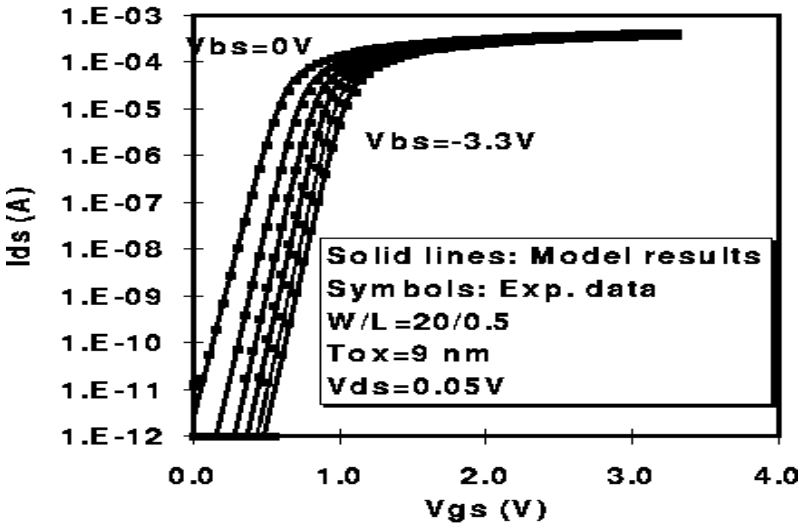

Figure 7-7. Same as Figure 7-5 but for a short channel device.

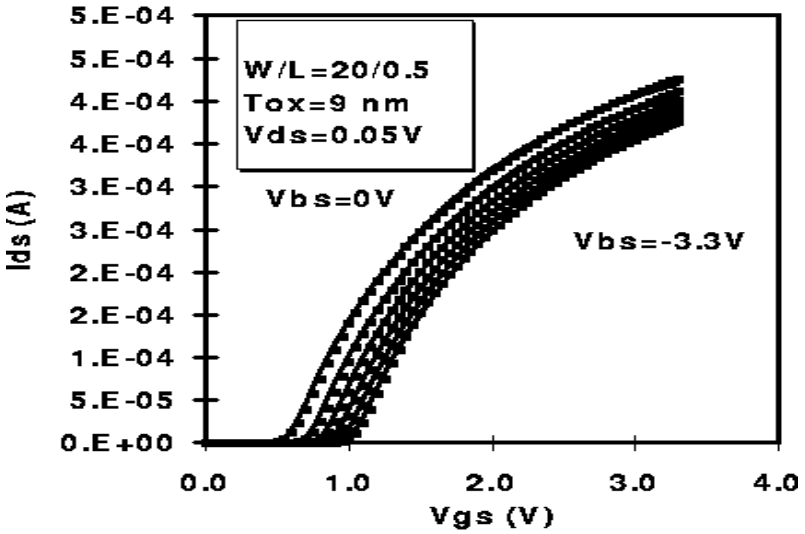

Figure 7-8. Same as Figure 7-6 but for a short channel device.

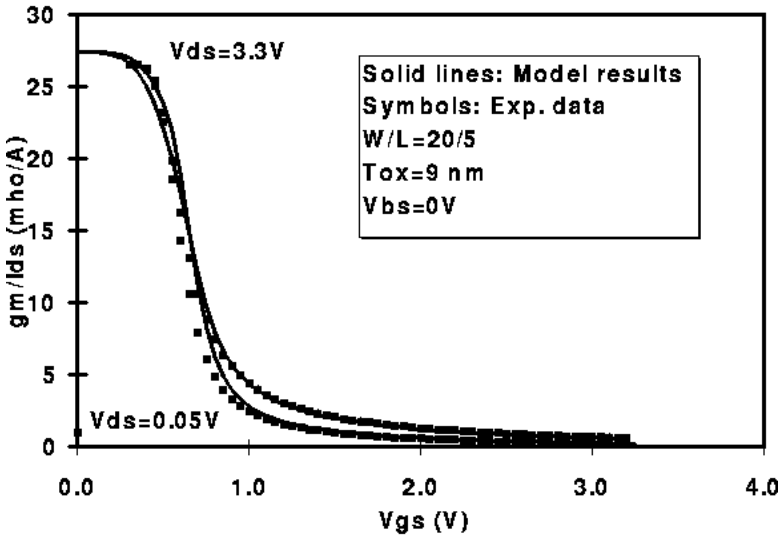

Figure 7-9. G_m/I_{ds} continuity from subthreshold to strong inversion regions.

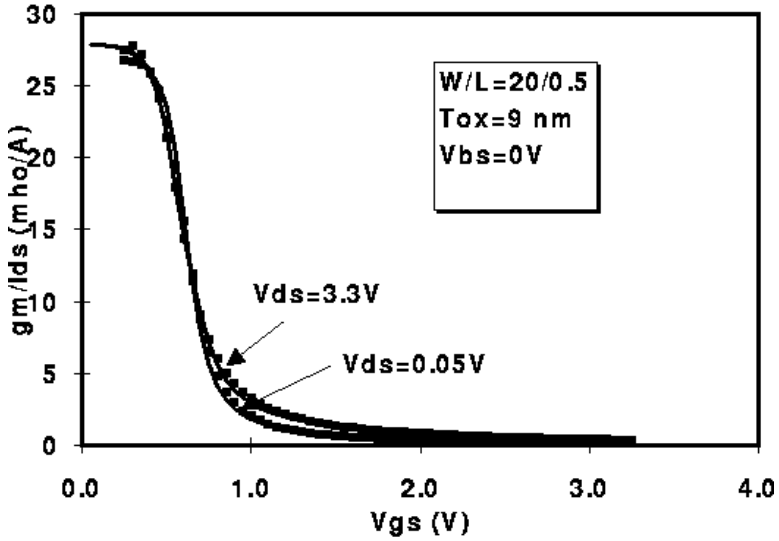

Figure 7-10. Same as Figure 7-9 but for a short channel device.

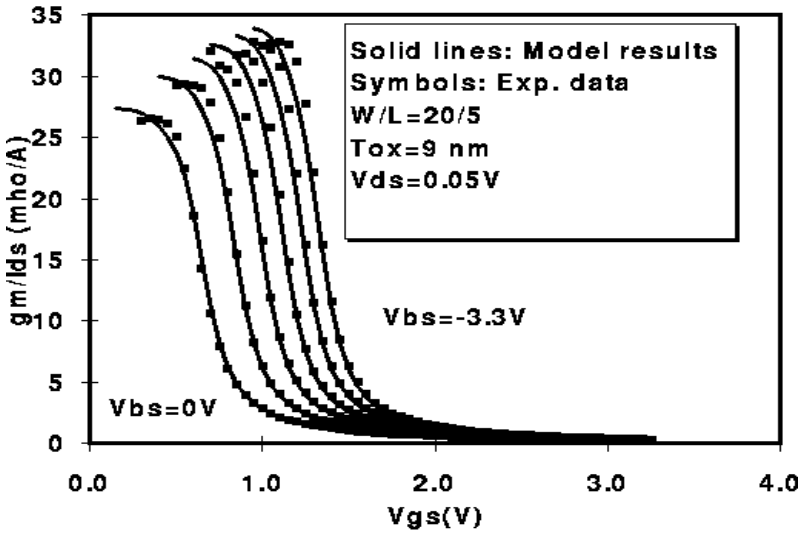

Figure 7-11. G_m/I_{ds} continuity as a function of V_{bs}.

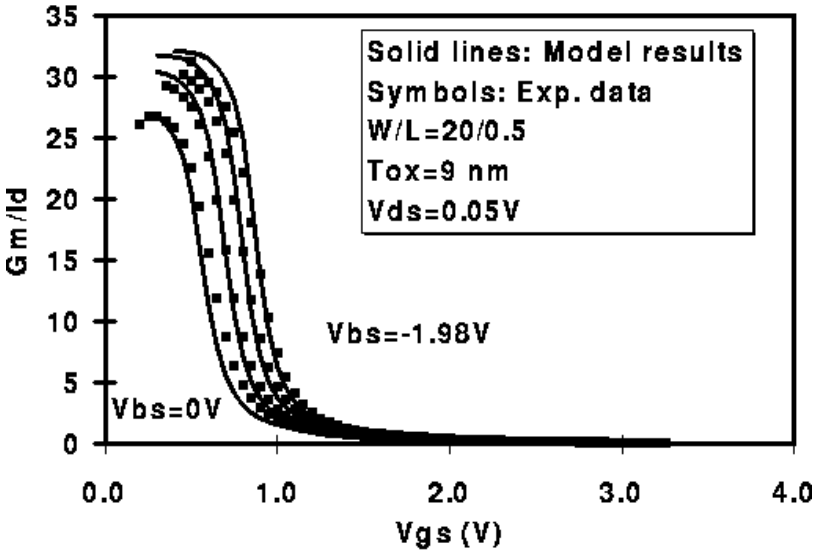

Figure 7-12. Same as Figure 7-11 but for a short channel device.

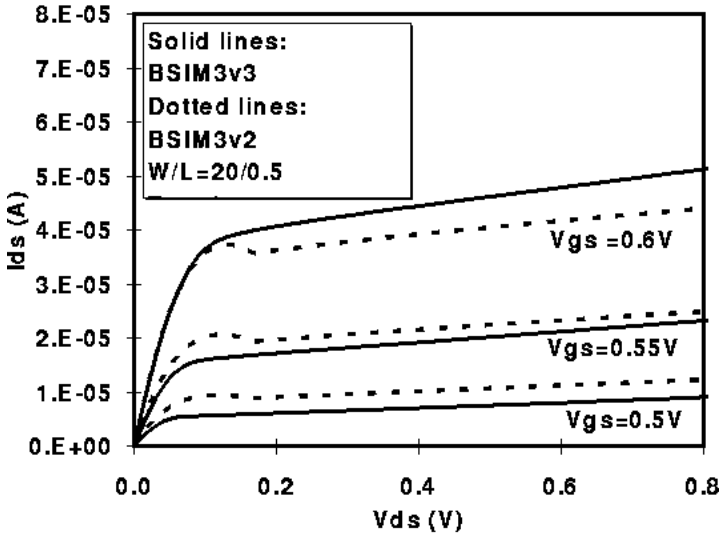

Figure 7-13. Comparison of G_{ds} with BSIM3v2.

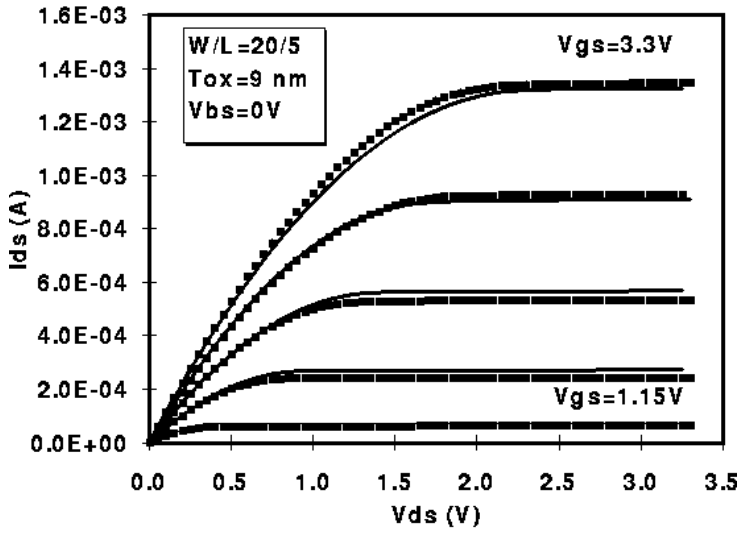

Figure 7-14. Smooth transitions from linear to saturation regimes.

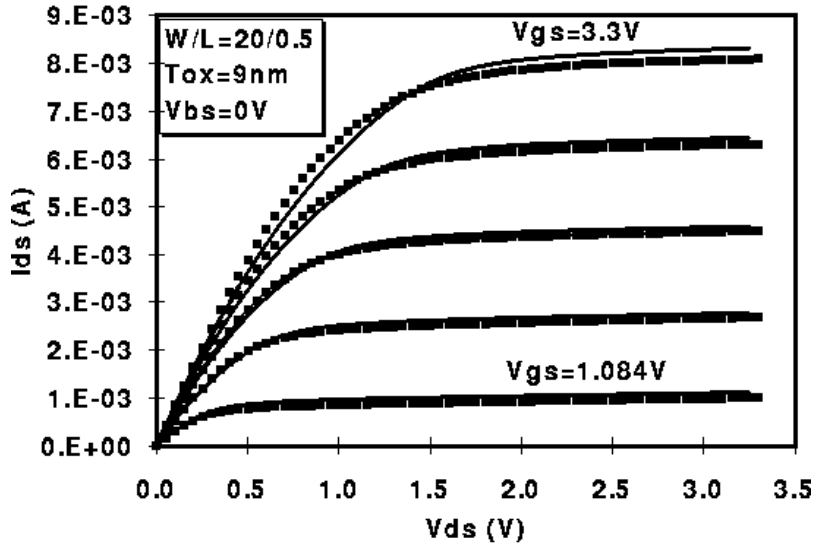

Figure 7-15. Same as Figure 7-14 but for a short channel device.

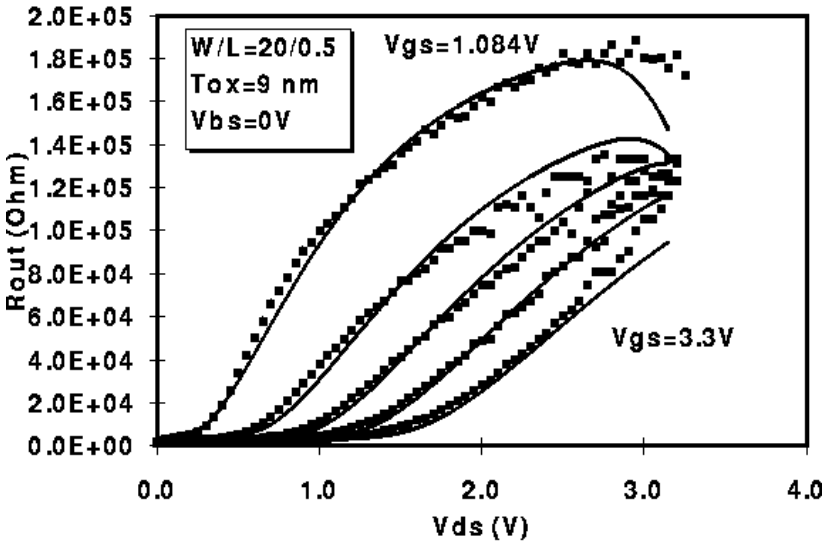

Figure 7-16. Continuous and non-negative R_{out} behavior.