

## THIN FILM TRANSISTOR MODELING: FREQUENCY DISPERSION

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Using new materials (including organic materials), scaling down to shorter device sizes, using printed TFT technology, and operating Thin Film Transistors (TFTs) at higher frequencies all bring upfront the issues of frequency dispersion of the TFT current-voltage and capacitance-voltage characteristics. This dispersion depends on the interplay of the contact phenomena and electron transport in the device channel. The standard way to account for the frequency dispersion is using the Elmore model (see Fig. 1 a) [1,2], which introduces the RC delays to reflect the propagation time of the carriers along the channel. However, this model is not sufficient for the quantitative modeling or parameter extraction for three reasons. First, it does not account for varying carrier and potential distributions. This could be remedied by using an RC transmission line model with varying parameters along the channel and further improved by making accounting for nonlinearities of the transmission line segments, similar to what has been done in the THz SPICE [3] (see Fig. 1b). Second, in contrast to crystalline field effect transistors, traps in the TFT channel also play a crucial role in determining the TFT frequency dispersion. This has been accounted for by introducing frequency dependent temperature model Variable Dispersion Model (VDM). [4] Third, the TFT contacts might determine the frequency dispersion and in short channel TFTs, and the non-uniform current distribution along the contact needs to be accounted for. In this paper, we review the emerging modeling approaches for reproducing the frequency dispersion in different types of TFTs with emphasis on the compact models that could be used for the device characterization, device and circuit design (when implemented in SPICE) and for the parameter extraction.

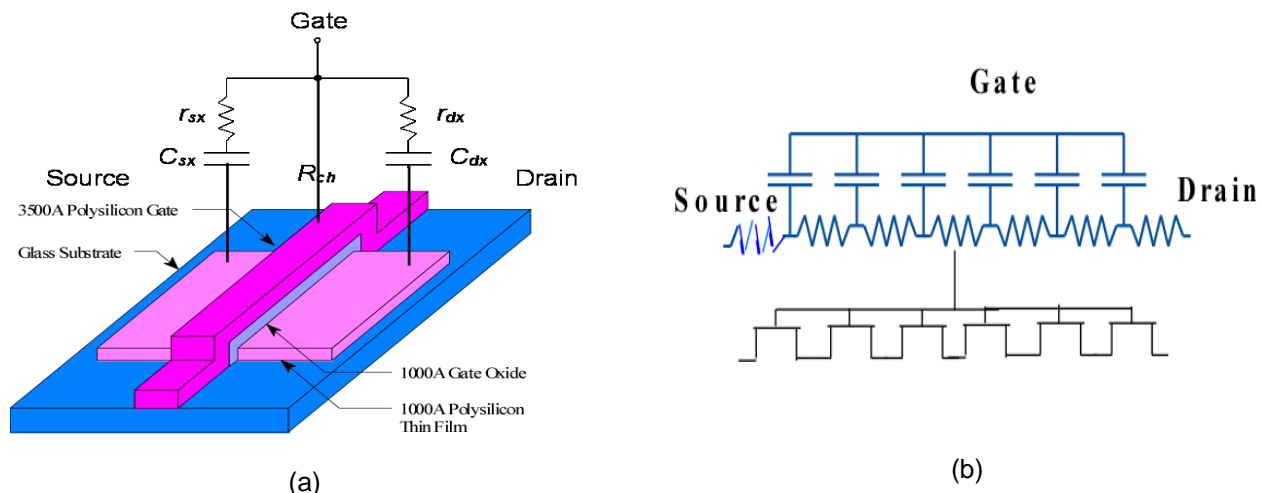


Figure 1 TFT structure and Elmore model (a) and transmission line and non-linear transmission line models (b).

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