

ABSTRACT :

Influence of the package on conducted mode emissions in a digital integrated circuit : a case study

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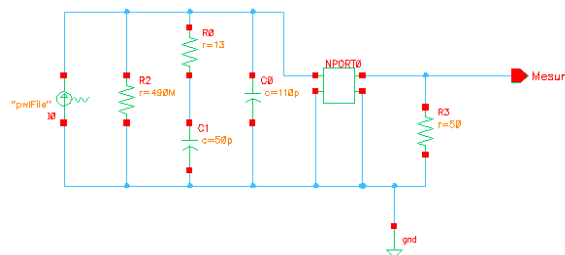
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Nowadays, it is clearly stated that perturbations generated by digital integrated circuits have to be taken into account as soon as in the design phase. These perturbations rise from current pulses related to state changes in logical gates. However, the characteristics of these pulses closely depend from the environment of the integrated circuit, thus making it compulsory to model its behavior towards these transitions.

The simplest model consists in replacing the integrated circuit by an ideal current generator $I(t)$, the parameters of which can be obtained by simulation means. In addition, in order to improve this model, a study was conducted from a 16-bit asynchronous counter in 0,6 μm CMOS technology.

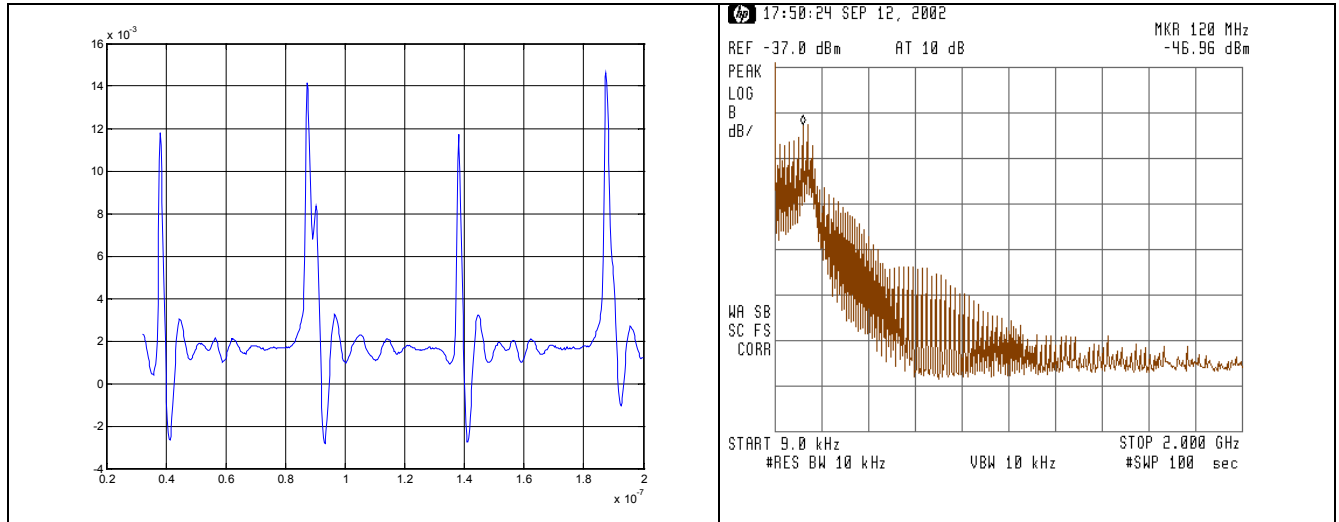


In fact, the counter chip was laid out on a PCB with connections as short as possible ; then, current pulses were measured from the voltage generated on the terminals of a 1- Ω resistor in series between chip ground and PCB ground. This work allowed us to present a model taking into account the behavior of both the chip and its environment.

Research was further conducted in order to model the behavior of the chip now inserted in its package. In fact, by supposing that the influence of the package was concentrated on the power and ground supply connections of the chip, and that these could be

replaced by a resistor R in series with an inductor L, the study was carried out by placing the die on a PCB including the measurement circuitry as well as the elements representing the package.

Measurements were achieved using $R=0\ \Omega$ and $R=0,6\ \Omega$, $L=20\ \text{nH}$ and $L=2,7\ \text{nH}$, in both frequency and time domains.



In order to compare simulation and measurements, the behavior of the circuitry external to the die (PCB tracks, R and L devices, power supply) was studied from S-parameters. These results were then compared to the ones obtained by mounting a die in its package. In this case, two methods for measuring the current flowing from die ground were explored : 1- Ω resistor between chip ground and PCB ground, and a Tektronix CT6 current probe.

References:

- [1] E. Sicard, Chen Xi “ Modélisation de l’activité en courant d’un Coeur de circuit integer” CEM Compo 99 Toulouse, p79-84
- [1] M.Ramdani, J.L Levant « Méthode de conception orientée CEM des CI logiques à haute densité » CEM Compo 00 Toulouse p 32-37.