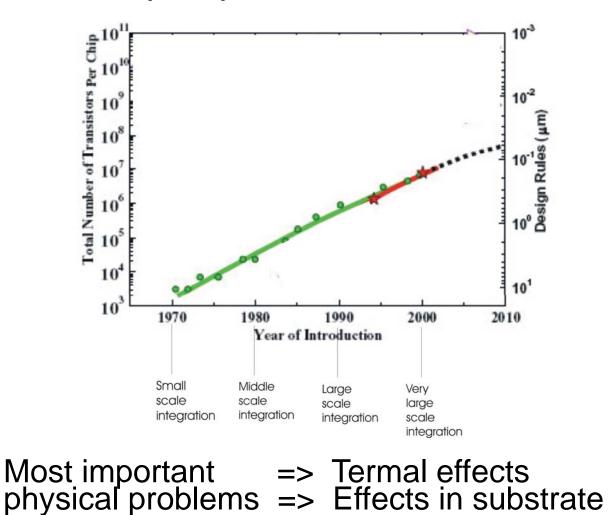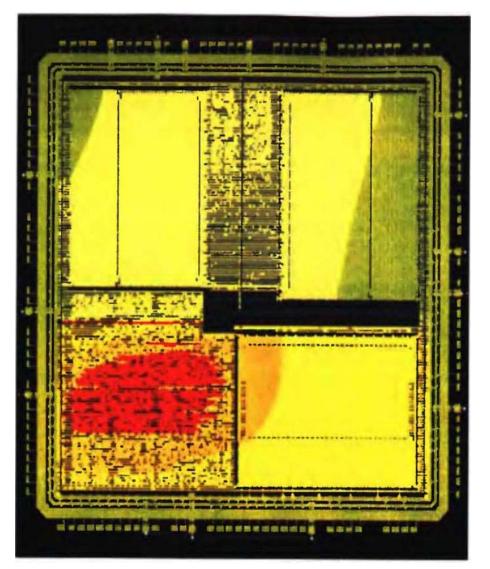# MB JASS - 2009

Numerical models of MOS devices and modelling methodology of physical effects in IC substrates.

T. Krupkina, D. Rodionov, A. Nikolaev.
Moscow State Institute of Electronic Technics (Technical University)
ieem@miee.ru
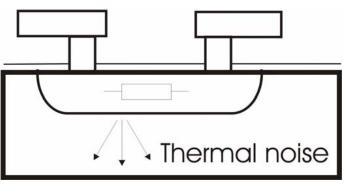
Historical perspective of the ICs evolution

Most important   => Termal effects
physical problems => Effects in substrate

Substrate noise distribution

Main problem => Substrate noise can cover all chip

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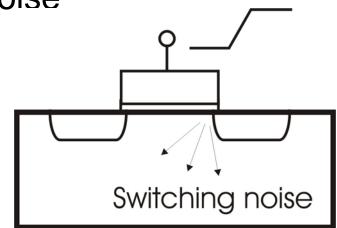## Modern features in integrated circuits design

- Complexity and integration level are increase with moving to new technology generation;

- IC development flows are moving to 'System-on-chip' projects;

- Deep submicron technology process are using. New physics effects are incoming;

- Impact from effects in IC substrate are increasing;

Substrate noise classification:
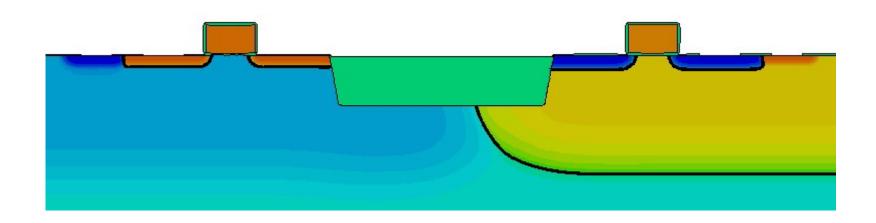
- Intrinsic (thermal) noise

- Switching noise

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Technology CAD systems application in IC and SoC design

- Development of technology processes and integrated device constructions;

- Definition of the minimal layout size and library cell creation

- Calculation of effects in SoC substrate that define interaction between integrated devices;

- Calculation of electrophysical parameters, electrical characteristics of integrated devices using numerical multidimentional modelling of IC blocks and substrate cross sections;
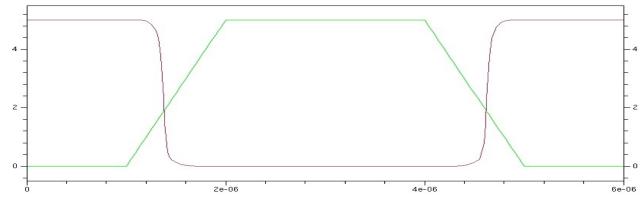
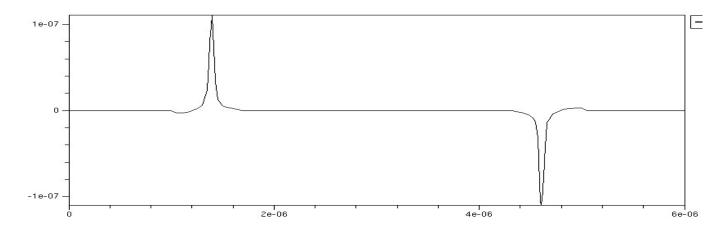## Research of distributed physical effects using TCAD Synopsys tools

CMOS process with N-well and shallow trench isolation
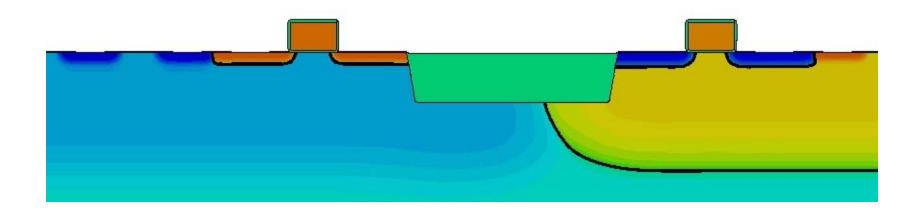
Tran analysis results
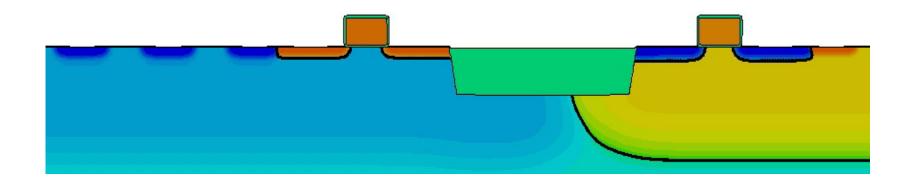
- Input and output pulse signals

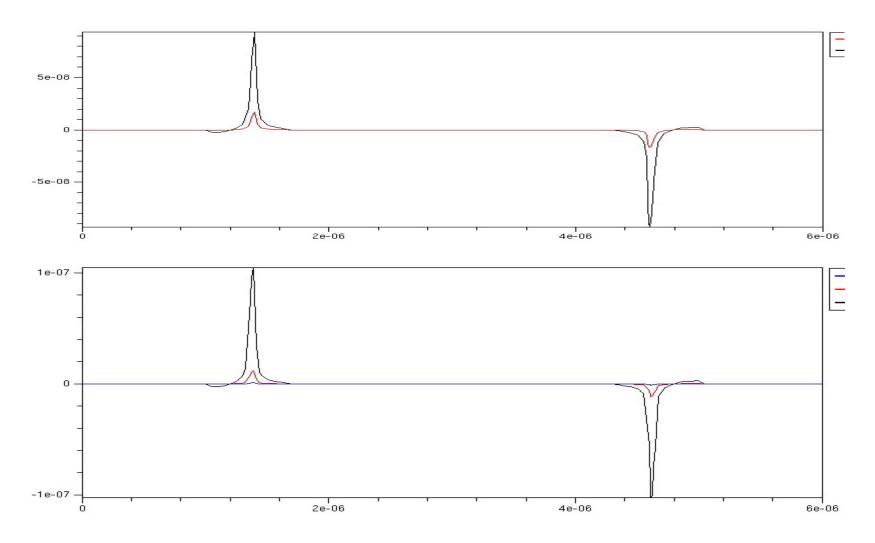- Dynamic current change through substrate contact

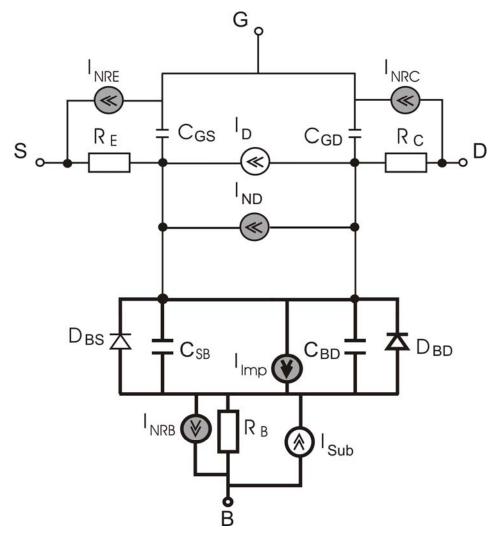**CMOS cross sections with 2 and 3 substrate contacts**

Dynamic current change through substrate contacts

Equivalent non-linear circuit of nMOS device with elements that taking into account substrate influence

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Equivalent non-linear circuit of pMOS device with elements

that taking into account substrate influence

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