MiMOSA

SUMMARY

"Above and In-IC RF MEMS"
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RF MEMS can be categorized according to functionality criteria. A possible approach is to divide them in: (i) RF MEMS switches (with similar functionality to the MOS switch in silicon ICs), (ii) passives (MEMS inductors and capacitors), (iii) resonators (providing full equivalent circuit functions) and (iv) transmission lines and antennas.

RF MEMS looks attractive for RF IC telecommunication applications, especially wireless, because they offer : (i) device and systemminiaturization, (ii) integration above- and in- ICs and lower costs, (iii) power savings, (iv) novel integrated functionality together with high performance (supporting, for instance, future reconfigurable mobilecommunication systems and (v) better reliability in harsh environment.

One challenge for the future is to design a reconfigurable transceiver dedicated to different applications such as GPS, local/home level, 3G mobile terminals. In this case, particular attention is paid to the power consumption of the building blocks of the transceiver where RF MEMS could significantly contribute. Typical device blocks such as switched capacitors arrays, switched inductors arrays, will be used in order to achieve reconfiguration of key analog blocks such as filters, Voltage Controlled Oscillators (VCOs), impedance matching circuits, etc. Particular gains and advances in terms of real new MEMS-adapted transceiver architectures can be made by the use of recently demonstrated MEMS resonators.

Above- and In-IC integration of RF MEMS is foreseen in direct connection with the use of these devices in RF applications and especially in wireless. It raises two basic problems: (i) to monolithically integrate the MEMS device with the electronics (avoid wiring between two separate dies) and (ii) ensure full operational compatibility (voltages, current, impedance) between MEMS and IC.

From the technological point of view, because most part of RF MEMS switch (contact or contact-less) and/or passive devices fabrication requires surface micro-machining, integration with CMOS active devices is achievable: Use of materials such as metals (Al, Au, AlCu, Cu, Ni, Pt, W) or polysilicon for both suspended and fixed membranes/cantilevers and of sacrificial layers (1-10mm) such as polymers (polyimide), SiO2 or silicon, are the most versatile solutions for above- and in-IC integration. Above- and In- IC RF MEMS process also requires a low-temperature (<400°C) budget and tight control of the degradation of the electrical characteristics of associated electronics.