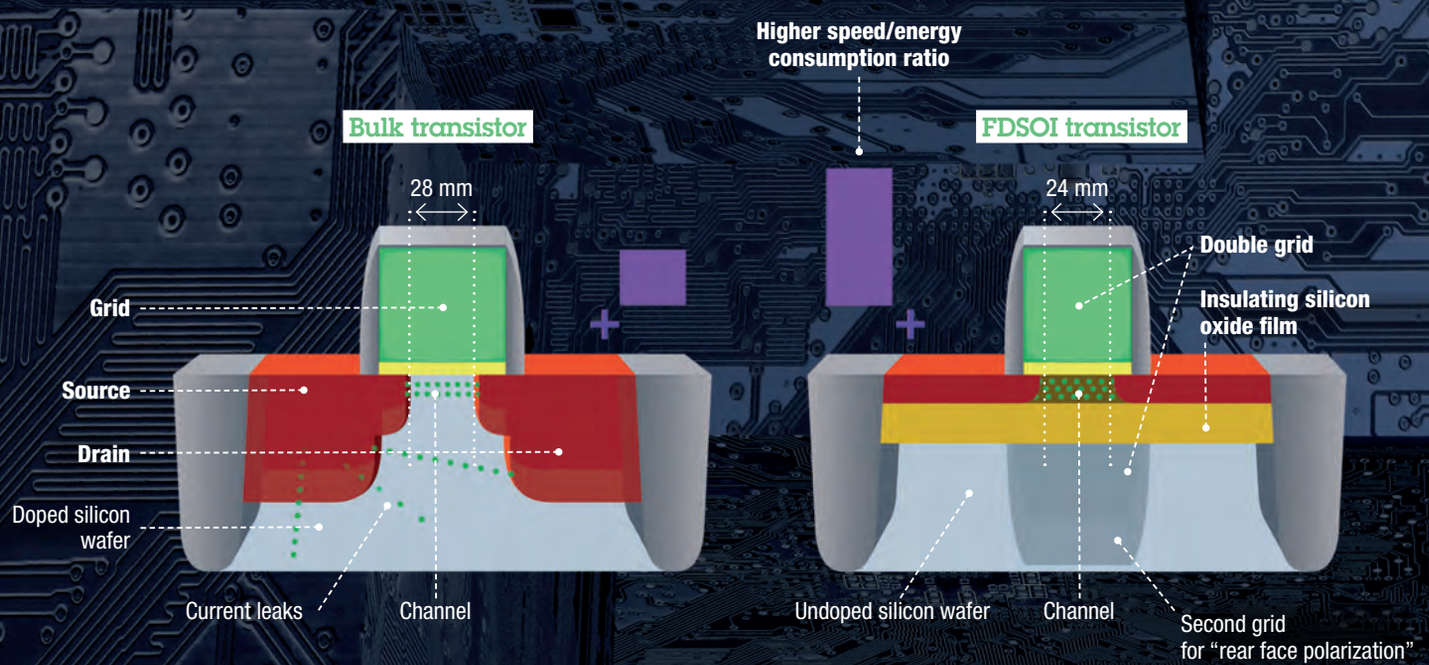
The FDSOI transistor

PRINCIPLE

Leti-designed FDSOI technology is based around adding a film of insulating silicon oxide to conventional transistor architecture. This innovation ensures efficient, energy saving transistor operation, while responding to the challenge of miniaturization.



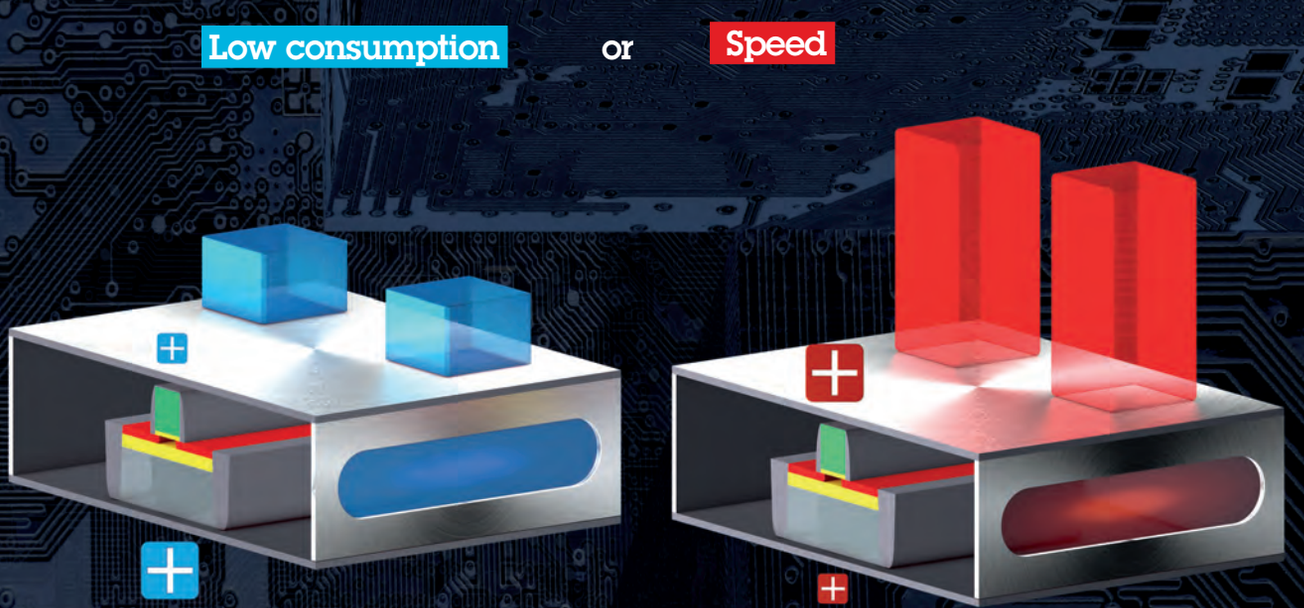
The quest for the infinitely small

There's a transistor at the heart of every microprocessor. It is composed of three elements supported by a doped, generally solid silicon wafer: the grid (or gate), the source and the sink. When an electrical voltage is applied to the grid, an electron current flows between the source and the sink via the silicon. Thus, by applying or not applying a voltage, a transistor works like a switch in an open or closed position, thereby producing the 0 and 1 composing binary data. To increase speed and lower energy consumption of transistors, the microelectronics industry has continually reduced their size down to around 20 nanometers, at which current leaks appear, causing a deterioration in transistor performance.

Credit: Mathieu Grousson, Aude Garnier / Fabrice Mathé (Computer graphics), in collaboration with **Olivier Faynot and François Andrieu of Leti, CEA Tech Institute**

MAJOR ADVANTAGES

- ➜ 25% faster than equivalent transistors on solid silicon.
- ➜ 30 - 40% less energy consuming than equivalent transistors on solid silicon.
- ➜ Operating voltage reduced to 0.4 V and very low power dissipation.
- ➜ High reliability with calculation error rate 100 to 100 times less than solid wafer technologies.
- ➜ Very low variability of transistors on the same board because the silicon wafer is not doped and is very uniform.
- ➜ Competitive because its planar architecture allows production on standard microelectronics tools.



The FDSOI solution

FDSOI technology overcomes current leakage by using a thin film of silicon laid on a thin layer of insulating silicon oxide. Acting as a barrier, the latter insulating layer is deposited on the silicon wafer, which no longer requires doping.

The transistor performance characteristics can be enhanced by applying a voltage to its rear face: this is called «rear face polarization». The combination of this voltage and the insulating oxide layer then becomes a second grid and, depending on the relative voltages applied to the transistor's front and rear faces, its properties can be altered as desired: the FDSOI transistor can either be very low energy or very fast.