EECS16B
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40 Years of Microprocessor Trend Data

Transistors (thousands)
Single-Thread Performance (SpecINT x 10^3)
Frequency (MHz)
Typical Power (Watts)
Number of Logical Cores

Year

A **fin field-effect transistor** (FinFET) is a multigate device, a MOSFET (metal-oxide-semiconductor field-effect transistor) built on a substrate where the gate is placed on two, three, or four sides of the channel or wrapped around the channel, forming a double gate structure. These devices have been given the generic name "finfets" because the source/drain region forms fins on the silicon surface. The FinFET devices have significantly faster switching times and higher current density than planar CMOS (complementary metal-oxide-semiconductor) technology.

FinFET is a type of non-planar transistor, or "3D" transistor. It is the basis for modern nanoelectronic semiconductor device fabrication. Microchips utilizing FinFET gates first became commercialized in the first half of the 2010s, and became the dominant gate design at 14 nm, 10 nm and 7 nm process nodes.
The potential of Digh Hisamoto's research on DELTA transistors drew the attention of the Defense Advanced Research Projects Agency (DARPA), which in 1997 awarded a contract to a research group at UC Berkeley to develop a deep sub-micron transistor based on DELTA technology.[10] The group was led by Hisamoto along with TSMC's Chenming Hu. The team made the following breakthroughs between 1998 and 2004.[11]

- **1999 – P-channel FinFET (sub-50 nm)** – Digh Hisamoto, Chenming Hu, Xuejue Huang, Wen-Chin Lee, Charles Kuo, Leland Chang, Jakub Kedzierski, Erik Anderson, Hideki Takeuchi[13]
- **2001 – 15 nm FinFET** – Chenming Hu, Yang-Kyu Choi, Nick Lindert, P. Xuan, S. Tang, D. Ha, Erik Anderson, Tsu-Jae King Liu, Jeffrey Bokor[14]
- **2004 – High-k/metal gate FinFET** – D. Ha, Hideki Takeuchi, Yang-Kyu Choi, Tsu-Jae King Liu, W. Bai, D.-L. Kwong, A. Agarwal, M. Ameen

They coined the term "FinFET" (fin field-effect transistor) in a December 2000 paper,[16] used to describe a non-planar, double-gate transistor built on an SOI substrate.[17]
Apple iPhone 11 Pro Max Teardown

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We are always excited to see a new Apple iPhone, and this year’s iPhone 11 line is no exception. This is the first ever Apple event to launch an iPhone with three rear cameras. There is also the mysterious U1 chip which appeared on screen at the Apple event, but which no one on stage made mention of. And, let’s not forget Apple is replacing the 7000 grade aluminum body with 100% recycled aluminum - a choice aimed at environmental responsibility.

The iPhone 11 Pro Max we have in our hands is a Midnight Green Model A2161 with 512 GB of storage.

Board Images

The following annotated board images show the design wins we have identified so far.

Design Wins

ST Microelectronics STPM80 Wireless Charging Receiver IC