

Advanced Integrated Circuit Technology

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Recommended Literature

S. A. Campbell, *The Science and Engineering of Microelectronic Fabrication*. Oxford Series in Electrical Engineering, Oxford University Press, 1996, ISBN: 0-19-510508-7

C. Y. Chang, S. M. Sze, *ULSI Technology*. McGraw-Hill, 1996, ISBN: 0070630623

B. El-Karah, *Fundamentals of semiconductor processing technologies*. Kluwer Academic Publishers, 1995.

S. Wolf, R. N. Tauber, *Silicon Processing for the VLSI Era*. Lattice Press, 2000, ISBN 0-9616721-6-1

S. Deleonibus, *Electronic Device Architectures for the Nano-CMOS Era*. Pan Stanford Publishing Pte. Ltd., Singapore, 2009, ISBN 13 978-981-4241-28-1 / ISBN 10 981-4241-28-8.

F. Schwierz, H. Wong, J.J. Liou, *Nanometer CMOS*. Pan Stanford Publishing Pte. Ltd., Singapore, 2010, ISBN-10 981-4241-08-3

Tapan K. Gupta: Copper Interconnect Technology (McGraw-Hill Professional; 1st edition, 2008)

Mikhail Baklanov, Paul S. Ho, Ehrenfried Zschech: Advanced Interconnects for ULSI Technology (John Wiley & Sons, 2012)