

TSV互连结构传输性能分析及故障建模研究

尚玉玲¹, 钱伟¹, 李春泉², 豆鑫鑫¹

(¹ 桂林电子科技大学 电子工程与自动化学院, 广西 桂林 541004;

² 桂林电子科技大学 机电工程学院, 广西 桂林 541004)

摘要: 随着集成电路复杂度的提高以及半导体制造工艺水平的不断发展, 硅通孔(Through Silicon Via)TSV技术成为三维集成电路的一种主流互连技术, 建立单个TSV的三维物理模型, 通过回波损耗来分析不同物理参数和尺寸变化对信号传输性能的影响; 利用硅通孔的参数提取模型对其进行RLC参数的提取, 并建立等效的电路模型和故障电路模型. 扫描频率在10 GHz范围内, 利用故障电路末端电压来分析故障的大小, 同时通过最小二乘法拟合一条根植电压曲线来判断故障大小.

关键词: 三维集成电路; 信号完整性; 硅通孔; 回波损耗; 短路故障

Analysis Transmission Performance of TSV

Interconnect Structure and Fault Model

SHANG Yu-ling¹, QIAN Wei¹, LI Chun-quan², DOU Xin-xin¹

(¹ School of Electronic Engineering and Automation, Guilin University of Electronic

Technology, Guilin 541004, China; ² School of Electromechanical Engineering,

Guilin University of Electronic Technology, Guilin 541004, China))

Abstract: With the increasing complexity of IC and the development of the semiconductor manufacturing process, through silicon via (TSV) has become a main interconnect technology for 3D-IC. 3D physical model of single TSV is built to analyze the effect of different physical parameter and changing size on the performance of signal transmission by return loss. The parameter extraction model of TSV is adopted to obtain the parameter of RLC. Furthermore, both the equivalent circuit model and the fault circuit model are established. The value of the crack is determined by the changing terminal voltage of the fault circuit in the frequency range of 10 GHz. At the same time, the curve on judging the value of crack is estimated with the least square method.

Key words: 3D integrated circuit; signal integrity; through-silicon-via; return loss; short fault

作者简介:

尚玉玲 女, (1977-), 博士, 副研究员. 研究方向为集成电路测试、信号完整性分析方面的研究.

钱伟 男, (1990-), 硕士研究生. 研究方向为信号完整性分析研究.

李春泉(通讯作者) 男, (1975-), 博士后, 教授, 硕士研究生导师. 研究方向为微电子制造工程、先进制造技术、信号完整性分析研究, E-mail: lichunquan@gmail.com.

豆鑫鑫 男, (1990-), 硕士研究生. 研究方向为信号完整性分析研究.