Very Large Scale Integration (VLSI) Systems, 3 (3), 437 (September 1995). Merged Current Switch Logic (MCSSL) and Differential Cascode Voltage Switch Logic (DCVSL) are two common structures for differential BiCMOS logic family, that have several potential applications in high-speed VLSI circuits. This paper studies the fault characterization of these BiCMOS circuits. The impact of each possible single fault on the behavior of the circuits is analyzed by simulation. A new class of faults which is unique to differential circuits is identified and its testability is assessed. We propose a design-for-testability method that facilitates testing of this class of faults. Two different realizations for this method are introduced. The impact of this circuit modification on the behavior of the circuit in normal mode is investigated.

Bathtub failure rate and upside-down bathtub mean residual life. Jie Mi. IEEE Transactions on Reliability, 44 (3), 388 (September 1995). This paper shows that: (1) the mean residual life (MRL) of a component has an upside-down bathtub-shape if the component has a bathtub-shape failure-rate function, but the converse does not hold; (2) there is an optimal burn-in policy to maximize the MRL when the underlying lifetime distribution has a bathtub-shape failure rate.

Quick inspection of power plane short fault on multilayer substrate. Fang-Lin Chao and Ruey-Beei Wu. IEEE Transactions on Components, Packaging, and Manufacturing Technology, Part A, 18 (3), 466 (September 1995). A quick inspection approach for finding the power plane short fault on multichip modules is proposed in this paper. The current source is applied on two diagonal corners of the power plane. The location of the short fault can be determined by as few as four voltage measurements. Also, the sheet conductivity of the power plane can be obtained as a by-product. Experiments have been performed and the successful prediction of the exact short point validates the present inspection approach.

Nondestructive detection of defects in miniaturized multilayer ceramic capacitors using digital speckle correlation techniques. Y. C. Chan et al. IEEE Transactions on Components, Packaging, and Manufacturing Technology, Part A, 18 (3), 677 (September 1995). The novel application of a digital speckle correlation method (DSCM) was demonstrated for the in situ and nondestructive detection of cracks in small objects such as multilayer ceramic capacitors (MLC's) in surface mount printed circuit assemblies. A combined CSCI and double lens optical arrangements was employed for the measurement of minute surface deformations in MLC's. An improved cross algorithm instead of the original full-field search method was developed based on the unimodal character of the DSCM and reduced the operation time by an order of magnitude without sacrificing the measuring accuracy. The internal cracks in MLC's that contributed to the thermal displacements on the MLC surface after the electrical loading could be uniquely identified using this improved DSCM. This technique was found to be extremely sensitive to the presence of internal cracks in MLC's of different sizes ('1202', '0805', '0603', and '0402') created by thermal shock and has been shown to be more reliable and user-friendly than other conventional nondestructive techniques. A resolution of better than 20 nanometers in surface deformation measurements is achieved within 0.01 pixel resolution. The location and the size of defects, as obtained from the DSCM, correlate well with destructive physical analyses and surface temperature variation analyses performed on the respective samples.

Electrochemical processes resulting in migrated short failures in microcircuits. Gabor Harsanyi. IEEE Transactions on Components, Packaging, and Manufacturing Technology, Part A, 18 (3), 602 (September 1995). Metals can exhibit dendritic short-circuits caused by electrochemical migration in conductor–insulator structures, which may result in failures and reliability problems in microcircuits. The classical model of electrochemical migration has been well known for several decades. This process is a transport of metal ions between two metallization stripes under bias through a continuous aqueous electrolyte. Due to the electrodeposition at the cathode, dendrites and dendrite-like deposits are formed. Ultimately, such a deposit can lead to a short circuit in the device and can cause catastrophic failure. A few anomalous and newly discovered phenomena have initiated us to perform some revisions and to add supplementary models to the conventional one. A theoretical review based on practical results is given about the most important possible processes. Material design aspects are also discussed.

Popcorning: a failure mechanism in plastic-encapsulated microcircuits. Anthony A. Gallo and Ramesh Munamarty. IEEE Transactions on Reliability, 44 (3), 362 (September 1995). Popcorning is a failure mechanism in plastic-encapsulated microcircuits. It occurs when the inherently hygroscopic encapsulant is rapidly exposed to high temperatures during reflow solder assembly of the component to a printed circuit board. At these temperatures the moisture absorbed by the molding compound vaporizes and rapidly expands leading to the development of high stresses. When these stresses exceed both the interfacial adhesion strength and the fracture toughness of the molding compound, delamination and cracking result. Cracking is accompanied by a characteristic pop sound (and thus the name popcorning).