Non-destructive Testing of Electronic Components Overheating Using Infrared Thermography

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Abstract

Software-hardware IR thermography subsystem for non-destructive testing of electronic components overheating has been developed. IR measuring part included: Flir Thermovision A40 infrared camera with 17 mkm macro lens, Quantum Focus Instruments Corp InfraScope, precise positioning system. Software part for IR data processing included two standard tools: ThermaCAM Researcher, NEC San-ai Image Processor and several original software tools for extension of the subsystem abilities. The sets of examples are presented to illustrate the efficiency of using IR thermography measuring subsystem for non-destructive testing of electronic components (semiconductor devices, chips, PCBs) to improve thermal stability and reliability of electronic products.

Keywords: Electronic components, chips, PCBs, units, infrared thermography, overheating, hot points, reliability

1. Introduction

Electronic components overheating caused by electrical power is the most important factor reducing their reliability. The increase of 10-15°C in the semiconductor device active region temperature can reduce product lifetime by more than 50%. As a result, the thermal effects are one of the main limiting factors in electronic equipment operation especially for modern components with growing power density and elements temperatures. So the control and monitoring of electronic components thermal behavior is necessary to detect their possible failures and to enhance their reliability. As it is known the most effective way to provide safe thermal regimes of electronic equipment is temperature investigation in the different levels of electronic components: from semiconductor chips to PCBs and units. Thermal imaging with IR cameras [1] provides a nondestructive, noninvasive, noncontact mapping of temperature in electronic components thus allowing the quick detection and recognition of hot spots and overheating in electronic components.

In this work we describe the infrared thermography system which is used for noncontact mapping of temperature in electronic components. IR images are used then for detection and analysis of electronic components overheating.

2. Infrared thermography system

As it is seen from Fig. 1 the infrared thermography system consists of two parts:

Hardware part is based on Flir Thermovision A40 infrared camera with 17 mkm macro lens and InfraScope (Quantum Focus Instruments Corp) for IC measuring. The precise 3D positioning system is used providing more opportunities for testing of small-size complex device constructions (semiconductor chips, for example).

Software part for IR data processing includes two standard tools: ThermaCAM Researcher and NEC San-ai Image Processor. Several additional original software tools have been developed to extend the subsystem abilities:
3.2 Device electronics and component coring

![Diagram of device electronics and component coring]

Figure 3: Diagram of device electronics and component coring

3.3 electron and component coring

![Diagram of electron and component coring]

Figure 4: Diagram of electron and component coring

3.4 Non-destructive testing of electronic components

![Diagram of non-destructive testing of electronic components]

Figure 5: Diagram of non-destructive testing of electronic components
Page 130

References


4 Conclusions

The electronic components have been studied. The main conclusion was that the power supply section (comprising the 12V and 5V supplies) has been designed to provide a continuous flow of power to the rest of the circuit.