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Zhenzhi He, Li Wei, Minghui Shao, Xingning Lu

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# Detection of micro solder balls using active thermography and probabilistic neural network

Zhenzhi He[a], Li Wei[b], Minghui Shao[a], Xingning Lu[a,c *]

[a] School of Mechanical & Electrical Engineering, Jiangsu Normal University, Xuzhou 221116, China

[b] TangShan Key Laboratory of Mechantronics, Tangshan College, Tangshan, 063000 China

[c] State Key Laboratory of Digital Manufacturing Equipment and Technology, Huazhong University of Science and Technology, Wuhan 430074, China

**Abstract**: Micro solder ball/bump has been widely used in electronic packaging. It has been challenging to inspect these structures as the solder balls/bumps are often embedded between the component and substrates, especially in flip-chip packaging. In this paper, a detection method for micro solder ball/bump based on the active thermography and the probabilistic neural network is investigated. A VH680 infrared imager is used to capture the thermal image of the test vehicle, SFA10 packages. The temperature curves are processed using moving average technique to remove the peak noise. And the principal component analysis (PCA) is adopted to reconstruct the thermal images. The missed solder balls can be recognized explicitly in the second principal component image. Probabilistic neural network (PNN) is then established to identify the defective bump intelligently. The hot spots corresponding to the solder balls are segmented from the PCA reconstructed image, and statistic parameters are calculated. To characterize the thermal properties of solder bump quantitatively, three representative features are selected and used as the input vector in PNN clustering. The results show that the actual outputs and the expected outputs are consistent in identification of the missed solder balls, and all the bumps were recognized accurately, which demonstrates the viability of the PNN in effective defect inspection in high-density microelectronic packaging.

**Keywords:** solder ball; defect inspection; active thermography; principal component analysis (PCA); Probabilistic neural network (PNN)

[*] Corresponding author: Dr. Xiangning Lu
Email address: lxnam89@163.com

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