Keysight Technologies

Using a Thermal Imager for Electronics Design and Troubleshooting

Application Note

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Introduction

As thermal imaging technology has advanced, an alternative to using traditional cooled thermal imagers has emerged. Today, imagers using un-cooled microbolometer detectors have improved upon the performance of their cooled counterparts. They are also more affordable, which has created new application possibilities, including their use in electronics applications.

Situation

The rapid miniaturization of components used in the electronics industry makes circuit design challenging. As electronic equipment gets smaller, these miniaturized components increase circuit board density, which in turn increases power density.

R&D engineers need to optimize circuitry and ensure that their designs do not have unexpected hotspots attributed to specific components since high temperatures affect overall functionality, performance, and instrument design reliability. In production, process engineers need to ensure that circuit boards are manufactured with good components, verify soldering quality, ensure product components work together as expected, and track product and process continuity.

One of the fastest ways to troubleshoot design and manufacturing quality issues on circuit board is through physical inspection. Traditionally, this is done by touching the surface of the circuit board to check for hotspots. However, this technique is dangerous if high voltage circuits are checked without proper safety precautions.

Solution

One solution is to use a thermocouple to determine the temperature of the circuit board. However with this method, only temperatures at certain points can be measured and some hot spots might go undetected.

Using an un-cooled thermal imager is a safer alternative for testing electronics. With the ability to measure temperature distribution over the whole circuit board, R&D and process engineers can quickly inspect the circuit board to find thermal anomalies using non-contact temperature measurement.

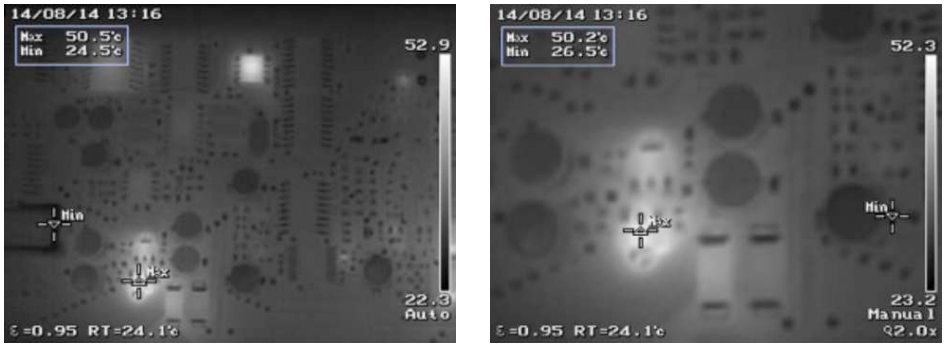

Figure 1. Thermal image of PCB board and its corresponding image zoomed into the hottest point

Today, there is a vast variety of thermal imagers on the market. However, one that is suitable for electronics applications needs to have good resolution to view dense circuits. It also has to have the focusing capabilities required to obtain clear infrared (IR) images at a close distance.

The handheld Keysight Technologies, Inc. True*IR* thermal imager is equipped with fine resolution capability that is able to effectively quadruple its resolution, from 160 x 120 pixels to 320 x 240 pixels at no extra cost. Fine resolution is achieved using complex algorithm on a lower resolution detector, which in this case is 160 x 120 pixels.

The algorithm works by first acquiring multiple image frames, while assuming that each frame is slightly shifted due to natural hand movement when capturing the image. Next, these frames are aligned through a process called super-position. In this step, the software aligns the images based on common feature points on each frame before putting them together to form a higher resolution image. The higher resolution image is then reconstructed to enhance and sharpen the image further. This process also effectively improves the Instantaneous Field of View (iFOV) by 1.5 times.

Other useful features of the True*IR* thermal imager are the ability take thermal images as close as 10 cm from the surface, provide 4 x digital zoom, and image logging capability, which allows IR images to be automatically taken over time as the circuit board powers up and run. Collectively these features simplify the design and inspection of circuit boards with miniaturized components, while enhancing operator safety.

Figure 2. U5855A True*IR* thermal imager

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