Agilent

Burn-in Testing Techniques for Electronic Devices

Application Note

Agilent Technologies

Introduction

Electronic devices are routinely tested multiple times during the manufacturing process, including the wafer-level, module-level, and module burn-in tests. Systems and materials begin to wear out under use, and various situations can lead to failure. Therefore, failures are defined within specific bounds under specific tolerance limits. Early failures may come from poor design or improper manufacturing.

Accelerated life tests that subject units to higher-than-usual levels of stress such as voltage, temperature, humidity, pressure, and loading are used to speed up the deterioration of materials or electronics components. This enables analysts to collect failure information more quickly. About 40% of microelectronic failures are reportedly due to temperature. In other words, temperature is the most critical factor for component failure. Burn-in is a screening technique performed by applying high voltage and temperature at a product life cycle's early stage to remove latent defects. It is used for highly intergrated circuit systems.

Burn-in test during manufacturing process

Burn-in testing requires the consideration of several factors when choosing a solution. These include device power, method of temperature measurement, and power requirements. All of these affect the thermal resistance of the device, which ultimately affects the capability to stress devices at high temperature.

It is important to note that there are various types of temperature sensors and data acquisition (DAQ) devices to choose from. Agilent has seven models of multifunction USB DAQ devices to choose from, and each one has its own advantages for a specific application.

system for burn-in testing, there are various aspects to consider.

Typical aspects include:

- Number of channels
- Sampling rate
- Cost-effective high volume solution
- High accuracy of device under test (DUT)
- Test the DUT control and measurement
- Minimal floor space or compact system
- High level of temperature control

It is essential to use a stable and highly accurate DAQ device to support each of the aspects listed above. Because the DAQ systems are designed for general use, they are affordable, easy to use, do not consume too much space, and do not damage the DUT.

In order to obtain accurate measurement, Agilent high-performance, multifunction USB DAQ devices provide the total solution and meet the increasingly demanding reliability testing challenges.

Figure 1 illustrates an example of a burn-in test system in an environmental chamber. The system uses a temperature sensor, signal conditioner, and Agilent high-performance USB DAQ device to obtain the temperature measurement.accurately by performing the burn-in test with a larger sample size of input signals.

Advantages of Agilent's USB DAQ in burn-in test

Agilent high-performance multifunction USB DAQ device offers 64-CH single-ended or 32-CH differential analog inputs, with up to 3 MSa/s sampling rate and A/D resolution of 12 bits and 16 bits. With the 64-CH single ended or 32-CH differential analog inputs, the DUTs operating voltages can be closely verified and monitored. As a result, a large number of DUT can be monitored efficiently and continously.

Monitoring the current drawn by each DUT can provide an excellent insight into the proper operation of the DUT. Voltage outputs produced by inductive current sensors or shunt resistors can be monitored by the Agilent high-performance multifunction USB DAQ device.

Voltage levels from etiher type of current sensor are compared to user-defined high and low limits of the DAQ system. The failure is displayed and logged if the limit is exceeded.

Thermal control during test and burn-in plays a key role in reducing cost and increasing production yield. Device temperature is measured by attaching a small thermocouple directly to the device or by using temperature sensors and signal conditioners. Accurate temperature measurement plays a crucial role for burn-in system, in order to obtain accurate data. An Agilent high-performance multifunction USB DAQ device provides one of the best solutions, with its 64-CH single ended or 32-CH differential analog inputs.

With its sampling rate of up to 3 MSa/s, the Agilent high-performance multifunction USB DAQ device provides a broader range of input signals to be sampled at one time. Users can measure data more accurately by performing the burn-in test with a larger sample size of input signals.

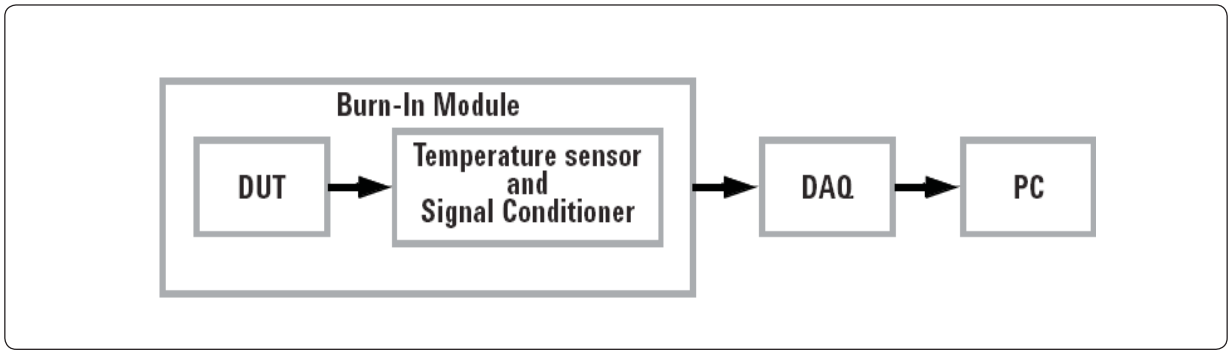

Figure 1. Burn-In test in an environmental chamber

When an input signal is taken, the sampled analog signal must be converted from a voltage value to a binary number so that the value can be read. The A/D converter uses a finite number of evenly spaced values to represent the analog signal.
The number of different values is determined by the number of bits used for the conversion. Most modern converters use 12 bits or 16 bits. Agilent high-performance multifunction USB DAQ device comes with the A/D resolution of 12 bits or 16 bits.

Today, USB is a widely used interface. Its low cost and simplicity make it a great choice when you need to create a quick test solution. This short time-to-measure feature of USB is particularly attractive in engineering labs and other environments where instruments are frequently moved, shared, and reconfigured.
To facilitate these applications, the Agilent high-performance multifunction DAQ devices offer USB connectivity.

With its intended use in consumer applications, USB is not only inexpensive and widely used (it is in every PC today) but also easy to use. Benefits of USB are as follows:

- Increased productivity
- Low cost
- Production space saving for burn–in test systems

Conclusion

Most electronics components have an infant-mortality period of about one year under ordinary operating conditions. The reliability problem in the infant-mortality period becomes extremely important. The main purpose of performing burn–in is to quarantee customers high reliability of the products.

Agilent high-performance multifunction USB DAQ devices have the top-class features needed to meet the increasing demand for reliability testing and guarantee high reliability of end products. In additon to this, Agilent also offers basic multifunction DAQ device that provide the best solution to customers.

Related Literature

- David Gardell, *Temperature Control During Test and Burn-in*
- *System Developer Guide - Using USB in the Test and Measurement Environment*
(Application Note 1465-12)
- Way Kuo, Fellow, IEEE and Taeho Kim, *An Overview of Manufacturing Yield and Reliability Modeling for Semiconductor Products*
- Steven Petersen, Product Test Solutions, Thermotron Industries, *The Application of Burn-in to DC/DC Converter Production Testing*

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