ATP's Next Generation "Test During Burn-In" System

The new testing system includes the "Automatic Test Equipment " capability, further strengthening the quality and reliability of ATP's Industrial Grade DRAM Modules

1.0 Introduction

DRAM Modules are a crucial determining factor in server reliability. Defective DRAM modules during the service life corrupt data and can cause system-wide server downtime. The slightest amount of down time translates into millions of dollars of loss in revenue. ATP has recently incorporated its patent pending Test During Burn In (TDBI) System, Supervisory Control and Data Acquisition (SCADA) System, and the Automatic Test Equipment (ATE) into one sophisticated system. The two combined testing capabilities are intended to provide extended long-term quality and reliability of ATP industrial grade DRAM modules.

2.0 The Industrial Grade DRAM Reliability Testing Improvement

The newly upgraded ATP TDBI, SCADA, and ATE systems are designed to achieve the following goals:

a) Increased data quality acquisition: Traceability via continuous quality data acquisition at the production, screening, and customer field failure levels. Customer QBR engagement will also be utilized to proactively review quality data and to jointly collaborate on corrective action strategies.

b) Increased process improvement: Data from production processes and the field are gathered, analyzed, and action items are generated. Systematic flexibility is given to production level screening processes to apply both proactive improvements and corrective action. Field failure DPM data will proactively expedite screening process corrections. Screening process DPM data will facilitate production corrective action and, finally, production process DPM data will aid initial design improvement. (Figure. 1)

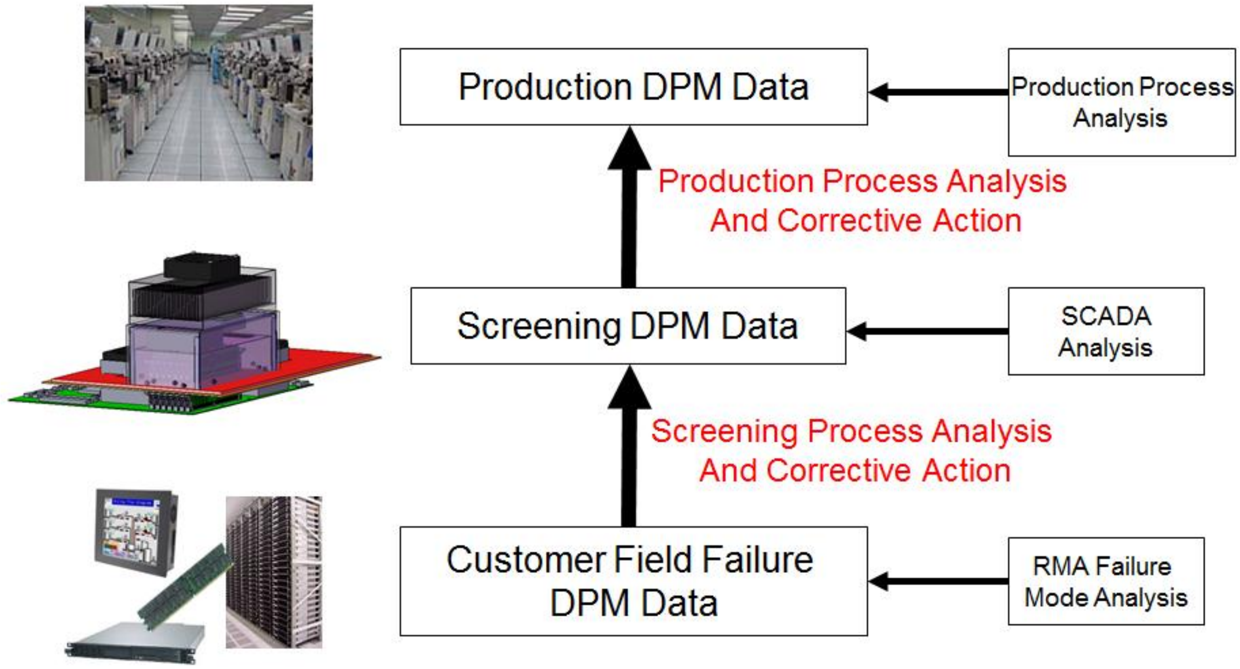

Figure. 1: A goal for the new TDBI and SCADA Quality System

2.1 The SCADA and TDBI System Upgrade Overview

The SCADA system has been upgraded to allow for real time remote monitoring and control over the thermal burn-in testing array. The independent software environments and temperature cycles can be run concurrently while all profiles and test cycles are fully recorded against production lot logs in the SCADA Database.

The third version of the ATP patent-pending TDBI system consists of: a.) the miniature chamber, which isolates temperature cycling to targeted area, b) module riser adapters from the motherboard, which allow for easy production volume module insertions, and c) multiple temperature sensors, which regulate target temperature profiles. The new system operates on a wide testing temperature of -40° to 85°C, an extraordinary capability, something other TDBI systems can hardly achieve (Figure. 2). Furthermore, ATE and its customized testing patterns were developed to thermally test ATP industrial grade DRAM modules with tailor-made electrical signal patterns.

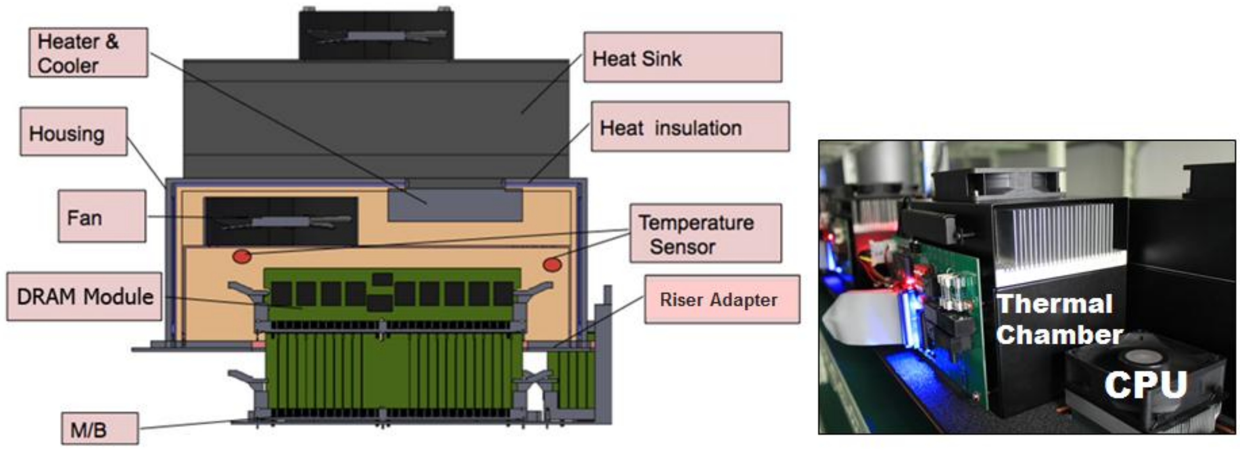

Figure. 2: The Third Version of the ATP TDBI System

2.2 The ATP New Automatic Test Equipment Test

The new ATP ATE and TDBI tests both play a vital role for ATP joint-qualification capabilities, as they qualify different customers' new products with different host system applications. The new ATE test provides electrical testing patterns with various parameter settings, such as marginal voltage, signal frequency, clock, command timing and data timing under continuous thermal cycles. For specific weaknesses of some ICs, ATE can provide specific testing patterns to stress the screening of the particular defects during the testing. Also, based on customers' requests, tailor-made electrical testing patterns can be programed and implemented into the ATE testing process. The ATE testing system is also able to pin point individual defective ICs, or defective DRAM PCB boards, which provides a much more efficient failure analysis method for both new product development and mass production stages (Figure 3.) Moreover, the new ATE system can automatically download the SPD specifications into the testing machines and run the test, while post analysis data of can be uploaded into the production DPM collection.

Combining two tests, the elevated temperature and critical testing signal patterns, accelerates the detection of IC infant mortality and enables IC batch screening, which improves incoming IC quality control. This elevates overall ATP DRAM module quality to a new level. Since these systems offer both application and system specific testing, they also perform as powerful tools for product failure mode analysis. Both systems have the capability for swift scalability and ramp up during mass production.

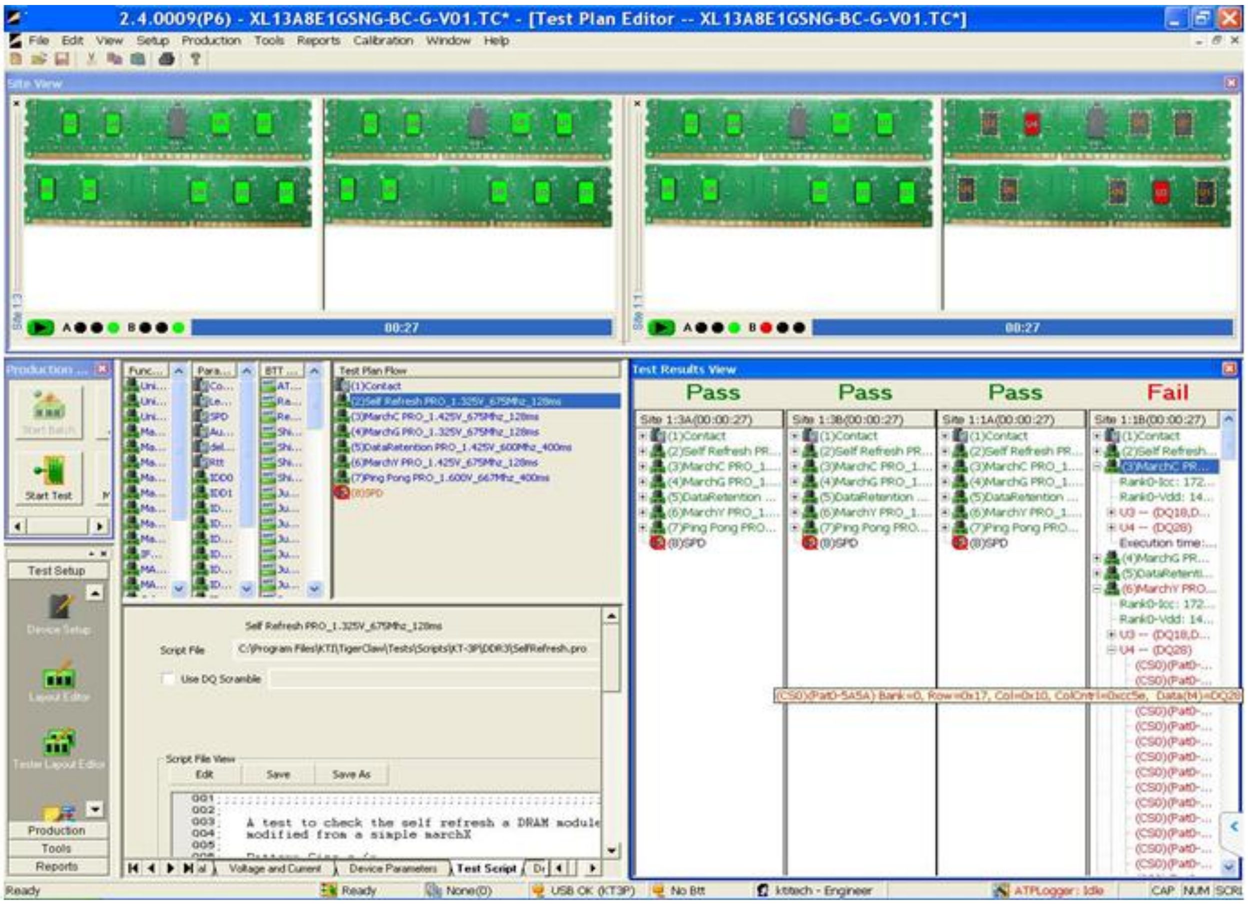

Figure. 3: The New ATP ATE Operation Interface

2.3 The Process Comparisons of ATP Integrated TDBI and ATE Systems vs. Conventional Large Chambers and Other Proprietary Testers

There are generally two other categories of mass-production-scale burn-in systems on the market, the conventional large thermal chambers and other proprietary tests. In Comparison to these systems, the unique advantages of the ATP TDBI and ATE combined systems are highlighted below.

Flexibility: The design of miniature thermal chambers physically covers only the DRAM modules. This channels the heating and cooling energy to only the DRAM modules, thereby excluding the rest of the testing set-up (such as motherboards). This provides flexibility in motherboard choice. Also, the ATP design control ATE system allows flexibility in the software environment and data patterns, ensuring flexibility in temperature profiles. Other proprietary testers physically heat up or cool down the entire testing apparatus with limited testing patterns, which reduces the flexibility of the motherboards used. Conventional large thermal chambers have few limitations to implement the customer-desired temperature profiles.

Operational Efficiency: Since the ATP miniature thermal chambers only contain DRAM modules, only the DRAM batches need to be replaced. This saves valuable operational time during the mass-production burning-in and minimizes the time for hardware swap or repairs. The compact-sized chambers also reduce power consumption and are highly efficient in small quantity production. Conventional large thermal chambers are slow, making it difficult to swap entire batches of testing DRAM modules from the multiple testing systems installed in the large chambers. Also, the bulky chambers consume excessive energy and are not suitable for small quantity production. Regarding other proprietary testing systems, the lead-time of testing hardware repair and swaps are not truly calibrated for use in mass production.

Testing Efficiency: The ATP chambers isolate the testing DRAM modules and do not thermally stress the rest of testing systems. This minimizes the failure of other testing components, such as the motherboards. In conventional large thermal chambers, the failures of non-DRAM-related testing components are constant given that the whole system is thermally stressed. The non-related testing component failures cause the reflow of the testing and increasing test time (Figure. 4) Furthermore, the constant swapping of DRAM modules for the motherboards in conventional chambers wear out the motherboard connectors. In contrast, ATP provides a special design of riser adapters, elevating and extending the DRAM modules from the motherboard in order to allow the DRAM modules to be fully immersed by the chamber cover. The riser adapters also eliminate wear issues in the motherboard connectors. In addition, the testing temperature of the new ATP TDBI systems exceeds the working temperature range of DRAM modules. Many conventional chambers cannot meet the demanding working temperature requirements of industrial grade DRAM modules.

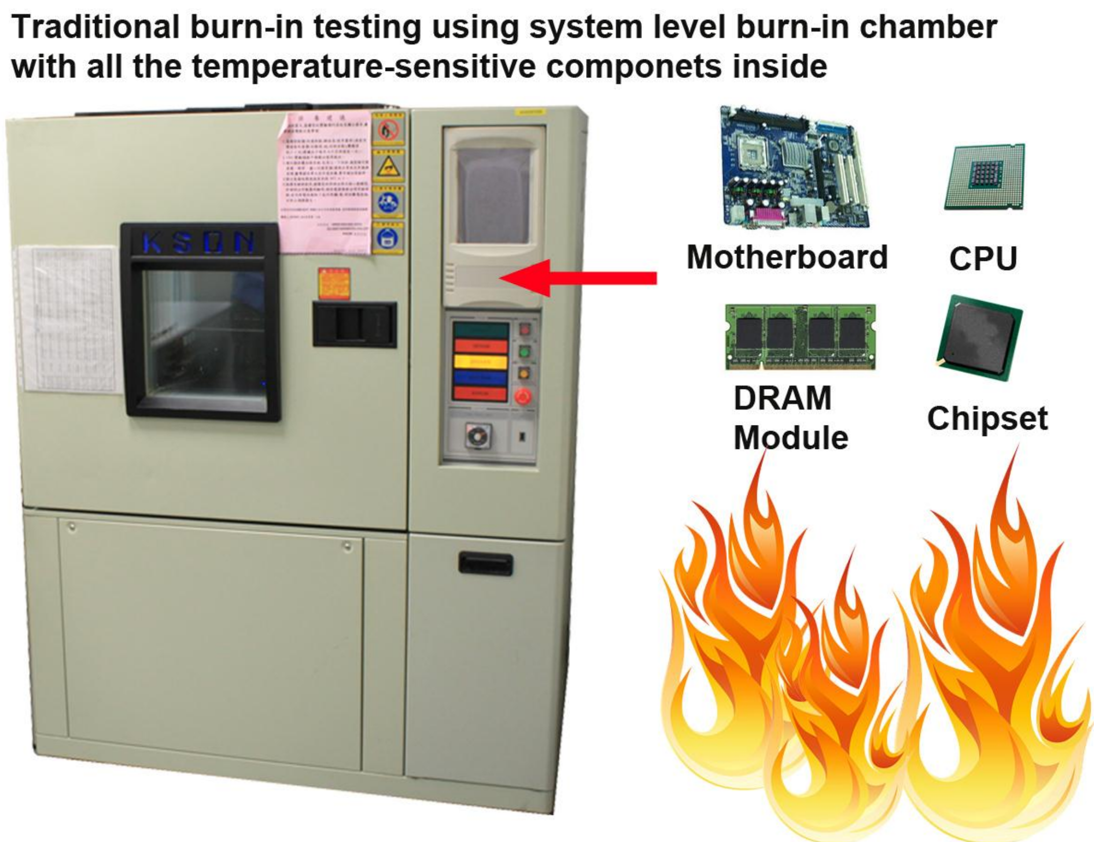

Figure. 4: The Conventional Large Thermal Chamber

Scalability: Conventional large thermal chambers involve costly investment and long implementation lead times. Usually, setting up conventional thermal chambers takes six months for a meaningful capacity boost. Other proprietary testers are built to order with more unknown operational variables and require at least three months to scale up the testing capacity. With the slim design of ATP TDBI system, the main contributors of the lead-time are limited to gathering motherboards and some key components, which normally take two months for a capacity increase. (Figure.5)

Figure. 5: The Scalability of the ATP TDBI and ATE System

3.0 Conclusion

ATP has successfully integrated the ATE and TDBI tests and the SCADA system into one mass-production-scale burn-in system. ATP focuses on maximizing the ATE testing coverage and accelerating the TDBI testing cycle. A traceable quality record from IC level testing (from module level ATE production data to field product usage) has been built, massively collected, and analyzed via the SCADA system. The entire system is designed to a) build a system for quality data acquisition, and b) implement a system for process improvement, based on the quality and reliability driven industrial and server environments. The new system provides a wide testing temperature ranging from -40° to 85°C, which few other TDBI systems can provide. The combined tests have proven to effectively lower the field return rates from major ATP OEM customers up to 30%. The system has again demonstrated ATP’s add on value and its commitments to indusial-grade quality and reliability.

About ATP

ATP Electronics is a leading manufacturer of high performance, high quality and durable NAND flash memory solutions, as well as DRAM memory modules. With over twenty years of experience in the design, manufacturing and support of memory products, ATP continues to focus on mission critical applications such as industrial, telecom, medical and enterprise computing where high levels of technical support, performance consistency and wide operating temperature ranges are required. As a true manufacturer, ATP offers in house design, testing and product tuning. ATP also offers extensive supply chain support with controlled/fixed BOM's and long product life cycles. For more information on ATP products, please visit www.atpinc.com.