

Cactus[®] Technologies

Quality and Reliability Process

White paper CTWP014

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01 Introduction

Cactus Technologies Limited (Cactus) is a NAND flash storage manufacturer which offers high quality, reliable products to industrial & OEM customers. This document describes the quality assurance and reliability programs that have been developed to achieve the quality objective and continual improvement of product capability, quality and reliability.

Cactus Technologies has been awarded ISO9001:2008 certification since 2008. A quality management system compliant to the ISO 9001 standard is established and the entire product provision process, such as product storage, product inspection, etc., is fully documented in a series of procedures and work instructions. With this management system Cactus Technologies will always provide consistent, high quality products & services to customers.

Our high quality products are manufactured to our exact specifications by a contract manufacturer who is accredited with ISO9001:2008, ISO14001:2004 and ISO/TS16949:2009. The ISO/TS16949 system is an automotive industry quality standard which aims for not only continual improvement but also defect prevention and reduction of variation & waste in the supply chain. This is a prestigious certification that allows Cactus Technologies to serve automotive manufacturers with NAND flash products.

All products always go through a series of internal design verification and external environmental tests before they are released to market. These tests are to guarantee Cactus Technologies products are compliant to industry standards in both technical (e.g. ATA/ATAPI specification, SD specification) and environment requirements (e.g. RoHS, REACH).

Cactus Technologies Quality Assurance and Reliability Program may be envisioned as a pyramid in which each testing layer is supported and confirmed by any testing layer(s) below while assuring the validity of the testing layer above. This hierarchy of activity is shown pictorially in Figure 1.

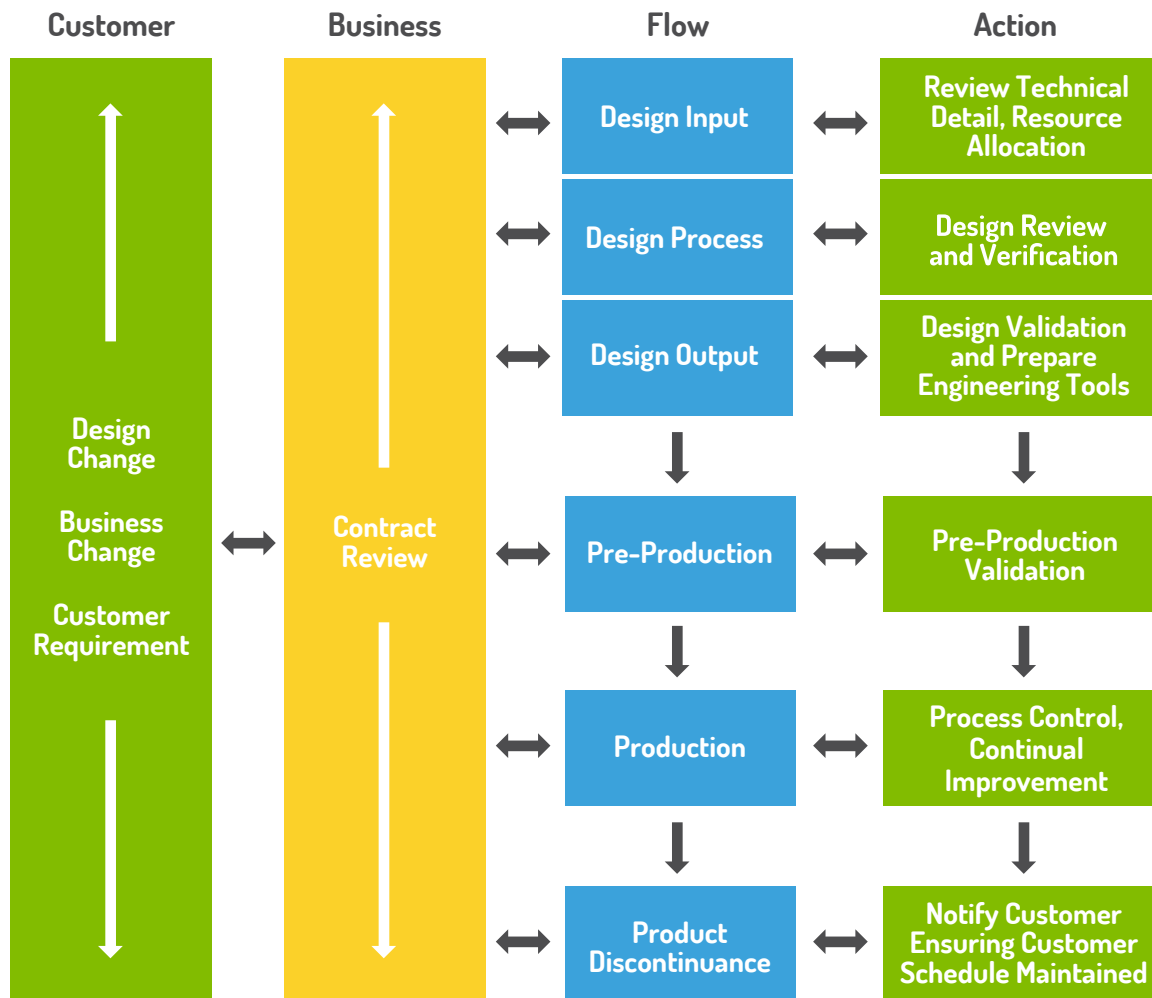


Quality Assurance and Reliability Program
Relationships in Cactus Technologies Quality Assurance and Reliability Program

FIG. 1

02 Design & Development

Cactus Technologies follows a controlled process for design and development. This process is shown in Figure 2 together with the ongoing production phase and the eventual product discontinuance phase.



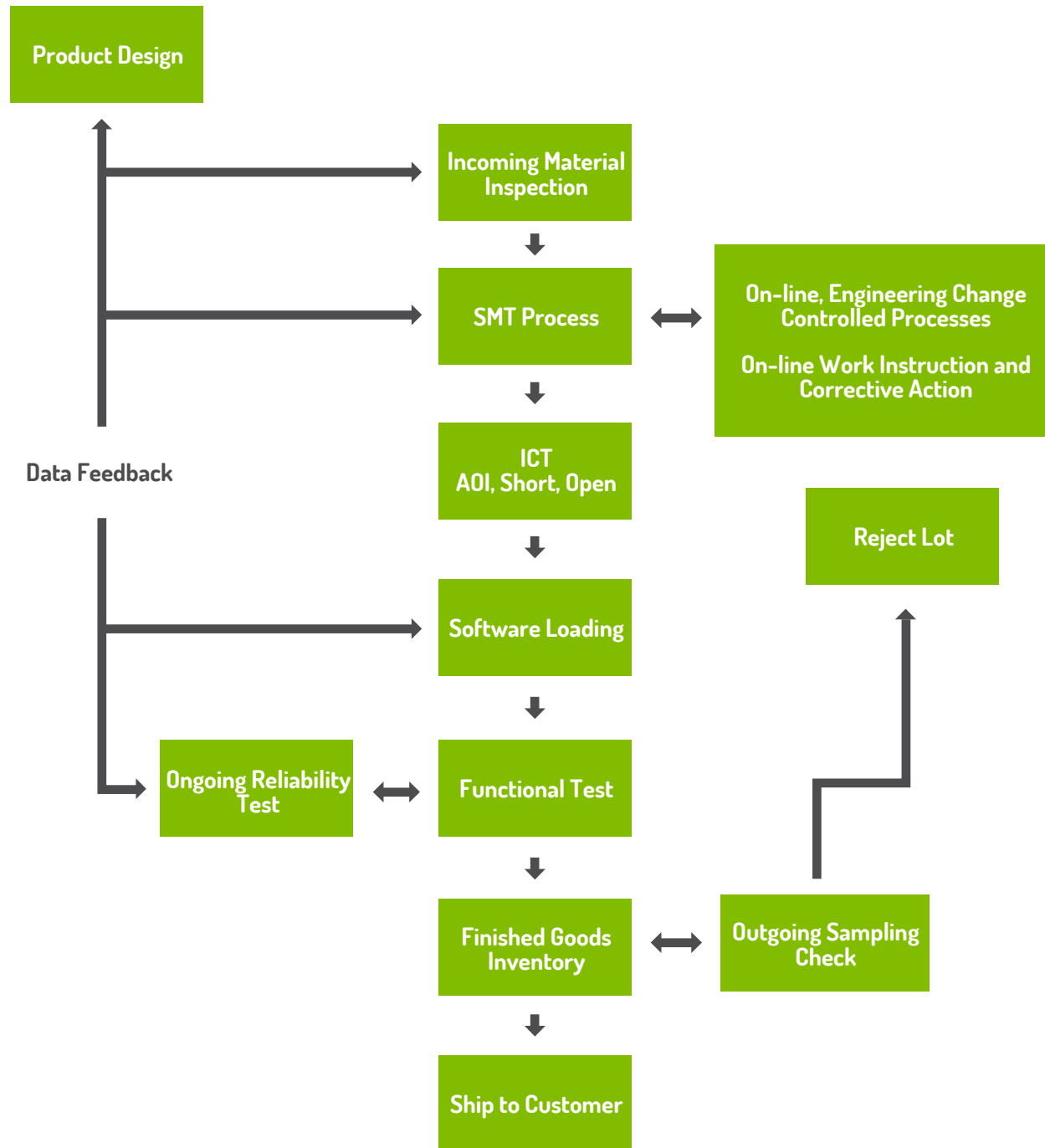
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FIG. 2

03 Manufacturing Flow

Figure 3 shows a generalized view of the production flow that identifies the key testing steps. The menu of Quality Assurance and Reliability testing steps are described in greater detail below.



General Manufacturing Flow

FIG. 3

Quality Assurance (QA) testing begins with the receipt of raw materials. The quality of the materials used is controlled by vendor certification or by incoming tests established to monitor critical material parameters.

Manufacturing processes are defined and qualified for each product type. In each of the manufacturing and testing steps, the Work Instructions (WI) describe or reference test conditions, failure criteria, data collection, data storage, equipment calibration and disposition of product. These process steps and work instructions are computerized and monitored.

First Article (FA) from SMT process will be tested by engineer to verify settings and parameters are correctly defined before mass production.

A preventative maintenance program is in place to prevent loss of process control due to equipment failure. In addition, all critical equipment is backed up.

Traceability of product from an identifiable manufacturing lot is coded into the Data code (D/C) on product label and marking of packaging info, which is controlled by computer records.

04 Continual Improvement

The basic flow for Continual Improvement in technical processes is shown below. Problems are traced back to the root cause and fed back to design phase.



Continual Improvement

FIG. 4

05**Product Warranty****Stop Shipments**

As a result of a customer product return, long-term reliability results, etc., which determines that current inventory does not meet specification, Cactus Technologies has a Stop Shipment process that quarantines suspected defective product from being shipped. This process requires that current inventory is checked and corrective action is taken before shipments can resume.

Customers will be contacted if delivery commitments are expected to be affected.

Return Material Authorization RMA process

When product shipped to the customer do not meet specification, Cactus Technologies has a RMA process to return the defective product and will investigate the cause and verify confirmed failures. This process requires the customer to contact the appropriate Sales Representative for a RMA Number.

When the product is returned to Cactus Technologies, an investigation is carried out with root cause analysis and corrective action which is summarized in a report to the customer.

Warranty Process

All Cactus Technologies industrial and commercial products are warranted for 5 years and 2 years respectively. They are tested to be free from defects in material and workmanship and to conform to the published specifications. During the warranty period, should your Cactus Technologies product fail under normal use in the recommended environment and operating conditions due to verified improper workmanship or materials, Cactus Technologies will provide warranty service as outlined in the product manuals.

06**Standard Cactus Qualification Reliability Tests****Internal Qualification**

1. Products configuration check
2. Functional test
3. ATA/ATAPI compliance test (for ATA product)/Burn-in test (for others)
4. Performance test
5. Power consumption measurement
6. Operating temperature test
7. Endurance test

Environmental Test By 3rd party Lab

8. Altitude test
 - With reference to IEC60068-2-13
9. Drop test
 - With reference to IEC60068-2-32
10. Temperature cycling test
 - With reference to IEC60068-2-14
11. UL94 (Flammability)
 - UL94
12. RoHS2
 - DIRECTIVE 2011/65/EU
13. REACH
 - 76/769/EEC
14. CE
 - EN61000-3-3
 - EN61000-3-2
 - EN55022 CLASS B
 - EN55024
15. FCC
 - 47 CFR FCC Part 15 Subpart B2013
16. Shock test
 - MIL-STD 883G Method 2002.4
15. Vibration test
 - MIL-STD 883G Method 2007.3 condition A

Ongoing Reliability Test

Cactus Technologies adopts Ongoing Reliability Test (ORT) to monitor products quality throughout the entire production period. It helps to detect discrepancy/deviation in products and makes sure that products are always manufactured to the same specifications & quality level.

Cactus ORT will randomly pick samples from inventory with a predefined percentage or quantity, and test them in an environmental chamber that provides the stress profile of thermal cycling to induce fatigue damage.

Quality of the products is then measured from the results of this test. If a unit fails, the lot of units that were produced along with the failed unit is then tagged for re-test or repair to either verify or fix the problem. Furthermore, investigation will be carried out to find out the cause of failure including, but not limited to, assembly process, defective components or any other possibilities. Based on the analysis result, corrective actions will be established & implemented to eliminate those issues from re-occurrence.

Cactus Technologies is committed to providing high quality NAND flash storage products to industrial & OEM customers. Cactus Technologies NAND flash products are designed for maximum reliability with high quality components & world-class manufacturing facilities. With all the quality assurance and reliability programs implemented, Cactus Technologies is considered by customers as one of the finest NAND flash storage manufacturer in the world.

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