Use of RFID Tags Identification for Probe Card Tracking

Specifications and Requirements

ISMI Wafer Probe Council

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1.0 EXECUTIVE SUMMARY

This document outlines the structure, content and projected use of a standard design for RFID tags that can be used for probe cards in a high volume manufacturing environment. Individual users may determine the best methods for mounting the tags to their probe cards and the necessary RF antennas at each point of use.

This work was done by the ISMI Wafer Probe Council as part of their normal activities.

2.0 PROJECT OVERVIEW & BACKGROUND

The Wafer Probe Council consists of engineering and operations professionals from the International SEMATECH Manufacturing Initiative (ISMI) member companies who are directly involved with the mechanics, electronics, and operations issues related to wafer probing on the test floor. During discussions on improving operations efficiency, many representatives realized they had a common problem: controlling and managing probe card inventory. Many test floors are faced with large inventories, in the thousands, of probe cards. Probe cards can occupy any one of a number of states, such as In Production, Repair In-house, Repair – Outsourced, Waiting Qual, Engineering Evaluation, In Inventory, etc. This, together with multiple part type revisions, back-up cards, and other device-related redundancies, makes tracking and monitoring the status and location of probe cards a complex task.

The Probe Council consequently developed a format for information that could be written to an RFID tag mounted on a probe card. This tag would contain the most common information unique to each probe card. Using the exclusive ID number on all RFID tags, a data retrieval system could also access additional information related to the probe card such as history of qualifications, repairs, and production usage.

3.0 RESULTS

An RFID solution was proposed to take advantage of new technology in reading, storing, and manipulating data configured as outlined below. By using an RFID tag, information can be easily captured at both supplier and user sites with little or no added burden on the operations staff. As the history of the probe card changes and evolves, the latest “status” information can easily be updated on the tag for future retrieval and review.

The information on the tag is separated into16 data fields, as follows:

PAGE	INFORMATION	DESCRIPTION
A	Card ID	Unique identifier for each probe card
B	Owner	Name of company that owns the card

C	Supplier	Name of company or internal group that built the card
D	Probe Card Technology	Specific technology used for constructing the probe card, buckling beam, cantilever, membrane,…
E	Owner Space Transformer/PCB Part Number	Space transformer or printed circuit board (PCB) part number of the owning company
F	Supplier Space Transformer/PCB Part Number	Space transformer or PCB part number of the supplier
G	Owner Head, Spider or Core Part Number	Head/spider/core part number of the owning company
H	Supplier Head, Spider or Core Part Number	Head/spider/core part number of the supplier
I	Owner Space Transformer/PCB Serial Number	Space transformer or PCB serial number of the owning company
J	Supplier Space Transformer/PCB Serial Number	Space transformer or PCB serial number of the supplier
K	Owner Head/Spider/Core Serial Number	Head/spider serial number of the owning company
L	Supplier Head/Spider/Core Serial Number	Head/spider serial number of the supplier
M	Polish/Clean Count	Cumulative total of all polish and clean occurrences over the life of the probe head
N	Maintenance Cycles	Cumulative total of all touchdowns since the last maintenance incident
O	Space Transformer/PCB Touchdowns	Cumulative number of touchdowns seen by the space transformer or PCB
P	Head/Spider Touchdowns	Cumulative number of touchdowns seen by the head, spider, or core

Page A contains the unique ID associated with each RFID tag from the manufacturer. The remaining pages, B through P can be written on or updated by the customer or user at any time. Each page can contain up to a 16-digit long hexadecimal word or 8 ASCII characters.

The tag can be used to automatically verify that the correct probe card has been selected for the product on the tester. Product information, in the form of a bar code, RFID tag, or other means of identification, typically accompanies the wafers as they arrive at the tester. The product type, version, and probing requirements would then be compared to the information derived from the probe card tag, and a positive match to the loaded wafers could be confirmed.

3.2 DESCRIPTION OF USE:

An RF tag mounted on a probe card (PC) in a production environment cycles from inventory, supplier maintenance, and use. The following example of its use assumes all necessary hardware is mounted and integrated into the end user's manufacturing control system.

When a PC is loaded onto a prober/tester system and a lot start is requested, the RFID reader will query the PC tag for its relevant data, typically the IDs and serial numbers (pages E, G, I, and K). The data from the PC are compared to the requirements of the loaded wafers to determine if the correct PC has been installed on the prober. If the system determines the PC is incorrect for the give material, it will stop the setup and inform the operator of the faulty condition. If the correct PC has been loaded, the setup will proceed.

During probing, the system tracks the number of touchdowns and cleaning cycles experienced by the PC. Whenever the probing is paused, the system will update the information on the tag, by first reading the current values and adding the new counts, then writing the updated numbers to the appropriate pages.

During maintenance, either at the customer's or supplier's site, the data on the tag can be accessed to ensure the proper files are being used on the probe card analyzer. Once maintenance has been completed, the maintenance cycle count (page N) can be updated or reset as applicable, thereby tracking the time between maintenance events.

The tag can also be used to help track and control PC inventory; a reader coupled to a database can track PC location and state. The tag reduces entry errors in the database and improves the visibility of the current inventory state. A portable reader can be used to quickly update and verify the PC inventory while the cards remain in storage without the operator ever handling the cards.

3.3 IMPLEMENTATION RECOMMENDATIONS

The following items must also be considered before having a fully functional system operating in a manufacturing environment. These are outside the scope of this document and are shown for information only.

Tag Readers

Commitment & Involvement from Probe Card Supplier(s)

Tag Suppliers

Host Computer System

Local IT Department Support

3.4 DEFINITIONS:

Head/Spider/Core Assembly – The electro-mechanical assembly that makes contact between the PCB and the DUT.

Reader – Specialized equipment used to power and access data on an RFID tag.

RFID Tag – A glass or plastic encapsulated IC, consisting of an RF antenna, capacitor, memory, and circuit responsible for memory access and manipulation as well as receiving and transmitting data via the RF antenna.

Probe Card – Mechanical and electrical interface hardware between a tester and the DUT.

Space Transformer/PCB – The printed circuit board that translates and conducts the tester signals as well as the power/grounds to the probe head assembly.

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