Trim & Form Debugging Expert System
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Abstract
Trim and Form Debugging Expert System (TFDES) is an expert system intended to give solution for various problems occurred in semiconductor's trim and form process. It can be an effective training tool to shorten the learning curve of engineers. The approach used to develop the TFDES is Case-based Reasoning (CBR), which is best fit for complex and unstructured trim & form problems. The memories and experiences are not easily reduced to rules especially for highly uncertain problems. So, the library of past cases or problems related to trim & form process would be used as the case bases or knowledge bases. Those knowledge bases will be compiled into HTML technical knowledge files, various tables and reports stored inside the TFDES database. The knowledge stored in Case table will be used as a case base for case matching purpose. The four-step process of CBR was used in developing the TFDES, which are Retrieve, Reuse, Revise and Retain. There are three modules available in this system, namely Data Entry Modules, Case Matching Modules, and Knowledge based Module. These modules and system workflow are well fit with the four-step process of CBR. CBR techniques used are known as Case Representation, Indexing, Adaptation, Storage, and Retrieval. The famous decision tree and nearest neighbor matching methods are used in case matching process. These methods have brought the nearest or best solution to the given problem.

Keywords: Trim and form process, Case Base Reasoning

1 Introduction
Semiconductors are the basic building blocks used to create an increasing variety of electronic products and systems. Most consumers picture semiconductors as small black boxes. The small black boxes are actually the packaging that surrounds the silicon chip itself and both protects the chip from the external environment and provides the interface between the chip and other electronic components. The semiconductor manufacturing process involves two distinct phases, wafer processing, commonly referred to as the front-end, and assembly operations, including die attach, wire bonding, packaging, trim & form, plating and testing function, which are commonly referred to as the back-end. The semiconductor assembly process first involves the separation from the wafer of the individual chips or "die" and the attachment of each die to a plated metal leadframe. The connection of the chip is then made either by bonding extremely fine gold or aluminum wire to the leadframe or by creating direct connections via a so-called flip chip die attach, to the substrate. Next the chips are molded by encapsulation in an epoxy plastic. In leadframe application, the leads are then deformed, in-plated, trimmed and formed, the chips are separated into individual devices.

Trim & form process is one of the back-end processes. It is a complex process and there are many phases, such as dambar cutting, dambar check, lead length cutting, roller forming, final forming, final lead length cutting, separation etc. Due to its complexity and highly accuracy, most of the metal parts inside the die-set are precision parts. The accuracy of those parts is within the tolerance zone of 0.003mm. There are various forming profiles, the common profiles are Gullwing (or G-forming) and J forming. G-forming products examples are TSOP, TQFP, HiQuad, etc and examples of products with J-forming are PLCC, SMA, SMB, etc.

1.1 Problem Statement
Most of the customers have very high expectation in product quality. They are expecting the Cpk value of more than 1.67, which is higher than normal industrial standard (Cpk value of 1.33), [1] Due to this, debugging of trim & form process becomes very specialize job and it only can be done by well-trained engineer. Most of the critical and knowledge to resolve the trim & form problems are not well recorded as there are many uncertainty and many factors related to the problem. It takes more than two years before the engineer can really debug the process effectively. The engineers need to understand the design know-how for him to work effectively.

There is an opportunity to build the debugging database for trim & form process and problem solving tool for engineers. The database will help to manage and store the data, which are already available but scatter around