Part Average Testing

Electroglas Test Floor Management Software

White Paper

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Background

The Automotive Electronic Council, Component Technical Committee document, AEC-Q001, presents guidelines for performing Part Average Testing (PAT). PAT is a statistically based methodology for identifying abnormal test results. Abnormal parts can contribute significantly to quality and reliability problems even though they are within the engineering or spec limits. PAT uses the distribution of test results for each part to establish static and dynamic six-sigma limits to identify outliers. Our PAT implementation checks for normality of data when determining limits. Any test result outside the six-sigma limit for a given part is considered an outlier and removed from the population—parts that fail the PAT limits are not shipped to the customer.

The automotive industry is the primary segment of our industry requiring PAT, however, the medical, military and any supplier with customers requiring KGD (Known Good Die) is now requiring their device makers to meet these requirements.

Challenges of Implementing PAT

Implementing PAT requires a toolbox with both breadth and depth. The requirements are:

- Query and Manage Test Results
  - Must be able to efficiently query test results from the tester files or from a data warehouse or database.
  - Determination of static PAT limits requires maintaining historical test results in either the raw format or a database.
  - Audit trail for PAT dynamic limits and results must be maintained.
- Analysis of test results
  - Efficient and accurate statistical methods, including robust statistics.
  - SPC methods
  - Probability distributions including test of normality
- Map generation
  - The results of the PAT outlier trimming may be used to generate a map for inking (or inkless) or update a database with the new bins.
  - Must be able to generate and update wafer maps in a variety of formats.
- Reporting
  - Graphics to display the distribution of the test results, SPC charts, wafer maps.
  - Point and click reports for both current and historical processes.

- Customizable and Scalable
  - PAT should be integrated seamlessly with existing processes. This requires tools that are easily customized and extended
  - PAT is both data and compute intensive; therefore, the solution must be scalable to support a large number of tools and products.

Test Floor Management Software (TFMS)

The SORTmanager and SORTware TFMS products from Electroglas address all of the above requirements.

At the core of all TFMS products is our 20+ year proven analytical, statistical, and graphics engine. This engine supports reading and writing data from a variety of sources, including databases and wafer map, and test file formats, including support for indexing and reading STDF files.

The statistical capabilities of the TFMS engine include univariate and multivariate methods for discrete and measurement data (including robust statistics), SPC, time series, linear models, probability distributions, test of normality, and survival and reliability analysis.

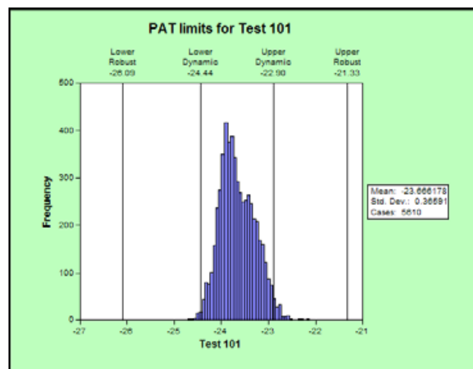
TFMS products have integrated graphics and reporting, including web integration. This allows users anywhere on your network to view the results and if necessary, drill down and interact with the data.

The management of wafer maps has been a cornerstone of TFMS. Map conversion is part of the infrastructure and new formats are always being added. The generation of a new map as a result of PAT or other statistical post processing (SPP) is seamless. With process step verification (PSV), we can ensure that PAT is performed automatically at the correct step in your process.

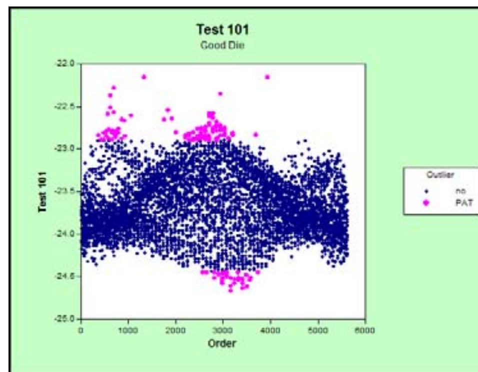
The TFMS products are part of an open system designed to integrate with your data, software and processes. Every aspect of the system can be customized or extended. When you need additional features or reports, we can build them and teach you how to do it yourself.

TFMS statistical PAT examples:

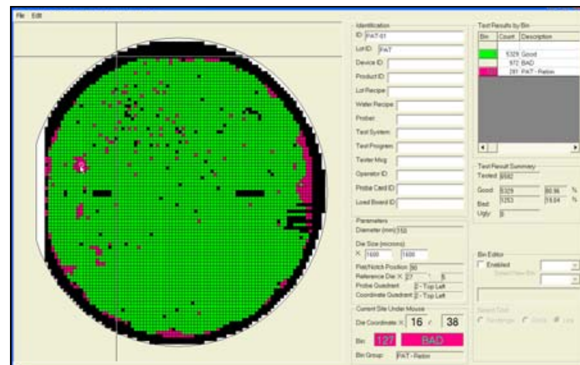
The following histogram of the test data display the Robust and Dynamic PAT limits.



The following graph highlights the PAT outliers in pink.



The PAT Outlier Die are Shown in Pink



Conclusion

TFMS easily integrates to your current process with customizable and scalable solutions. TFMS products are in production globally at sites with hundreds of tools. Contact EG to hear more about PAT and other TFMS solutions for enhancing your overall test effectiveness (OTE).