

# TadiVac2000 Case Studies

*Tadin's Semiconductor Equipment  
Optimization Implementation*

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## Mattson asher Case-study example

### Introduction

The Mattson Aspen asher runs a dual-wafer photoresist removal process. A customer indicated that they are running a series of Mattson ashers where the process end-point is based on time only, due to mismatch between the process and the machine capabilities. The recipe time length for various processes varies for different types of wafers. Further more, the asher could not determine the wafers' quality (resist exists, removed or rework), nor can it indicate true completion of the process (End-point). The outcome was low yields, low speed and capacity, intensive operation and engineering intervention.

The customer asked for Tadin's help to improve the overall performance.

### The TadiVac2000 Connection

One of TadiVac's many features, namely the Combined Alarm system is an optimal solution to the end-point problem. It can be set to sense the slope of the signals and the true end of the resist removal, enabling accurate and reliable detection of the end point. In addition, TadiVac enables to distinguish between processed, unprocessed and rework wafers, enabling continuous operation with high-yields, high capacity and minimal operator / engineering intervention.

The TadiVac2000 enables also real-time graphics display of the machine's operation and full history analysis of the machine and its process, with SPC functions, correlation to lot and wafer numbers and many additional built-in 'goodies'.

### TadiVac2000 Application

The TadiVac2000 was set to monitor and test two end point signals simultaneously.

The process sequence is as follows:

#### Stage 1

When the TadiVac2000 detects wafers in the process chamber(s), it starts testing the end point signal (for the specific wafers).

At first the TadiVac2000 verifies that the end-point signal crosses the "Analog Start Point", moving in the right direction.

- An end-point signal that does not cross the "Analog start point" at the right time and direction indicates that the wafer in the chamber is faulty.
- If end-point signal does cross the "Analog Start point" in the right direction, then the TadiVac2000 will continue the test.

#### Stage 2

The TadiVac evaluates the signal's stability during this stage. The process reaches a successful end when the end-point signal is stable for at least a

given period of time. This means that all photoresist was removed and the wafer can proceed to the next step.

If the end-point signal is not stable for the given time, it indicates that photoresist removal was incomplete or the wafer is defective.

In the case that TadiVac2000 detects a wafer that didn't complete the process in the expected time, the TadiVac2000 would stop machine operation only when a complete lot has passed through the process. The operator would then check the reason for the alarm and would decide how to proceed. Thus, a bad wafer can not pass the machine.

### **TadiVac Benefits**

- Identifies good and bad wafers.
- Prevents wafers with photoresist residues or faulty wafers from continuing to the next step.
- Shortens process time and total wafer time.
- Provides real-time monitoring of the ashing machine.
- Provides real-time supervision and alarm to deviations.
- Provides full historical analysis of machine and process.

**Mattson asher Analog and Binary TadiVac2000 Channels Examples**

**Analog Channels**

1	RF Power Forward
2	RF Power Reflected
3	RF DC-Bias
4	MFC #1
5	MFC #2
6	MFC #3
7	MFC #4
8	Pressure
9	Control Valve
10	End-Point
11	A-Cell
12	B-Cell
13	DAC Volts
14	
15	
16	

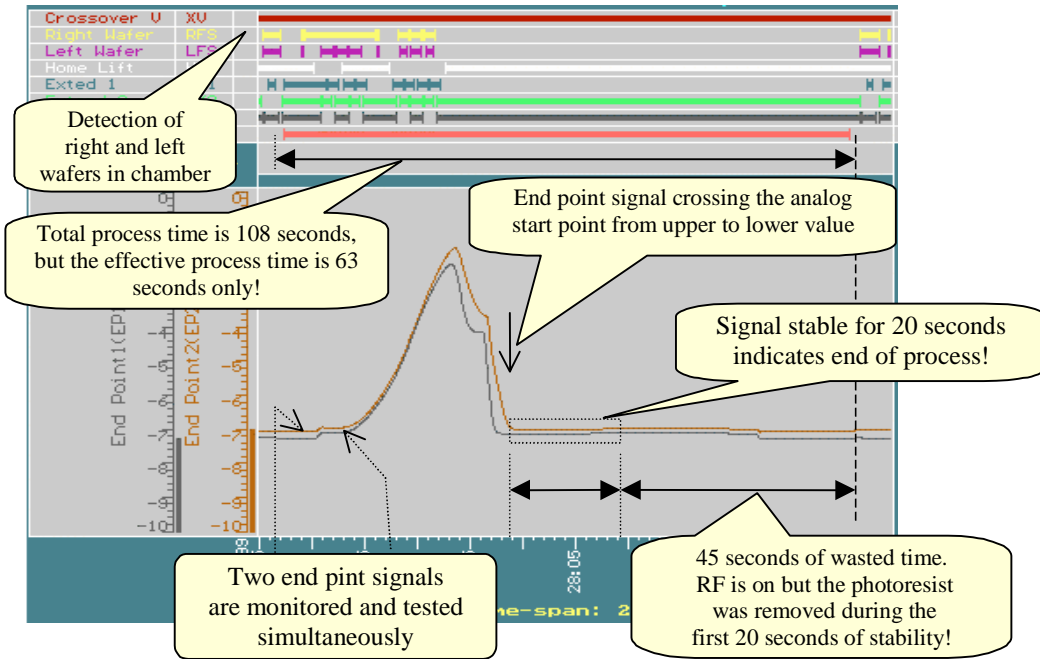
**Binary Channels**

1	RF On
2	Gas #1 Valve
3	Gas #2 Valve
4	Gas #3 Valve
5	Gas #4 Valve
6	Isolation Valve
7	Vacuum Valve
8	Vent Valve
9	Ballast On
10	Pins Up
11	Pins Down
12	Shuttle in Position
13	
14	
15	
16	

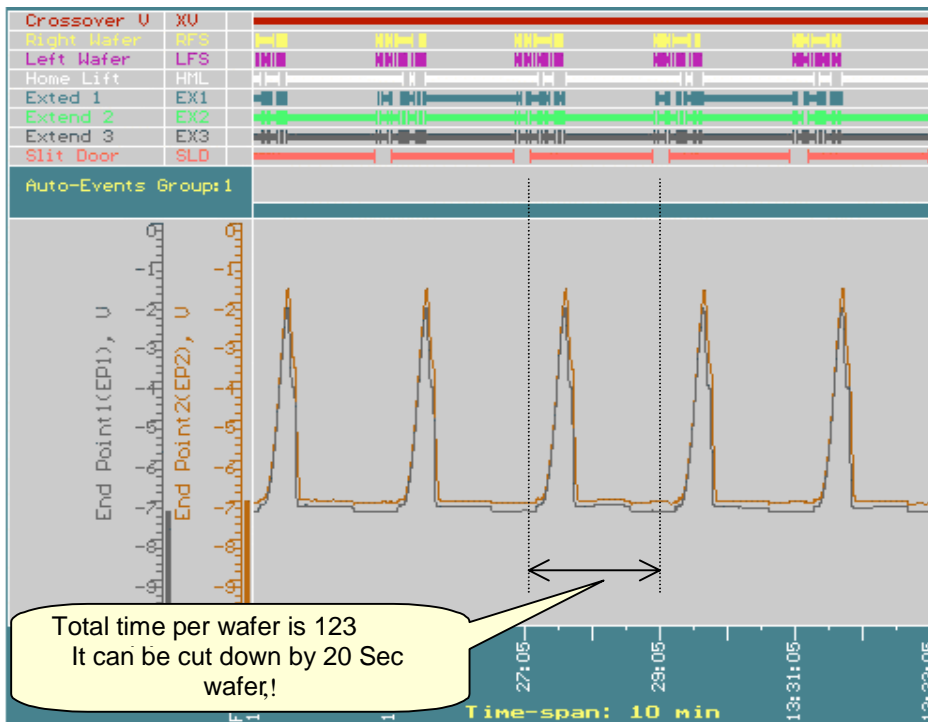
### TadiVac's contribution to the asher operation

Subject	TadiVac2000 Solutions
<b>Detection of wafer condition</b>	<p>The TadiVac2000 uses its combined stability alarm for two purposes:</p> <ul style="list-style-type: none"> <li>▪ To sense the end-point signal slope thereby determining the quality of the wafer and of the process.</li> <li>▪ To determine the stability of the end point signal. A signal that is stable for a preset time indicates that all photoresist material was removed from the wafer.</li> </ul> <p>TadiVac2000 gives a comprehensive solution to the end-point monitoring of ashers and etchers.</p>
<b>Historical data storage and analysis</b>	<p>TadiVac2000 provides process history going more than one year back. It enables historical analysis such as SPC, trends, etc., enabling process optimization and process problems detection and analysis.</p>
<b>Machine performance optimization</b>	<p>TadiVac2000 enables easy and accurate measuring of machine performance and allows immediate performance enhancements. It can measure net process time, net wafers/hour, total wafer run per process, etc. thus enabling comparison and long-term machine analysis.</p> <p>Analyzing the machine and the process can increase capacity by up to 20%. Return on investment is within weeks.</p>
<b>Real-time process and machine supervision</b>	<p>TadiVac2000 monitors all "suspect" parameters in real-time and alarms to any deviation from normal conditions, thereby eliminating damage to wafers and lost production time.</p>
<b>Maintenance and diagnostics, Intermittent problem detection.</b>	<p>TadiVac2000 monitors the machine parameters in real-time, and enables history analysis of various machine intermittent and lasting malfunctions. This efficiently results in more up-time and capacity with lower maintenance cost.</p>

**TadiVac2000's Mattson Aspen asher Typical Screens**



*Two end-point signals enable accurate process control.*



*TadiVac findings indicate a potential for 27% increase in the machine's throughput.*