The dawn of automated inspection

As integrated circuits grew ever more complex, visually inspecting them by human eyes, even with microscopes became impossible. That was the vision behind this tool that would lay the foundation for the emergence of VLSI. The bar for Very Large Scale Integration was circuits with more than 100 thousand transistors. That meant 300K contacts, or connections, had to be wired together. Imagine trying to check for each. Still many debated if it was worth replacing operators with these tools that cost upwards of $100K.

The question was settled in a landmark paper by David Angel, which showed yields were far higher when KLA’s tool was used to inspect photo masks than when human operators were used. In those days, acceptable yields were often in the 10-15% range. KLA’s mask inspection technology would pave the way towards achieving today’s 80-99% yields.
Win “the quality war” with the KLA ADD™/100 Series

It’s designed for fast precise photomask/reticle inspection... with unrivaled system flexibility.
The KLA ADD/100 Series...an important VLSI yield control tool.

The real challenge of the VLSI "quality war" is not only to beat the competition in quality, but also in IC density, complexity, performance—and price. This entails adding more process steps and sophistication, including more masking levels. Quality control at each and every step has to be increased dramatically to maintain profitable yields.

In the final analysis, "killer defects" in photomasks and reticle arrays—a major yield-decreasing factor—must be reduced by 20 to 25 percent annually. At the same time, defects will be getting smaller and harder to find as critical pattern dimensions also continue to decrease at about 25 percent annually. Small mask defects of little consequence today will become deadly "killers" tomorrow.

The harsh reality is that the inspection of photomasks and reticle arrays must contend with rapidly increasing complexity, while ensuring that smaller and fewer "killer defects" go undetected. KLA's automatic, microprocessor controlled defect detection and discrimination is the answer.

Since its inception, KLA Instruments Corporation has been helping modern semiconductor manufacturers to fight a more efficient "quality war." The very latest innovation in this fight is KLA's ADD/100 Series photomask/reticle/wafer inspection system. It provides 100-percent automatic inspection of photomasks and reticle arrays for defects as small as 0.9 microns at 95 percent probability. KLA systems are presently used by most major worldwide semiconductor manufacturers.

**ADD...automatic perfection.**

The KLA ADD/100 Series now includes Automatic Defect Discrimination (ADD), the latest advance in photomask inspection techniques. Just like error control and correction (ECC) used by computer networks, ADD brings the power of additional data checks to photomask inspection for the first time. Since a single photomask can have over 10 billion pieces of 0.3-micron data, quantization errors can cause many false defect readings. ADD sorts the "real" from "pseudo" defects to increase system accuracy, operational efficiency and throughput.

**KLA-100 Series...it watches everything.**

The KLA Automatic Photomask Inspection System is the heart of the ADD/100 Series. This fully automatic system makes it economically feasible and desirable to inspect every photomask or reticle array before delivery or use in production, to give you control over an essential factor in your wafer fabrication process. Designed for high throughput, the KLA-100 Series provides the operator with the option of a direct viewing binocular head or CRT display for set-up and review/classification of defects. Complete step-by-step text appears on the CRT reducing operator training time.

**KLA-50/60...increases throughput.**

The KLA-50/60 Inspection Controller is a terminal and storage system that increases your throughput by collecting, storing, and analyzing defect data from automatic inspection. It permits immediate inspection of the next photomask without delay for printing. And it lets you increase yield by optimally matching mask sets that have "killer defects" in the same die locations. The KLA-50/60 also interfaces with non-KLA devices.

**KLA-45...fast, off-line review.**

The new KLA-45 allows off-line review of photomasks, reticles and wafers without interrupting the inspection on the KLA-100/101. Also, with complete access to the system data base of previously inspected masks and reticle arrays, printed wafers can be quickly reviewed against mask defects—through automatic positioning at the defect site. Printable "killer defects" can be quickly sorted for mask repair. The KLA-45 operates through the KLA-40 interface terminal.

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**KLA-40...interface for mask repair stations.**

The KLA-40 is an interface terminal used to control off-line mask repair stations or other non-KLA X-Y positioning equipment. It operates through the KLA-50/60 Inspection Controller.

**KLA printers...a fast visual reference.**

The KLA-100 Series line printer produces hardcopy records of all inspection data gathered during set-up, inspection and defect review. It provides a record of mask quality, a tabular listing of each defect by location, size and category, a data summary, and a pictorial representation of the location of die with defects.
The KLA ADD/100 Series

KLA-100/101/102

**MASK SIZE**
3" to 6" square (7.6 to 15.2 cm)

**ARRAY SIZE**
2" to 5.5" square (5.1 to 14 cm)

**MASK THICKNESS**
0.060" to 0.120" (0.15 to 0.3 cm)

**OVERALL SIZE**
65"W x 34"D x 52"H
(165W x 86D x 132H cm)

<table>
<thead>
<tr>
<th>Machine Variables</th>
<th>Units</th>
<th>KLA-100</th>
<th>KLA-101</th>
<th>KLA-102</th>
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<tbody>
<tr>
<td>Mask Material Type</td>
<td>~</td>
<td>Chrome</td>
<td>Chrome</td>
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<td>Pixel Size</td>
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KLA-50/60 Inspection Controller

**COMPUTER**
PDF-11/03

**TERMINAL**
Interactive with 11" CRT and ASCII-code keyboard

**I/O PORTS**
Seven total, for equipment interconnect (RS-232C EIA Standard)

**OVERALL SIZE**
48"W x 39"D x 42"H
(122W x 99D x 107H cm)

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KLA-45 Photomask/Wafer Review Station

**MASK SIZE**
3" to 6" square (7.6 to 15.2 cm)

**WAFER SIZE**
3" to 5" diameter (75 to 125 mm)

**MICROSCOPE**
American Optical trinocular head type. 6.5X, 10X, 20X, 40X objectives. 10X eyepieces. Transmitted and reflected illumination.

**REVIEW STATION SIZE**
28"W x 26"D x 19"H
(71W x 66D x 48H cm)

**INTERFACE TERMINAL SIZE**
(see KLA-40 data below)

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KLA-40 Interface Terminal

**KEYPAD**
Special function

**READOUT**
11" CRT

**SIZE**
18"W x 20"D x 39"H
(46W x 51D x 99H cm)

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KLA-100 Series Printers

**HCM-100D**

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<tr>
<td>PRINT SIZE</td>
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**HCM-100C**

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