

The Chip History Center

The semiconductor industry's virtual museum

KLA ADD/100 Series

Circa 1980

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.

835.4



Win "the quality war" with the KLA ADD/100 Series

It's designed for fast precise
photomask/reticle inspection...
with unrivaled system flexibility.



KLA Instruments Corporation

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 0.5-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 opera-

tor 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.

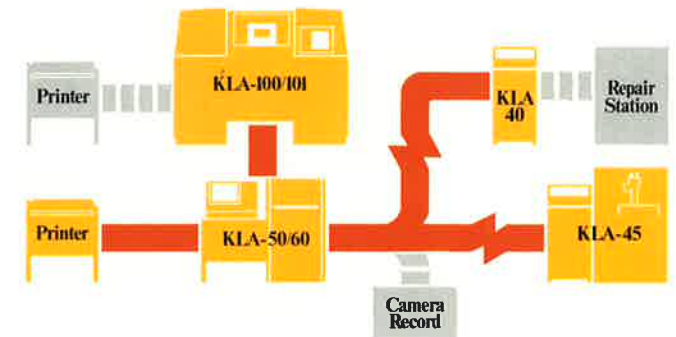
The new KLA-45 allows off-line review of photomasks, reticles and wafers without interrupting the inspection on the KLA-100/101. Also, with complete access to the system data base of previously inspected masks and reticle arrays, printed wafers can be quickly reviewed against mask defects—through automatic 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.

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.



KLA Line Printers

- Printout of set-up data
- Tabular defect listings
- Defect location maps
- Hard-copy, permanent records
- Fast reference for process control

KLA-50/60 Controller

- Increased system throughput
- Defect location/classification data storage
- Defect analysis
- Photomask set-up detail storage
- Non-KLA equipment interface

KLA-100/101 System

- Submicron defect detection
- Automatic Defect Discrimination (ADD)
- Self-alignment
- Automatic focusing
- Dual-viewing optics, plus TV display
- "Self-teaching" software

KLA-45 Station and Terminal

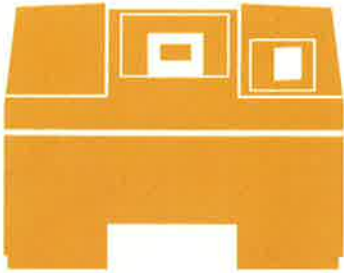
- Convenient, off-line review of masks, reticles and wafers
- Analysis of printable "killer defects"
- Increased overall system throughput
- Can be remotely located

KLA-40 Terminal

- Convenient interface to non-KLA repair stations and X-Y tables

The KLA ADD/100 Series

KLA-100/101/102



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

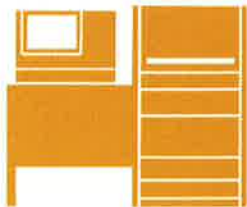
ARRAY SIZE
2" to 5.5" square (5.1 to 14 cm)

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)

Machine Variables	Units	KLA-100	KLA-101	KLA-102
Mask Material Type	—	Chrome (Iron Oxide Option)	Chrome (Iron Oxide Option)	Iron Oxide/ Chrome
Pixel Size	microns	1.25	0.5	0.78
Detection Sensitivity @95% probability	microns	2.0	0.9	2.0 (preliminary)
Inspection Rate at maximum sensitivity	sq. in./min.	1.75	0.4	0.7
	sq. cm/min.	11.3	2.6	4.5
Magnification				
Microscope (binocular)	—	500X	1000X	800X
CRT	—	800X	2000X	1280X

KLA-50/60 Inspection Controller



COMPUTER
PDP-11/03

TERMINAL
Interactive with 11" CRT and
ASCII-code keyboard

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

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

MEMORY	KLA-50	KLA-60
Type	Dual double-density, soft-sectored floppy disk drive. One-half Mega- byte floppy disks.	Dual single-density hard disk drives. Five Megabyte hard disks.
Set-up para- meters for dis- crete mask sets	750/disk	7,500/disk
Mask location/ inspection direc- tory for discrete inspections	7,500/disk	124,000/disk
Mask defect data storage (@60 defects/mask)	950/disk	10,000/disk

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)

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)

KLA-100 Series Printers



	HCM-100D	HCM-100C
TYPE	Matrix	Line
RATE	9600 Baud 180 lines/minute (equivalent)	9600 Baud 300 lines/minute
MAP SIZE	132 columns	132 columns
PRINT SIZE	Variable	Fixed
PHYSICAL SIZE	30"W x 25"D x 34"H (76W x 63D x 86H cm)	30"W x 25"D x 45"H (76W x 63D x 114H cm)



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