Interactive Graphical Computer-Aided Design System

An interactive graphical computer-aided design system has been developed including supporting software. The system is used for the design, layout, and modification of large-scale-integrated (LSI) metal-oxide semiconductor (MOS) arrays.

This interactive graphics system is structured around a small general-purpose computer and its supporting peripherals, dedicated to providing real-time support for a graphics storage display unit with a keyboard, a slave display unit, a hard copy unit, and a graphics tablet for designer/computer interface. The designer sits at the graphics terminal using an inductive pen associated with the graphics tablet. A nonstoring cursor tracks the path of the pen about the tablet. The designer selects commands by applying pen pressure to designated areas of the tablet and sends data to the computer by way of a data switch held in the other hand. The computer executes the commands given and reflects to the designer his graphical design needs. The designer can view portions of his work on the slave display unit while working with a different area on the master display. The designer also enters data through a keyboard and may obtain hard copies of the design.

The software network and communication flow of this interactive graphics system is shown in the illustration. The basic functions of the software systems are:

a. AIDS (artwork interactive design systems),
b. PRF-AIDS (place route fold - artwork interactive design systems),

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Interactive Graphics Software and Communication Flow

(...continued overleaf)
c. AIDS-PRF (artwork interactive design systems -
place parts fold),
d. CPAT (cell pattern generation),
e. CTMN (cell to mask tape), and
f. MNTC (mask tape to cell).

AIDS is the center of the designer/computer
software system. All actions at the tablet and terminal
are focused through AIDS. When using AIDS, the
designer steps through displays that allow the entering
of data to establish design parameters prior to the
design, such as component and line symbologies, the
definitions of libraries and files, grid symbologies,
and other commands for formatting. After these
actions have been taken, the design field appears on
the display, and the command menu attached to the
tablet becomes active. Using the pen, commands are
given to place, delete, name cells, add, copy, select
levels, and scale, for the controlling of single items or
groups of the design.

PRF-AIDS is a software conversion program that is
executed prior to the execution of AIDS. This
program converts data generated by the automatic
layout program. Automatic layout output consists of
all cell placement data, shape set data, and line set
data that constitute the total chip design.

AIDS-PRF is a software program that is executed
following AIDS. This program reads the AIDS data
base and produces data in the format of the automatic
layout data. It can be modified by the designer at the
graphics terminal and recreated reflecting only the
modifications performed. Thus the designer is given a
chance to interrupt the normal flow of the custom LSI
circuit design process and perform modifications that
cannot be provided by automatic layout.

CPAT is a software program that is executed
following the execution of AIDS. In this mode, AIDS
is used to perform cell design. The cell designer
approaches the graphics terminal with a thought, a
sketch, or an accurate layout of the artwork that will
eventually become a standard cell of a binary library if
desired. AIDS is used to digitize the information into
blocks and shapes that make up the artwork of the
cell. Upon completion of the cell design, the data is
filed into the AIDS data base. Executing CPAT
accesses the desired cell from the AIDS library and
generates library update source data. This source is
used as an input to generate a standard cell binary
library.

The CTMN conversion program allows the user to
output data from the AIDS library data base into a
format accepted by the mask pattern generator. Mask
pattern generator data is the block artwork exposure
information that constitutes the mask levels of the
circuit. This is the data that is processed into
photographic plates for fabrication of the circuit
design. Thus the user has the capability of directly
defining masks from the graphics terminal.

The MNTC conversion program provides the
designer with a “last look” capability. The mask data
tape is used as an input into the AIDS data base and
is treated as a cell. AIDS can then be used to view the
cell (total design) prior to the fabrication of the
masks. AIDS is used to scan the masks in great detail
at high gains for inspection and provides the designer
with a matching group of hard copies to form a large
mosaic of the total chip artwork. Acceptance of the
chip design at this point releases the design to the
mask facility.

These software packages were written in
FORTRAN. Although FORTRAN causes some
real-time degradation with respect to high-density
graphics, it provides a standard base for the
distribution of the system software to industry.

Note:
Requests for further information may be directed
to:
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Patent status:
Inquiries concerning rights for the commercial use
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