

## Appendix D. A Basic Library of Symbol Layouts

*[This information was first distributed as an informational message to participants of the MPC79 project, a multiuniversity multiproject chip set involving Stanford, CMU, MIT, Berkeley, U. of Rochester, and other schools. It is the official release announcement and documentation of the file of library symbol designs provided for use in that project. Both black-and-white and color checkplots have been added to this document to clarify the descriptions of the layouts. The black-and-white plots contain only outlines of symbols and boxes to help in interpreting the color plots.]*

### Summary

A single file in CIF 2.0 format is provided for your use. It contains standard I/O Pads, all the pieces needed to make PLA's, shift register cells on a pitch compatible with the PLA, and superbuffers for driving clock and control lines. The intention is that these should be a sufficient set of common cell designs to allow implementation of combinational functions and state machines simply by placement and interconnection, thus allowing students to focus their efforts on the architecture, logic, and cell designs specific to their own projects. They also serve as examples, and can be used to test your CIF plotting software.

Project lab coordinators at each participating school should retrieve the file from [MAXCKMPC79>LIBRARY79-250.CIF (250 is the value of lambda in CIF units, which is 2.5 microns). Additional hardcopy documentation with color checkplots will be mailed later to each school.

### Conventions

Since the library symbols were designed using ICARUS, they all have names in addition to numbers. Names are represented in the CIF file by the use of a userExtensionCommand, in the format "9 name;". These names may be used or ignored, but in this message all symbols are referred to by name. The terms symbol and cell are used interchangeably in this message.

In all cases, the origin of a symbol is the upper left corner of its minimum bounding box; hence, all Y coordinates in the CIF library symbol definitions are negative.

Since this library is intended to be compatible with even the simplest design systems, no geometric primitives other than boxes with default direction and no rotation transformations except multiples of 90 degrees are used; all box edges before and after transformation lie on the lambda grid.

Plots of various symbols should be made from the CIF file to serve as the illustrations for this document.

### Pad Descriptions

Bonding pads and associated circuitry are provided for input, output, clocked output, tristate input/output, Vdd, ground, and conversion of a single-phase clock input to two-phase. A standard configuration was chosen to simplify placement and interconnection of the pads. See PadBlank, which is called by most of the other pads, as an example:

```
DS 2; 9 PadBlank;
(4 Items.); (bounding box 0,0 to 26500,-26500);
L NM; B L 26500 W 2000 C 13250,-1000; (Vdd line);
L NM; B L 20500 W 2000 C 13250,-25500; (ground line);
L NM; B L 13500 W 13500 C 13250,-13250; (metal pad);
L NG; B L 11500 W 11500 C 13250,-13250; (overglass window);
DF;
```

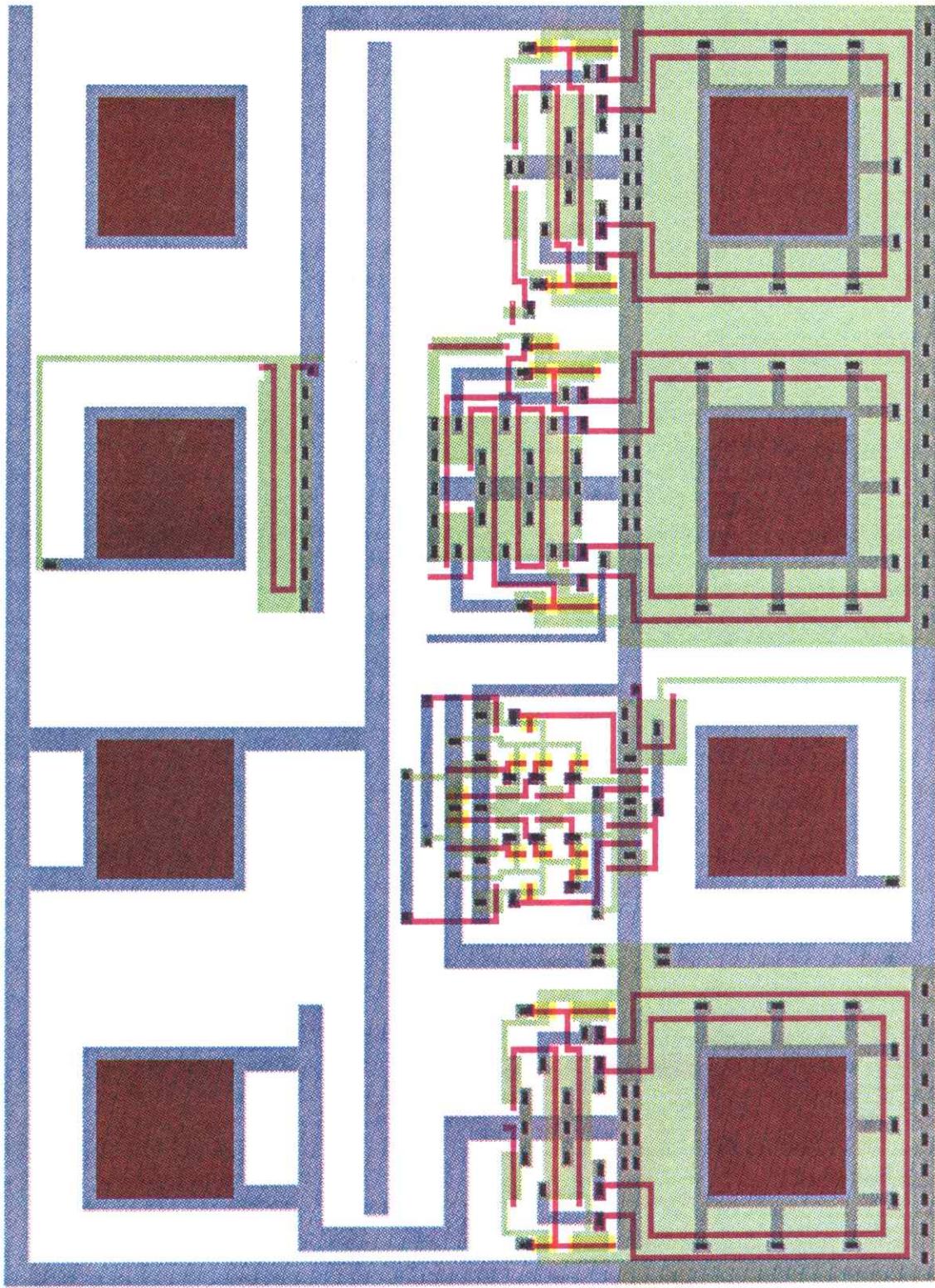
PadBlank illustrates the fact that each pad is a 135 micron metal square with a 115 micron square overglossing window in a 265 micron (106 lambda) square area, with horizontal metal lines along the top and bottom edges. The top metal line, which is always used for a Vdd connection, crosses the entire width of the symbol, and defines the outside edge of the project of which the symbol is a part. The default orientation is correct for pads along the top edge of a project. The bottom metal line is used for ground, and stops short of the edges of the symbol to facilitate running Vdd around the corners of a project without going outside the bounding box of the pad symbols. A typical project will have abutting pads around two, three, or four sides, with an 8-lambda Vdd ring around the outside, and an 8-lambda ground ring around the inside; pads should only be placed around the perimeter of a project, since interior pads are difficult to bond. The Vdd pad omits the ground line so that there will be a gap in the ground ring to bring power into the project. See PadSample for an example of all the pads and their power connections.

The pads and their sizes (in lambda) are as follows:

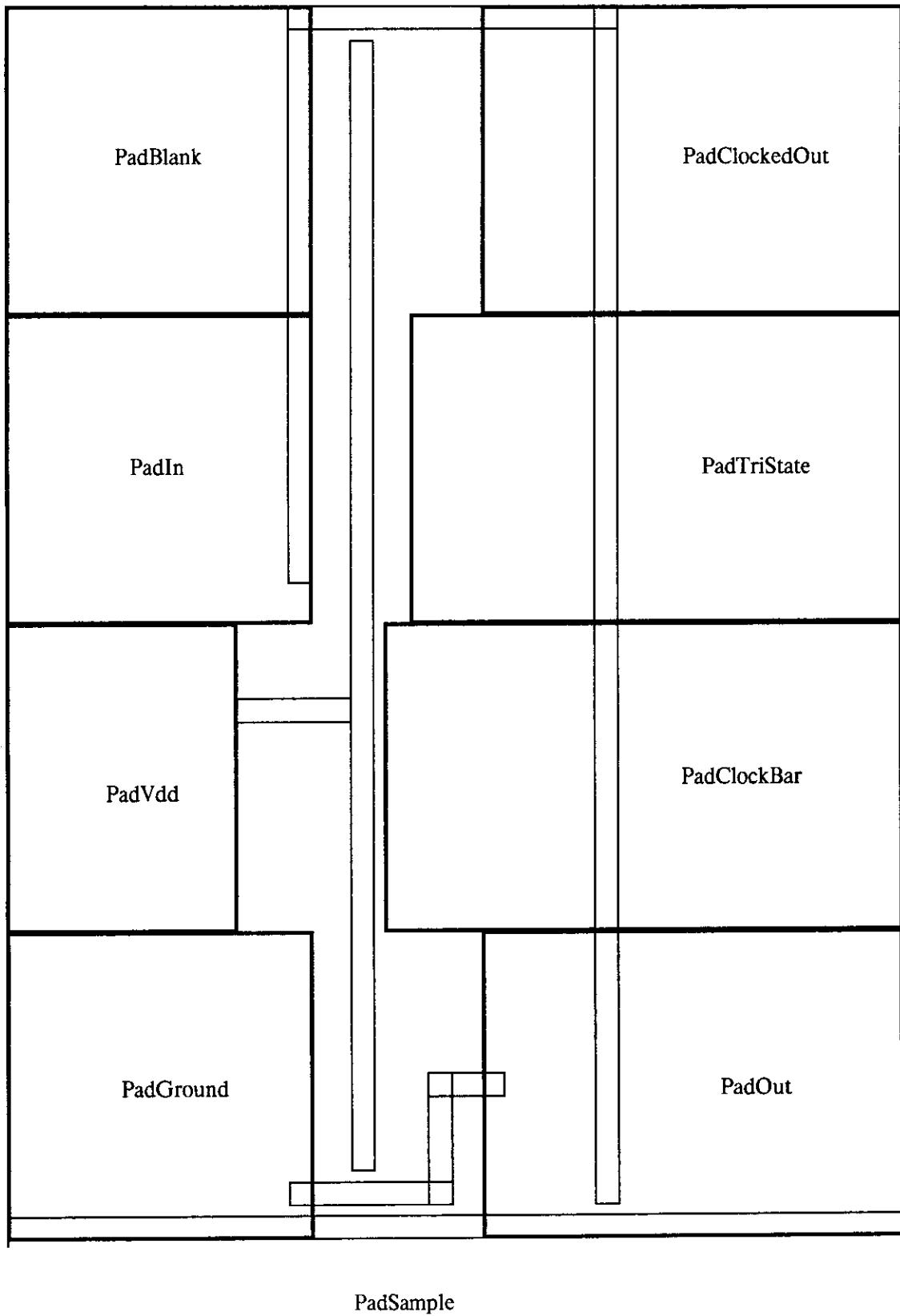
PadBlank	106x106
PadGround	106x106
PadVdd	106x80
PadIn	106x106
PadDriver	106x106
PadOut	106x145
PadClockedOut	106x145
PadTriState	106x170
PadClockBar	106x179

The output pads call PadDriver, which uses enhancement-mode pullups, so the output levels are TTL-like; internally these pads should be driven from level-restored signals. The input pad does no level restoration (it simply provides a lightning arrestor), so inputs from TTL-like devices should connect only to  $k=8$  logic, and should not control pass transistors.

Note that PadClockBar generates inverse clocks, guaranteed to never both be low at the same time, from a single-phase TTL-compatible input; these are driven by a powerful superbuffer for distribution around a chip, and are intended to be used with InvertingSB (described below) to generate clocks and gated control signals. Designers should carefully consider the implications of using this clock generation circuit before including it in their projects; it results in considerably less clocking flexibility than using separate input pads for the clock phases.







## PLA Descriptions

The PLA symbols provided for MPC79 were designed to be simple and clean, and are not as small as they could be in some cases. The pitch of the metal and poly lines in both planes is 8 lambda, when 7 lambda would be possible. This extra spacing makes layout of the edge cells on the same pitch much easier, and makes possible the layout of a shift register cell on the same pitch as the PLA inputs (16 lambda). The overall structure and orientation of the PLA is similar to that shown in Mead&Conway's *Introduction to VLSI Systems*, pp. 102-107 (inputs and outputs on the bottom edge, AND-plane on the left, OR-plane on the right); but, as can be seen by comparing the layouts, the extra spacing simplifies most of the cells.

See PLA-4-8-8 (a 4-input, 8-product term, 8-output PLA) as an example of how the pieces fit together. This layout illustrates the use of extra metal ground meshing that may be needed in large PLA's; typically a ground line for every 32 product term lines will be adequate, but a conservative designer might use more frequent ground lines. This layout also illustrates all the possible clocked and unclocked input and output cells, and the NOR output cells (which, if used in place of the usual inverters, effectively AND pairs of adjacent OR-plane outputs to facilitate "folding" of ROMs). For simplicity, no provision is made for an odd number of lines across either plane in either direction.

The basic cells provided are the following (cells marked with \* should be rotated 90 degrees clockwise for use in the OR-plane):

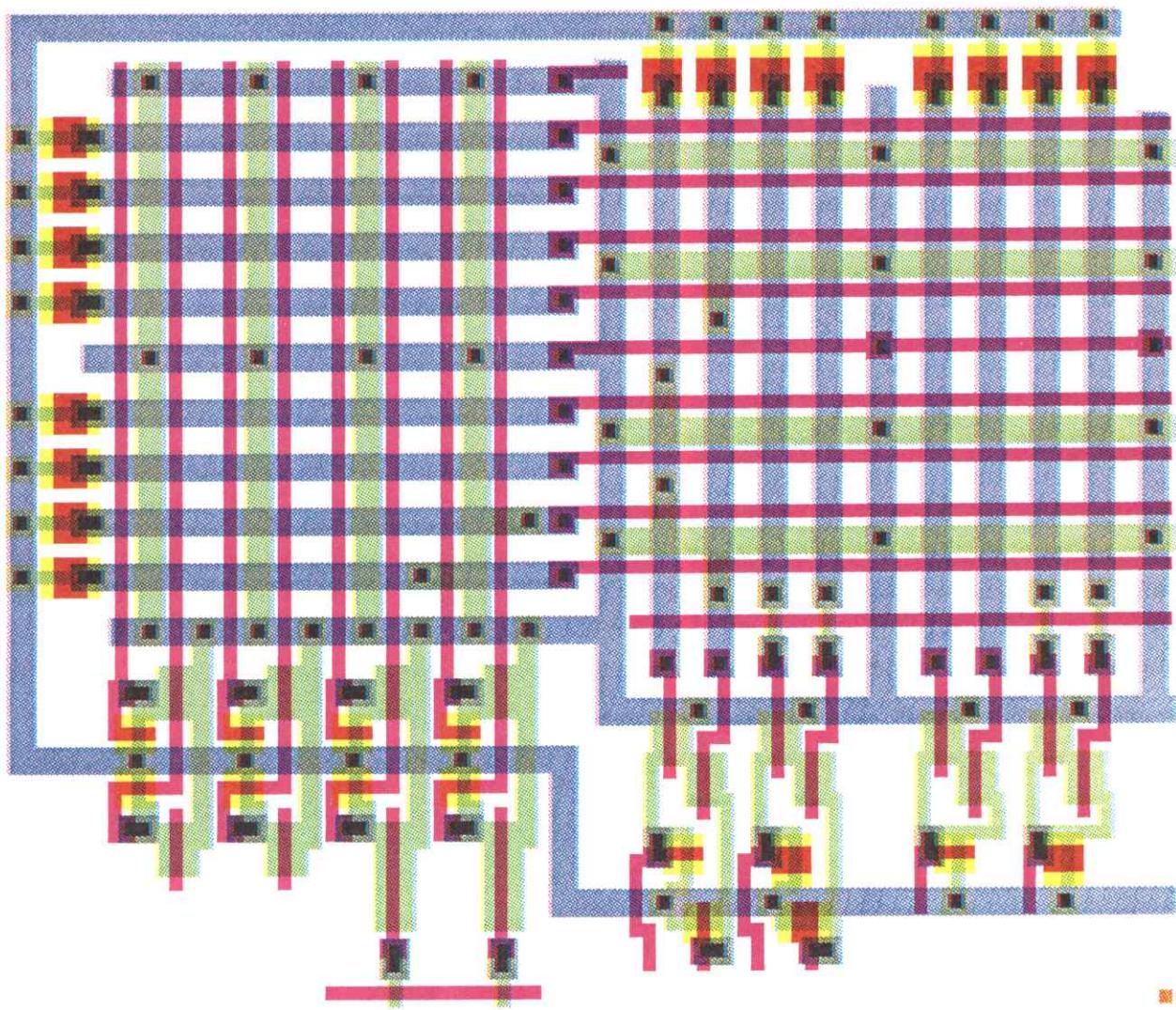
- PlaCell\*
- PlaGround\*
- PlaPullups\*
- PlaConnect
- Plain
- PlaClockedIn
- PlaOut
- PlaClockedOut
- PlaNorOut
- PlaClockedNorOut
- PlaHoleWires

These are the programming cells for the left and right sides of the AND-plane cells and the top and bottom of the OR-plane cells:

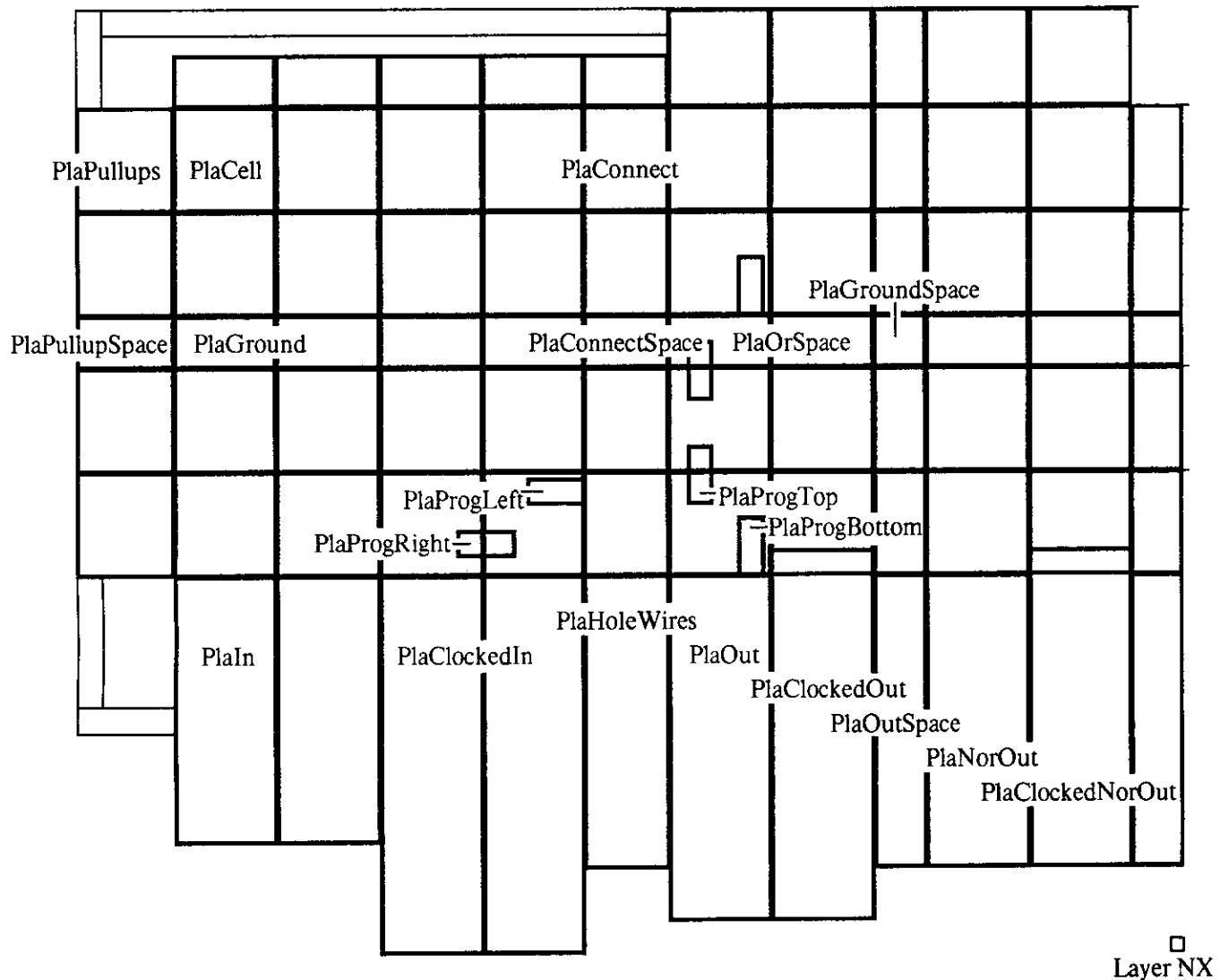
- PlaProgLeft
- PlaProgRight
- PlaProgTop
- PlaProgBottom

In addition, cells are provided to fill the spaces left to accomodate the optional extra ground meshing:

- PlaOrSpace
- PlaConnectSpace
- PlaGroundSpace\*
- PlaPullupSpace\*
- PlaOutSpace







Pla-4-8-8

### Superbuffer Descriptions

A set of superbuffers is provided for use as clock and control line drivers. They were optimized for flexibility and regularity, rather than absolute speed. SuperBuffer is a subcell of both InvertingSB and NoninvertingSB, and has no output structure of its own. With alternate cells mirrored, superbuffers fit together with their diffusion outputs regularly spaced 16 lambda apart along the top edge. To simplify placement, mirrored pairs are provided for both inverting and noninverting types.

The symbol SBExample illustrates the use of superbuffers with various input options. Generally, it is intended that Philinverse and Phi2inverse from PadClockBar would be distributed on the metal lines that (partially) cross the bottom edge of the superbuffers, and that clock gating signals would be routed in poly from below (low-true logic) into InvertingSB, making it into a NOR driver. Thus both gated and nongated clocks are driven through the same circuit, with similar delay (but use caution in loading these signals, since fatal clock skew is still possible).

The symbol names are as follows:

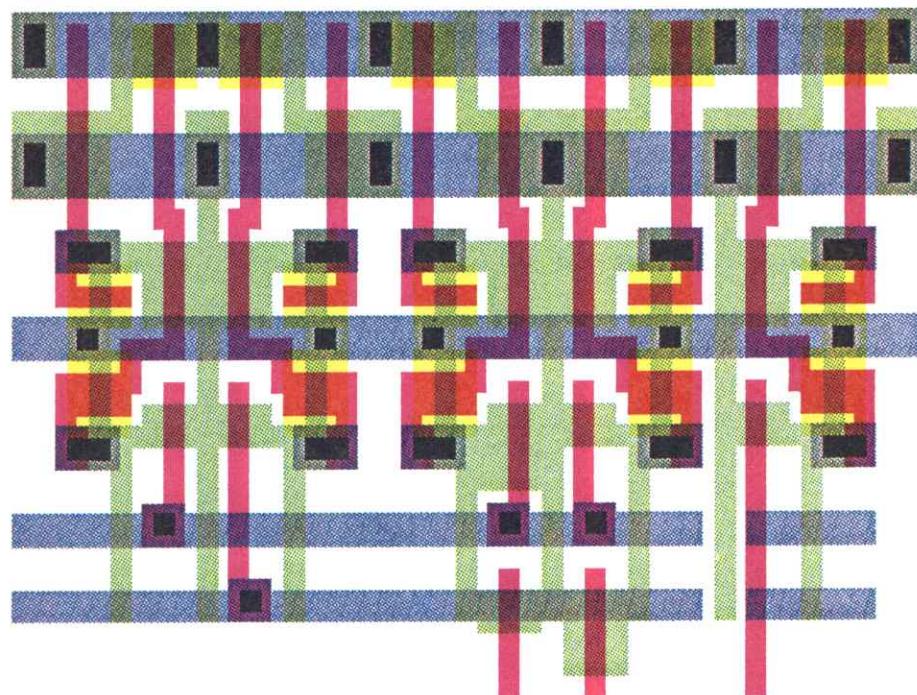
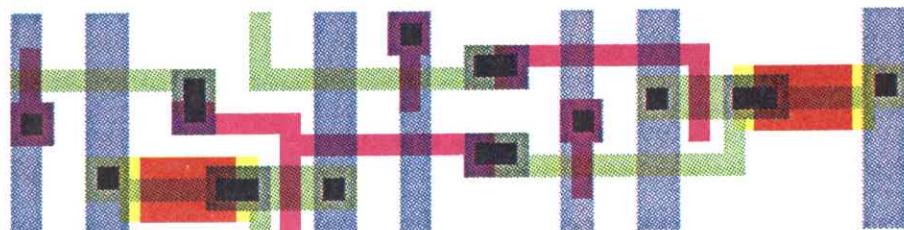
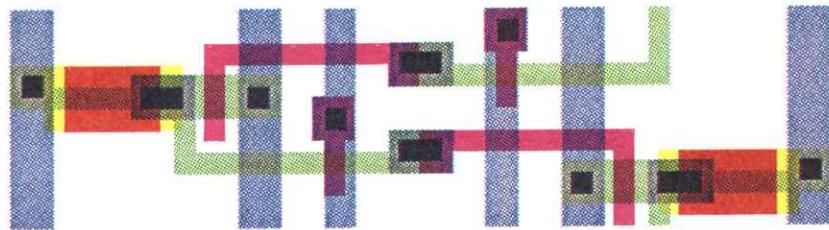
SuperBuffer  
InvertingSB  
InvertingSBPair  
NoninvertingSB  
NoninvertingSBPair  
SBExample

### Shift Register Descriptions

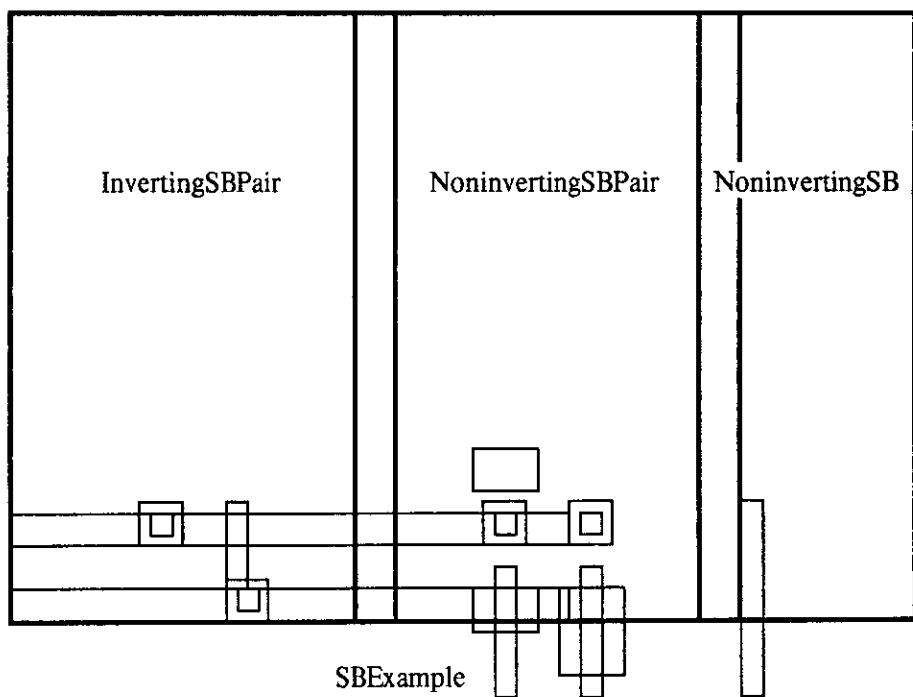
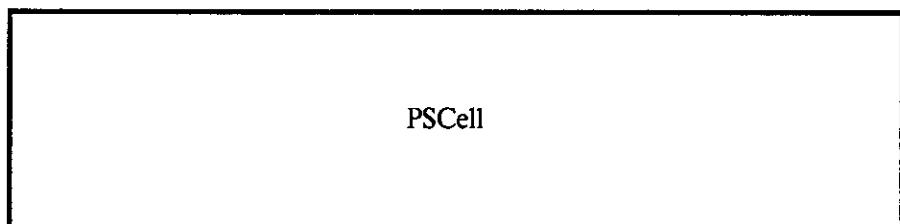
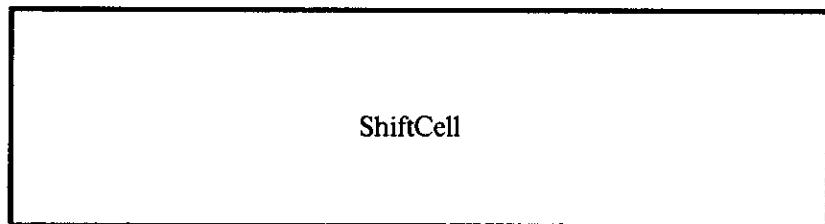
These full-bit shift register cells fit together with a pitch of 16 lambda, which make them useful for serial-to-parallel conversion (ShiftCell) on the pitch of PlaIn or PlaClockedIn, or for parallel-to-serial conversion (PSCell) on the pitch of PlaNorOut or PlaClockedNorOut. These cells have vertical metal power and clock lines, parallel to the direction of shift; they should be rotated to interface with the PLA in standard orientation.

The shift register symbol names are as follows:

ShiftCell  
PSCell







### Checking

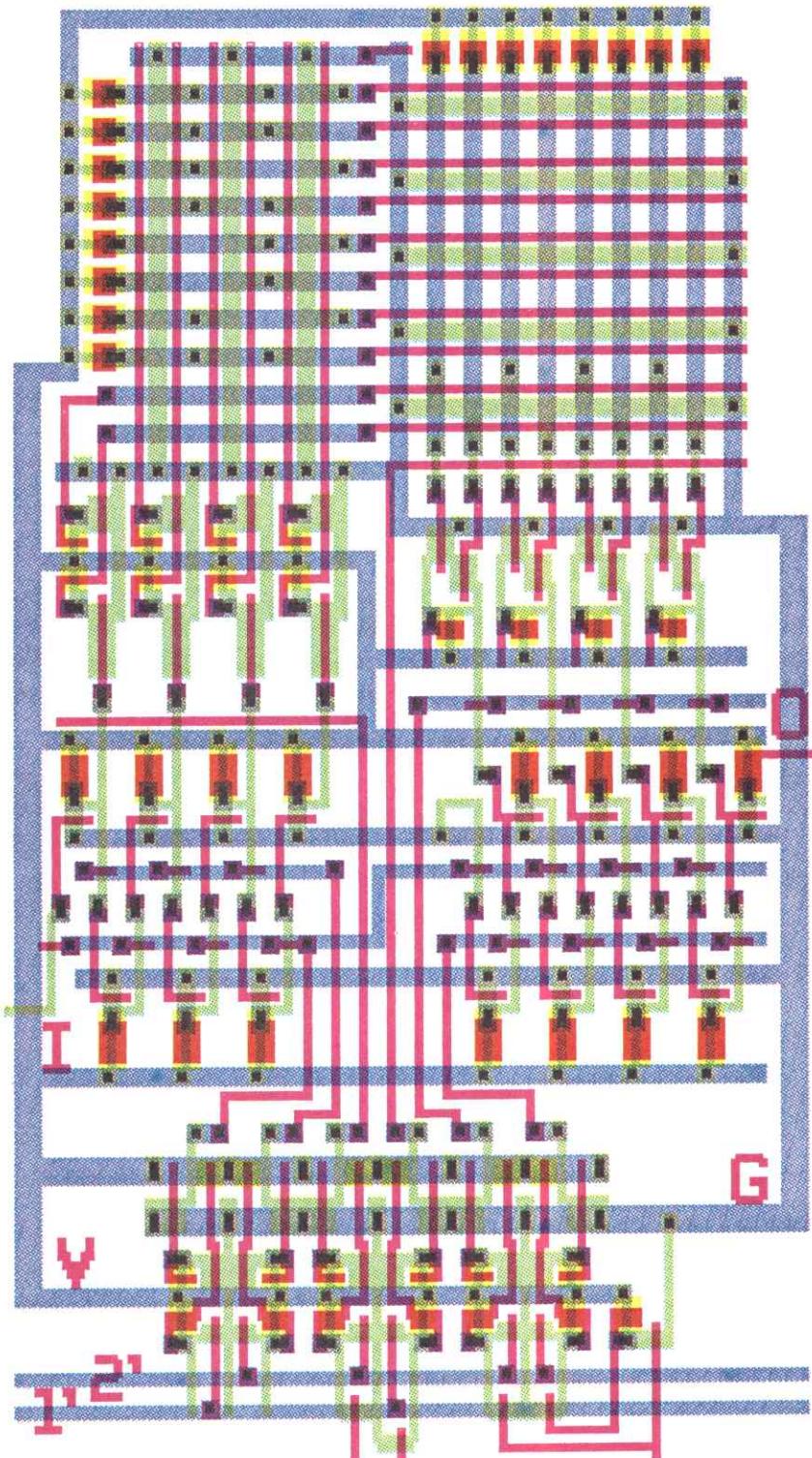
It is recommended that each designer take the time to examine library cells in detail before using them, to avoid misuse and to look for possible errors or incompatibilities. Although we have checked the cells carefully, they are not guaranteed to be free of logic, circuit, or design rule errors; if any errors are found, please notify MPC79@PARC immediately (the first person to report each fatal error will be amply rewarded). If anyone documents the cells in more detail, such as coordinates of connection points, etc., we would be glad to collect and distribute that information.

It would be useful if instructors would assign homework problems based on the library, such as to look for errors, to analyze the output pad or the clock pad, to develop formulas for the size and speed of the PLA, to analyze capacitive coupling of the clock to the storage node in ShiftCell, or to look at current limits of the power lines in various cells. We would be glad to see the results of such assignments.

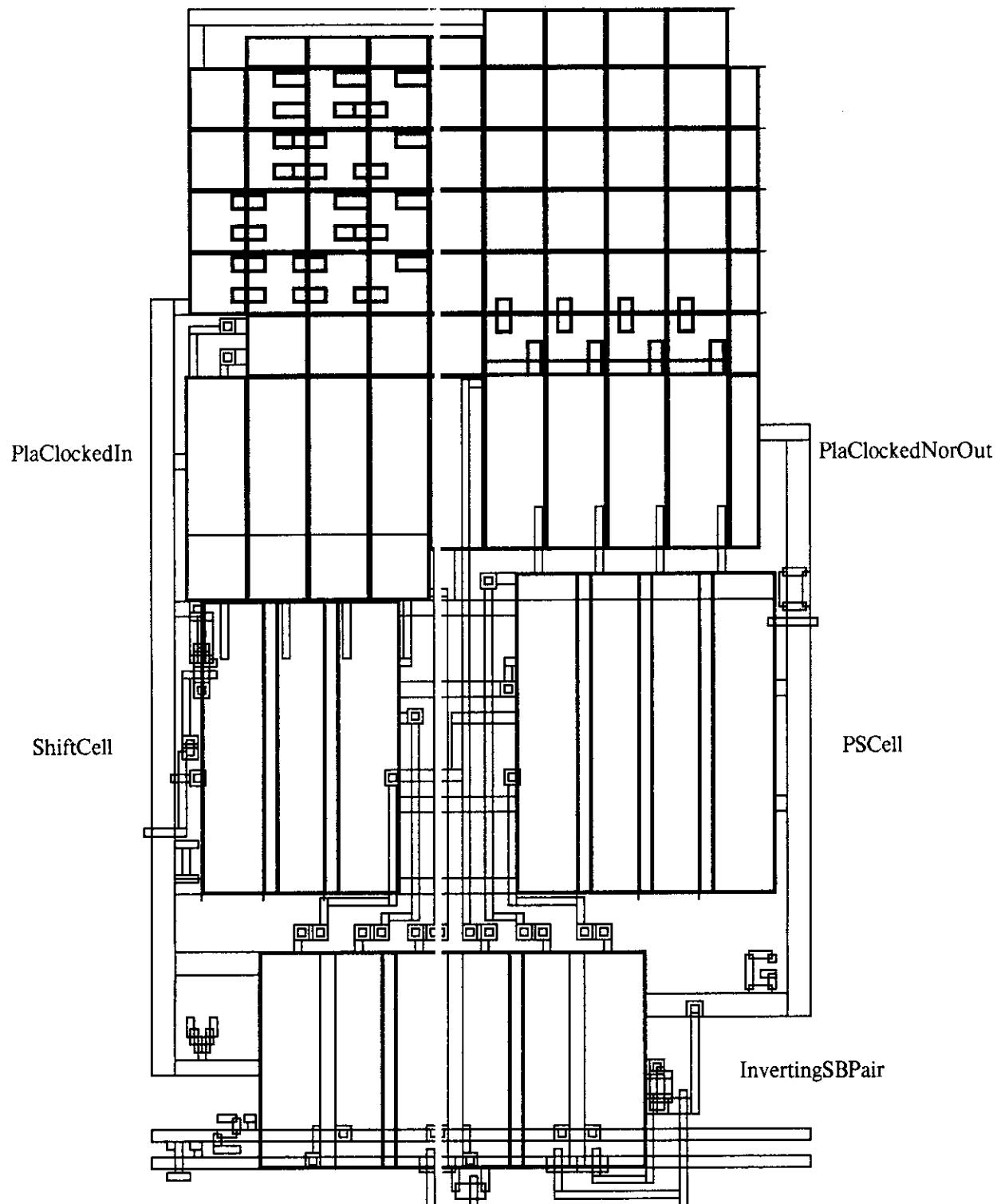
### Example

The last pair of figures shows a small project (named "Demo") assembled from library cells, to better illustrate how they can be interconnected to perform a non-trivial function. The example design implements a "serial ROM", which accepts a serial address input and delivers a serial data output (with 4 bits per word in this case). It illustrates the use of NOR outputs on the PLA to allow an 8x8 PLA (ROM) to implement a 16x4 ROM, and the use of both serial-to-parallel and parallel-to-serial conversion forms of the shift register, with clock gating and buffering included. This project is incomplete, as it still needs pads and programming of the ROM data.

The CIF text of the library file follows, with the example project included at the end of the file.







```

{ CIF 2.0 );
  Filed on [MAXC]<MPC79>LIBRARY79-250.CIF );
  Icarus file [MAXC]<MPC79>LIBRARY79-3.IC );
  Created by Sif from library79-5.ic );
  FAB nMOS, lambda=2.5 microns );
  modified by Lyon: October 12, 1979 1:08 PM );
  more comments added October 22, 1979 4:09 PM );
  userExtensionCommand 9 is Icarus symbol name );
  Squished January 24, 1980 11:11 AM );

DS 1;
9 ClockLogic;
L NM; B 10000 1500 5000,-14750;
      B 10000 1500 5000,-17000;
      B 9750 2000 4875,-2250;
L NP; B 500 4500 250,-15600;
      B 3000 500 1750,-13500;
L ND; B 2000 2750 1750,-14125;
L NM; B 1500 1000 2000,-12000;
L NP; B 750 1000 1625,-12000;
      B 5250 500 4125,-3750;
      B 500 1250 1750,-11125;
L NC; B 500 600 1750,-12000;
      B 500 1000 1750,-14750;
L NP; B 500 7250 1750,-7125;
L NI; B 1500 1500 2500,-10750;
L NP; B 1500 500 2500,-10750;
L ND; B 1000 1000 2250,-12000;
L NC; B 500 500 2250,-12000;
L ND; B 500 2500 2500,-10500;
      B 500 750 2500,-12625;
      B 1750 500 3375,-9500;
      B 1000 1500 4000,-17000;
      B 500 4250 3750,-14875;
L NC; B 500 1000 4000,-17000;
L ND; B 500 7000 4250,-9750;
      B 2500 500 5500,-11750;
      B 2500 500 5500,-9500;
      B 2500 500 5500,-6500;
      B 1000 1500 5250,-14750;
      B 4750 2000 7375,-2250;
L NI; B 1500 1500 5750,-11750;
      B 1500 1500 5750,-9500;
L NC; B 500 1000 5250,-14750;
      B 500 1000 5500,-2250;
L ND; B 1500 4000 6250,-15250;
L NP; B 1250 500 6125,-12500;
      B 1250 500 6125,-10250;
      B 1250 500 6125,-7250;
      B 500 1500 5750,-11750;
      B 500 1500 5750,-9500;
      B 500 1500 5750,-6500;
      B 500 5000 6250,-16250;
      B 500 3000 6500,-2250;
L NM; B 1000 1500 7000,-12250;
L NP; B 1000 750 7000,-12625;
L NM; B 1000 1500 7000,-10000;
L NP; B 1000 750 7000,-10375;
L ND; B 1000 1000 7000,-9750;
      B 1000 1000 7000,-12000;
L NM; B 1000 1500 7000,-7000;
L NP; B 1000 750 7000,-7375;
L ND; B 1000 1000 7000,-6750;
L NC; B 500 500 7000,-12000;
      B 500 500 7000,-12500;
      B 500 500 7000,-9750;
      B 500 500 7000,-10250;
L ND; B 500 1250 7000,-17125;
L NC; B 500 500 7000,-6750;
      B 500 500 7000,-7250;
L ND; B 2250 1000 8125,-16750;
L NP; B 1750 500 7875,-11000;
L ND; B 1000 500 7500,-9500;
      B 500 4500 7250,-4500;
L NP; B 1500 500 8000,-7250;
L ND; B 750 500 7625,-11750;
L NM; B 2250 1000 8875,-5000;
L ND; B 1500 2000 8500,-12500;
      B 1500 2000 8500,-8750;
L NI; B 1500 2000 8500,-16750;
L NP; B 1000 1000 8250,-5000;
      B 500 4000 8000,-2750;
L NC; B 500 500 8250,-5000;
L NP; B 500 6750 8500,-14375;
      B 500 2750 8500,-8875;
L NC; B 500 1000 9000,-2250;
L NM; B 10000 1500 14000,-14750;
      B 10000 1500 14000,-17000;
      B 9750 1000 13875,-5000;
      B 9750 2000 13875,-2250;
L ND; B 1000 1500 9500,-17000;
      B 1000 14250 9500,-8375;
L NC; B 500 1000 9500,-14750;
      B 500 1000 9500,-17000;
L ND; B 2500 1000 10500,-1250;
      B 2250 1000 10875,-16750;
      B 1500 2000 10500,-12500;
      B 1500 2000 10500,-8750;
L NI; B 1500 2000 10500,-16750;
L NC; B 500 1000 10000,-2250;
L ND; B 4000 2000 12000,-2750;
L NP; B 1750 500 11125,-11000;
      B 1500 500 11000,-7250;
      B 500 6750 10500,-14375;
      B 500 2750 10500,-8875;
      B 4000 500 12750,-250;
      B 500 4250 11000,-2125;
L ND; B 1000 500 11500,-9500;
      B 750 500 11375,-11750;
L NM; B 1000 1500 12000,-12250;
L NP; B 1000 750 12000,-12625;
L NM; B 1000 1500 12000,-10000;
L NP; B 1000 750 12000,-10375;
L ND; B 1000 1000 12000,-9750;
      B 1000 1000 12000,-12000;
L NM; B 1000 1500 12000,-7000;
L NP; B 1000 750 12000,-7375;
L ND; B 1000 1000 12000,-6750;
      B 500 4500 11750,-4500;
L NC; B 500 500 12000,-12000;
      B 500 500 12000,-12500;
      B 500 500 12000,-9750;
      B 500 500 12000,-10250;
L ND; B 500 1250 12000,-17125;
L NC; B 500 500 12000,-6750;
      B 500 500 12000,-7250;
L ND; B 1500 4000 12750,-15250;
L NP; B 5250 500 14875,-5000;
L ND; B 2500 500 13500,-11750;
      B 2500 500 13500,-9500;
      B 1750 500 13125,-6500;
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      B 1250 500 12875,-10250;
      B 1250 500 12875,-7250;
      B 500 3750 12500,-3125;
L NI; B 1500 1500 13250,-11750;
      B 1500 1500 13250,-9500;
      B 1500 1500 13250,-6500;
L NP; B 500 5000 12750,-15250;
L ND; B 2250 3000 14125,-2250;
L NP; B 500 1500 13250,-11750;
      B 500 1500 13250,-9500;
      B 500 1500 13250,-6500;
L ND; B 1000 1500 13750,-14750;
L NC; B 500 1000 13500,-2250;
      B 500 1000 13750,-14750;
L ND; B 500 3000 14000,-8000;
      B 1750 500 14875,-6500;
L NI; B 1500 1500 14750,-6500;
L NP; B 500 4250 14500,-2125;
      B 1250 500 15125,-7250;
L ND; B 1000 1500 15000,-17000;
      B 500 3750 14750,-11375;
L NP; B 500 1500 14750,-6500;
L ND; B 1750 500 15625,-9500;

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L NC; B 500 1000 15000,-17000;
L ND; B 3250 500 16625,-3500;
B 500 4250 15250,-14875;
L NM; B 1000 1500 16000,-7000;
L NP; B 1000 750 16000,-7375;
L ND; B 1000 1000 16000,-6750;
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L ND; B 1000 1000 16750,-12000;
B 500 2500 16500,-10500;
B 500 750 16500,-12625;
L NC; B 500 500 16750,-12000;
L NP; B 750 1000 17375,-12000;
B 500 1250 17250,-11125;
L NC; B 500 500 17250,-12000;
B 500 1000 17250,-14750;
L NP; B 500 5750 17250,-7875;
L ND; B 1000 1000 18250,-5000;
B 500 1250 18000,-4125;
L NC; B 500 500 18250,-5000;
L NP; B 500 4500 18750,-15500;
DF;

DS 2;
9 PadBlank;
L NM; B 26500 2000 13250,-1000;
B 20500 2000 13250,-25500;
B 13500 13500 13250,-13250;
L NG; B 11500 11500 13250,-13250;
DF;

DS 3;
9 PadDriver;
C 2;
L ND; B 26500 7000 13250,-3500;
B 7000 19500 3500,-16750;
L NC; B 1000 500 2000,-1000;
L NP; B 500 23000 2250,-14000;
B 4250 500 4125,-25250;
B 22500 500 13250,-2500;
L NM; B 1000 1500 3250,-7000;
B 1000 1500 3250,-13250;
B 1000 1500 3250,-19500;
L NC; B 500 1000 3250,-7000;
B 500 1000 3250,-13250;
B 500 1000 3250,-19500;
L NM; B 3250 1000 4875,-7000;
B 3250 1000 4875,-13250;
B 3250 1000 4875,-19500;
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L NP; B 500 19500 4250,-14250;
B 4750 500 6375,-23750;
B 18500 500 13250,-4500;
B 500 1500 6000,-25750;
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B 1000 2750 7000,-5125;
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B 1000 500 7000,-1000;
L ND; B 12500 7000 13250,-23000;
L NP; B 500 3000 8500,-25000;
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L NC; B 1000 500 19500,-1000;
B 7000 19500 23000,-16750;
L NM; B 3250 1000 21625,-19500;
B 3250 1000 21625,-13250;
B 3250 1000 21625,-7000;
L NP; B 4250 500 22375,-25250;
B 500 1500 20500,-25750;
L NC; B 1000 500 22000,-1000;
L NP; B 500 19500 22250,-14250;
L NM; B 1000 1500 23250,-7000;
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B 1000 1500 23250,-19500;
L NC; B 500 1000 23250,-7000;
B 500 1000 23250,-13250;
B 500 1000 23250,-19500;
B 1000 500 24500,-1000;
L NP; B 500 23000 24250,-14000;
DF;

DS 4;
9 PadOut;
C 3;
L ND; B 1000 6750 2250,-29875;
B 2500 1000 3500,-32750;
B 2000 3000 3500,-28750;
L NI; B 1500 4000 3500,-28750;
B 1500 2000 3500,-32750;
L NM; B 1000 1500 3500,-34250;
L NP; B 1000 750 3500,-33875;
L ND; B 1500 1000 3750,-34500;
L NP; B 500 7000 3500,-30250;
L NC; B 500 1000 3500,-34250;
L NP; B 3500 500 5250,-30750;
L ND; B 500 3750 4500,-34375;
B 2000 1000 5250,-29250;
B 3000 500 6000,-36000;
L NM; B 1500 2250 5500,-28625;
L NP; B 1500 1000 5500,-28000;
L NC; B 1000 500 5500,-28000;
B 1000 500 5500,-29250;
L NM; B 1000 3750 5750,-30625;
B 3500 1000 7000,-32750;
L NP; B 500 2250 6000,-27125;
B 500 3500 6750,-33500;
B 16500 500 14750,-31750;
B 5250 500 9125,-35250;
B 13250 500 13125,-29750;
B 500 1000 6750,-30250;
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B 4000 1750 9250,-35375;
B 1500 1000 8000,-32750;
L NM; B 3250 1000 8875,-28000;
L NP; B 1500 1000 8000,-28000;
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B 1000 500 8000,-28000;
L NP; B 500 2250 8500,-27125;
L ND; B 1500 1250 9750,-28125;
L NC; B 1000 500 9750,-28000;
L NM; B 6500 1000 13250,-30750;
B 6500 1000 13250,-34250;
L ND; B 6500 1000 13250,-34250;
L NC; B 1000 500 10750,-30750;
B 1000 500 10750,-34250;
L NM; B 2000 8500 13250,-30250;
L NC; B 1000 500 13250,-30750;
B 1000 500 13250,-34250;
L NP; B 500 1250 13250,-35625;
DF;

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```

L ND; B 6000 4000 16250,-30750;
L NP; B 6500 500 16500,-35250;
L NC; B 1000 500 15750,-30750;
L ND; B 4000 1750 17250,-35375;
L NC; B 1000 500 15750,-34250;
L ND; B 1500 1250 16750,-28125;
L NM; B 3250 1000 17625,-28000;
L NC; B 1000 500 16750,-28000;
L NP; B 500 2250 18000,-27125;
L ND; B 1500 1000 18500,-32750;
L NM; B 3500 1000 19500,-32750;
L NP; B 1500 1000 18500,-28000;
L NC; B 1000 500 18500,-32750;
B 1000 500 18500,-28000;
L ND; B 3000 500 20500,-29000;
B 3000 500 20500,-36000;
L NP; B 500 2250 20500,-27125;
L NM; B 1000 5000 20750,-30000;
L NP; B 1500 1000 21000,-28000;
L NM; B 1500 1000 21000,-28000;
L NC; B 1000 500 21000,-28000;
L ND; B 2500 1000 23000,-32750;
B 500 3750 22000,-34375;
B 2000 3000 23000,-28750;
B 1500 1000 22750,-34500;
L NI; B 1500 4000 23000,-28750;
B 1500 2000 23000,-32750;
L NM; B 1000 1500 23000,-34250;
L NP; B 1000 750 23000,-33875;
B 500 7000 23000,-30250;
L NC; B 500 1000 23000,-34250;
L ND; B 1000 6750 24250,-29875;
DF;

DS 5;
9 PadIn;
C 2;
L ND; B 19250 4500 12625,-23250;
L NC; B 1000 500 3750,-25000;
L NP; B 500 1750 5000,-23125;
B 18750 500 14125,-22250;
B 18750 500 14125,-24000;
L NC; B 1000 500 6250,-25000;
L NM; B 1000 4250 7000,-5125;
L ND; B 1000 2000 7000,-3500;
L NC; B 500 1000 7000,-3750;
L ND; B 16750 500 15625,-2750;
L NC; B 1000 500 8750,-25000;
B 1000 500 11250,-25000;
B 1000 500 13750,-25000;
B 1000 500 16250,-25000;
B 1000 500 18750,-25000;
B 1000 500 21250,-25000;
L ND; B 2000 3250 23000,-23125;
L NP; B 1000 1000 23000,-25500;
L NC; B 500 500 23000,-25500;
L NP; B 500 1250 23250,-21625;
B 500 2000 23250,-25000;
L ND; B 500 24000 24000,-14500;
DF;

DS 6;
9 PadGround;
C 2;
L NM; B 2000 4500 7500,-22250;
B 2000 4500 19000,-22250;
DF;

DS 7;
9 PadVdd;
L NM; B 26500 2000 13250,-1000;
B 13500 13500 13250,-13250;
B 2000 4500 7500,-4250;
L NG; B 11500 11500 13250,-13250;
L NM; B 2000 4500 19000,-4250;
DF;

DS 8;
9 PadTriState;
C 3;
L ND; B 500 4750 750,-34375;
L NM; B 1500 1000 1250,-34250;
L ND; B 1000 1000 1000,-34250;
L NI; B 1500 2500 1500,-32750;
L NC; B 1000 500 1250,-34250;
L ND; B 1500 6000 1500,-39250;
B 1000 1500 1500,-32750;
L NP; B 500 2500 1500,-32750;
B 750 1000 1625,-34250;
B 500 6750 1500,-39125;
B 750 500 2125,-34500;
L ND; B 1000 7000 2500,-30000;
B 17250 1000 10625,-42000;
L NP; B 500 1750 2500,-35125;
B 3500 500 4000,-35750;
L ND; B 2000 1000 3500,-33000;
B 2000 3000 3500,-30000;
L NI; B 1500 2000 3500,-33000;
B 1500 4000 3500,-30000;
L NP; B 500 6250 3500,-31125;
L NM; B 1000 6750 3750,-37125;
L NP; B 1000 750 3750,-34125;
L ND; B 1500 1000 4000,-34750;
L NP; B 3250 500 5125,-32000;
L NC; B 500 1000 3750,-34500;
L ND; B 2000 1000 5250,-31000;
L NM; B 4500 1000 6500,-40000;
L ND; B 500 2750 4750,-33875;
L NP; B 1500 1000 5500,-29500;
L NM; B 1500 2500 5500,-30250;
L NC; B 1000 500 5500,-29500;
B 1000 500 5500,-31000;
L NM; B 1000 6500 5750,-33250;
L NP; B 500 6250 5750,-37875;
B 14250 500 12625,-41000;
B 14250 500 12875,-35000;
B 500 2750 6000,-27875;
L NM; B 2750 1000 7375,-36000;
L NP; B 500 2000 6750,-38000;
B 14750 500 13875,-37000;
B 500 2250 6750,-33875;
B 5250 500 9125,-39000;
B 500 1500 6750,-31500;
B 13000 500 13250,-31000;
B 13000 500 13250,-33000;
L NM; B 1500 3500 8000,-30750;
L ND; B 4000 4250 9250,-40375;
B 1750 7000 8125,-35000;
L NP; B 1500 1000 8000,-29500;
L NM; B 12000 1000 13250,-42000;
L NC; B 1000 500 8000,-32000;
B 1000 500 8000,-36000;
B 1000 500 8000,-40000;
B 1000 500 8000,-42000;
B 1000 500 8000,-29500;
L NP; B 500 2750 8500,-27875;
L ND; B 8500 9000 13250,-34000;
L NM; B 6500 1000 13250,-30000;
B 6500 1000 13250,-34000;
B 6500 1000 13250,-38000;
L NC; B 1000 500 10500,-42000;
B 1000 500 10750,-34000;
B 1000 500 10750,-30000;
B 1000 500 10750,-38000;
L NM; B 2000 15500 13250,-34250;
L NC; B 1000 500 13250,-42000;
B 1000 500 13250,-34000;
B 1000 500 13250,-30000;
B 1000 500 13250,-38000;
L NP; B 6000 500 17750,-39000;
L NC; B 1000 500 15750,-34000;
B 1000 500 15750,-30000;

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L ND; B 1000 500 15750,-38000;
L NC; B 4000 4250 17250,-40375;
L ND; B 1000 500 16000,-42000;
L ND; B 1750 8250 18375,-34375;
L NM; B 1500 3500 18500,-30750;
B 3500 1000 19500,-36000;
B 4750 1000 20125,-40000;
L NP; B 500 2750 18000,-27875;
B 1500 1000 18500,-29500;
L NC; B 1000 500 18500,-32000;
B 1000 500 18500,-36000;
B 1000 500 18500,-40000;
B 1000 500 18500,-42000;
B 1000 500 18500,-29500;
L ND; B 1500 1750 19250,-27375;
L NM; B 1500 1000 19250,-27750;
L NC; B 1000 500 19250,-27750;
L ND; B 1500 1000 19750,-32000;
L NP; B 500 2250 19750,-33875;
L NM; B 5750 750 22625,-27875;
L ND; B 750 1750 20375,-31625;
B 2250 1000 21125,-31000;
L NM; B 1000 6750 20750,-33125;
L NP; B 500 2750 20500,-27875;
B 1500 1000 21000,-29500;
L NM; B 1500 1000 21000,-29500;
B 1500 1000 21000,-29500;
L NP; B 500 3750 20500,-40625;
L NC; B 1000 500 21000,-29500;
L NP; B 500 5500 21250,-34500;
B 2000 500 22000,-32000;
L ND; B 500 2750 22000,-33875;
B 1500 1000 22750,-34750;
B 2000 1000 23000,-33000;
B 2000 3000 23000,-30000;
L NI; B 1500 2000 23000,-33000;
B 1500 4000 23000,-30000;
L NM; B 1000 6750 23000,-37125;
L NP; B 1000 750 23000,-34125;
L NC; B 500 1000 23000,-34500;
L NP; B 500 6250 23000,-31125;
L ND; B 1000 7000 24250,-30000;
L NM; B 750 15000 25625,-35000;
DF;

DS 9;
9 PadClockBar;
C 2;
L ND; B 600 20750 2750,-12875;
B 1500 500 3500,-23000;
L NP; B 1000 1000 3500,-25000;
L ND; B 17000 500 11500,-2750;
L NM; B 1000 12250 3500,-32625;
L NC; B 500 500 3500,-26000;
L NP; B 5250 500 5875,-24750;
L NM; B 12750 1000 10125,-42500;
L NP; B 1000 1000 4250,-42500;
B 600 1000 4000,-41500;
B 4500 500 6000,-22000;
C 1 T 3750,-23250;
L NC; B 500 500 4250,-42500;
L ND; B 5500 5750 7000,-23625;
L NC; B 1000 500 5500,-26000;
L NM; B 8000 1000 10000,-23250;
L NC; B 1000 500 6750,-23250;
B 1000 500 7500,-26000;
L NP; B 500 3250 8250,-23375;
L ND; B 1000 1000 10500,-44250;
L NM; B 12750 1000 16375,-44250;
L NC; B 500 500 10500,-44250;
L ND; B 500 2750 10750,-42375;
L NP; B 1500 1000 13250,-23250;
L NC; B 1000 500 13250,-23250;
L NP; B 500 500 14250,-23500;
L ND; B 1000 1000 16000,-42500;
B 500 1000 15750,-41500;
L NC; B 500 500 16000,-42500;

L NM; B 1000 3500 19500,-4750;
L ND; B 1000 1500 19500,-3750;
L NC; B 500 1000 19500,-3750;
L NP; B 1000 1000 22250,-44250;
L NC; B 500 500 22250,-44250;
L NP; B 500 2750 22500,-42375;
L NM; B 1750 1500 23625,-40250;
B 2000 21500 25500,-12750;
B 2000 13500 25500,-34250;
L ND; B 2000 7000 25500,-25500;
L NC; B 500 1000 25000,-22750;
B 500 1000 25000,-28250;
B 500 1000 26000,-22750;
B 500 1000 26000,-28250;
DF;

DS 10;
9 PadClockOut;
C 3;
L ND; B 1000 6750 2250,-29875;
B 2500 1000 3500,-32750;
B 2000 3000 3500,-28750;
L NI; B 1500 4000 3500,-28750;
B 1500 2000 3500,-32750;
L NM; B 1000 1500 3500,-34250;
L NP; B 1000 750 3500,-33875;
L ND; B 1500 1000 3750,-34500;
L NP; B 500 7000 3500,-30250;
L NC; B 500 1000 3500,-34250;
L NP; B 3500 500 5250,-30750;
L ND; B 500 3750 4500,-34375;
B 2000 1000 5250,-29250;
B 3000 500 6000,-36000;
L NM; B 1500 2250 5500,-28625;
L NP; B 1500 1000 5500,-28000;
L NC; B 1000 500 5500,-28000;
L NM; B 1000 3750 5750,-30625;
B 3500 1000 7000,-32750;
L NP; B 500 2250 6000,-27125;
B 500 3500 6750,-33500;
B 13250 500 13125,-31750;
B 5250 500 9125,-35250;
B 13250 500 13125,-29750;
B 500 1000 6750,-30250;
L ND; B 6000 4000 10250,-30750;
B 4000 1750 9250,-35375;
B 1500 1000 8000,-32750;
L NM; B 3250 1000 8875,-28000;
L NP; B 1500 1000 8000,-28000;
L ND; B 5250 500 9875,-34500;
L NC; B 1000 500 8000,-32750;
B 1000 500 8000,-28000;
L NP; B 500 2250 8500,-27125;
L ND; B 1500 1250 9750,-28125;
L NC; B 1000 500 9750,-28000;
L NM; B 6500 1000 13250,-30750;
L NC; B 1000 500 10750,-30750;
L NM; B 2000 10250 13250,-31125;
L ND; B 2000 2000 13250,-35250;
L NC; B 1000 500 13250,-30750;
B 1000 500 13250,-34750;
B 1000 500 13250,-35750;
L ND; B 6000 4000 16250,-30750;
B 5250 500 16625,-36000;
B 8250 500 18875,-35250;
L NC; B 1000 500 15750,-30750;
L ND; B 4000 1750 17250,-35125;
B 1500 1250 16750,-28125;
L NM; B 3250 1000 17625,-28000;
L NC; B 1000 500 16750,-28000;
L NP; B 500 2250 18000,-27125;
L ND; B 1500 1000 18500,-32750;
L NM; B 3500 1000 19500,-32750;
L NP; B 1500 1000 18500,-28000;
L NC; B 1000 500 18500,-32750;
B 1000 500 18500,-28000;

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L ND; B 3000 500 20500,-29000;
L NP; B 500 1000 19750,-31500;
B 3500 500 21250,-30750;
B 500 2250 20500,-27125;
L NM; B 1000 5000 20750,-30000;
L NP; B 1500 1000 21000,-28000;
L NM; B 1500 1000 21000,-28000;
L NC; B 1000 500 21000,-28000;
L ND; B 500 3000 22000,-33250;
B 1750 1000 22625,-33500;
B 2500 500 23000,-32000;
B 2000 3000 23000,-28750;
L NI; B 1500 4000 23000,-28750;
B 1500 1500 23000,-32000;
L NP; B 2250 500 23625,-34500;
B 500 750 22750,-34875;
L NM; B 1000 1500 23000,-33250;
L NP; B 1000 750 23000,-32875;
B 500 6000 23000,-29750;
L NC; B 500 1000 23000,-33250;
L ND; B 1000 5750 24250,-29375;
L NM; B 1500 1000 25000,-34000;
L NP; B 750 1000 24625,-34000;
B 2000 500 25250,-35500;
L NC; B 1000 500 25000,-34000;
L ND; B 1000 2750 25250,-34875;
DF;

DS 11;
9 PadSample;
C 6 R 0.1 T 0,-106000;
C 7 R 0.1 T 0,-79500;
C 5 R 0.1 T 0,-53000;
C 2 R 0.1 T 0,-26500;
L NM; B 77750 2000 38875,-105000;
B 10250 2000 24875,-60500;
B 2000 49500 25500,-24750;
B 28750 2000 38875,-1000;
B 14250 2000 31625,-102000;
B 2000 97000 31000,-51500;
C 9 R 0,-1 T 77750,-53000;
C 8 R 0,-1 T 77750,-26500;
B 2000 11250 37750,-97375;
B 6500 2000 40000,-92750;
C 4 R 0,-1 T 77750,-79500;
C 10 R 0,-1 T 77750,0;
B 2000 103000 52250,-51500;
DF;

DS 12;
9 PlaCell;
L NM; B 4000 1000 2000,-750;
B 4000 1000 2000,-2750;
L NP; B 500 4000 500,-2000;
L ND; B 1000 4000 1500,-2000;
L NP; B 500 4000 2500,-2000;
DF;

DS 13;
9 PlaGround;
L NM; B 4000 1000 2000,-750;
L NP; B 500 2000 500,-1000;
L ND; B 1000 2000 1500,-1000;
L NC; B 500 500 1500,-750;
L NP; B 500 2000 2500,-1000;
DF;

DS 14;
9 PlaPullups;
L NM; B 1000 4000 500,-2000;
L ND; B 1000 1000 500,-750;
B 1000 1000 500,-2750;
L NC; B 500 500 500,-2750;
B 500 500 500,-750;
B 2250 500 1875,-750;
B 2250 500 1875,-2750;
L NI; B 2250 1500 2375,-750;
B 2250 1500 2375,-2750;
L NP; B 1250 1500 2375,-750;
B 1250 1500 2375,-2750;
L NM; B 1500 1000 3000,-750;
B 1500 1000 3000,-2750;
L NC; B 1000 500 3000,-2750;
B 1000 500 3000,-750;
L ND; B 1000 1000 3250,-2750;
B 1000 1000 3250,-750;
DF;

DS 15;
9 PlaConnect;
L NM; B 1250 1000 625,-750;
B 1250 1000 625,-2750;
L NP; B 1000 1000 750,-750;
B 1000 1000 750,-2750;
L NC; B 500 500 750,-750;
B 500 500 750,-2750;
L NP; B 2250 500 2125,-500;
B 2250 500 2125,-2500;
L NM; B 1000 4000 2500,-2000;
L ND; B 1250 1000 2625,-1500;
L NC; B 500 500 2500,-1500;
DF;

DS 16;
9 PlaConnectSpace;
L NM; B 2250 1000 1125,-750;
L NP; B 1000 1000 750,-750;
L NC; B 500 500 750,-750;
L NP; B 2250 500 2125,-500;
L NM; B 1000 2000 2500,-1000;
DF;

DS 17;
9 PlaOrSpace;
L NP; B 4000 500 2000,-500;
L NM; B 1000 2000 1250,-1000;
B 1000 2000 3250,-1000;
DF;

DS 18;
9 PlaGroundSpace;
L NP; B 2000 500 1000,-500;
L NM; B 1000 2000 1250,-1000;
L NP; B 1000 1000 1250,-500;
L NC; B 500 500 1250,-500;
DF;

DS 19;
9 Plain;
L NM; B 4000 1000 2000,-750;
B 4000 1000 2000,-5500;
L NP; B 1000 1000 500,-8000;
B 1000 1000 500,-3000;
B 500 1500 250,-7000;
B 500 1500 250,-4000;
B 2250 500 1375,-6500;
L NM; B 1500 1000 1000,-8000;
L NI; B 1500 1500 1000,-6500;
B 1500 1500 1000,-4500;
L NP; B 1500 500 1000,-4500;
L NM; B 1500 1000 1000,-3000;
L NP; B 500 2750 500,-1375;
L NC; B 1000 500 1000,-8000;
L ND; B 1000 1000 1000,-5500;
L NC; B 1000 500 1000,-3000;
L ND; B 1000 1500 1250,-7750;

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        B 1000 1500 1250,-3250;
        B 500 1500 1000,-6500;
        B 500 250 1000,-7125;
L NC;  B 500 500 1000,-5500;
L ND;  B 500 1500 1000,-4750;
        B 500 250 1000,-3875;
        B 1000 1250 1500,-625;
L NC;  B 500 500 1500,-750;
L ND;  B 1500 2000 2500,-3000;
        B 1500 2000 2500,-8750;
L NP;  B 500 6750 2500,-3375;
        B 500 3000 2500,-8750;
L ND;  B 1000 1000 3500,-750;
        B 750 7750 3375,-4875;
L NC;  B 500 500 3500,-750;
DF;

DS 20;
9 PlaClockedIn;
L NP;  B 4000 500 2000,-14000;
C 19;
L ND;  B 1500 2000 2500,-10750;
L NM;  B 1000 1500 2500,-12750;
L ND;  B 1000 1000 2500,-13000;
L NP;  B 1000 750 2500,-12375;
        B 500 2500 2500,-11000;
L NC;  B 500 1000 2500,-12750;
L ND;  B 500 1250 2500,-13875;
DF;

DS 21;
9 PlaProgTop;
L ND;  B 1000 2250 500,-1125;
L NC;  B 500 500 500,-500;
DF;

DS 22;
9 PlaProgBottom;
L ND;  B 1000 2250 500,-1125;
L NC;  B 500 500 500,-1750;
DF;

DS 23;
9 PlaProgLeft;
L ND;  B 2250 1000 1125,-500;
L NC;  B 500 500 500,-500;
DF;

DS 24;
9 PlaProgRight;
L ND;  B 2250 1000 1125,-500;
L NC;  B 500 500 1750,-500;
DF;

DS 25;
9 PlaPullupSpace;
L NM;  B 1000 2000 500,-1000;
        B 1000 1000 3250,-750;
DF;

DS 26;
9 PlaOut;
L NM;  B 4000 1000 2000,-3750;
L NP;  B 4000 500 2000,-500;
        B 500 3000 250,-10500;
L NM;  B 4000 1000 2000,-10750;
L ND;  B 500 3250 750,-6875;
L NM;  B 1000 1500 1000,-8750;
L ND;  B 1000 1000 1000,-8500;
L NP;  B 1000 750 1000,-9125;
        B 500 1750 750,-12375;
L ND;  B 1500 2000 1500,-4750;
L NM;  B 1000 2500 1250,-1250;
L NP;  B 1000 1000 1250,-2000;
L ND;  B 1500 500 1500,-8250;
L NC;  B 500 1000 1000,-8750;
L ND;  B 1000 1000 1250,-10750;
L NC;  B 500 500 1250,-2000;
        B 500 500 1250,-10750;
L NP;  B 500 4000 1500,-4250;
        B 1500 500 2000,-9000;
L NI;  B 1500 1500 2000,-9000;
L ND;  B 750 500 1625,-10250;
        B 2250 500 2375,-11500;
        B 500 2250 2000,-9375;
        B 1000 1000 2500,-3750;
        B 1500 2000 2750,-6250;
L NI;  B 1500 1500 2750,-11500;
L NC;  B 500 500 2500,-3750;
L NM;  B 1500 1000 3000,-12500;
L NP;  B 750 1000 2625,-12500;
        B 500 3250 2750,-6125;
L NC;  B 1000 500 3000,-12500;
L NP;  B 500 500 2750,-13000;
        B 500 1500 2750,-11500;
        B 750 500 3125,-4750;
L NM;  B 1000 1000 3250,-2000;
L NP;  B 1000 1000 3250,-2000;
L NM;  B 1000 2500 3250,-1250;
L ND;  B 1000 1000 3250,-12500;
L NC;  B 500 500 3250,-2000;
L ND;  B 500 5500 3500,-9500;
L NP;  B 500 2750 3500,-3625;
DF;

DS 27;
9 PlaClockedOut;
L NM;  B 4000 1000 2000,-4750;
L NP;  B 4000 500 2000,-1500;
        B 500 3000 250,-11500;
L NM;  B 4000 1000 2000,-11750;
L ND;  B 500 3250 750,-7875;
L NM;  B 1000 1500 1000,-9750;
L ND;  B 1000 1000 1000,-9500;
L NP;  B 1000 750 1000,-10125;
        B 500 1750 750,-13375;
L ND;  B 1500 2000 1500,-5750;
        B 1000 1000 1250,-500;
L NM;  B 1000 1000 1250,-500;
L ND;  B 1000 1000 1250,-2500;
L NP;  B 1000 750 1250,-3125;
L NM;  B 1000 1500 1250,-2750;
L ND;  B 1500 500 1500,-9250;
L NC;  B 500 1000 1000,-9750;
L ND;  B 1000 1000 1250,-11750;
L NC;  B 500 500 1250,-500;
L ND;  B 500 1500 1250,-1500;
L NC;  B 500 1000 1250,-2750;
        B 500 500 1250,-11750;
L NP;  B 500 4000 1500,-5250;
        B 1500 1000 2000,-10250;
L NI;  B 1500 2000 2000,-10250;
L ND;  B 750 500 1625,-11250;
        B 2250 500 2375,-12500;
L NI;  B 2000 1500 2500,-12500;
L ND;  B 500 2250 2000,-10375;
        B 1000 1000 2500,-4750;
        B 1500 2000 2750,-7250;
L NP;  B 1000 1500 2500,-12500;
L NC;  B 500 500 2500,-4750;
L NM;  B 1500 1000 3000,-13500;
L NP;  B 750 1000 2625,-13500;
        B 500 3250 2750,-7125;
L NC;  B 1000 500 3000,-13500;
L NP;  B 500 500 2750,-14000;
        B 750 500 3125,-5750;
L ND;  B 1000 1000 3250,-500;
L NM;  B 1000 1000 3250,-500;

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L ND; B 1000 1000 3250,-2500;
L NP; B 1000 750 3250,-3125;
L NM; B 1000 1500 3250,-2750;
L ND; B 1000 1000 3250,-13500;
L NC; B 500 500 3250,-500;
L ND; B 500 1500 3250,-1500;
L NC; B 500 1000 3250,-2750;
L ND; B 500 5500 3500,-10500;
L NP; B 500 2750 3500,-4625;
DF;

DS 28;
9 PlaHoleWires;
L NM; B 1250 1000 625,-5500;
B 2250 1000 1125,-750;
B 1000 5250 750,-8625;
B 2000 1000 2250,-10750;
B 1000 3500 2500,-1750;
B 1250 1000 2625,-3750;
DF;

DS 29;
9 PlaOutSpace;
L NP; B 2000 500 1000,-500;
L NM; B 2000 1000 1000,-3750;
B 2000 1000 1000,-10750;
B 1000 3500 1250,-1750;
DF;

DS 30;
9 PlaNorOut;
L NM; B 4000 1000 2000,-3750;
L NP; B 4000 500 2000,-500;
L NM; B 4000 1000 2000,-10750;
L ND; B 500 3000 750,-6750;
L NM; B 1000 1500 1000,-8750;
L ND; B 1000 1000 1000,-8500;
L NP; B 1000 750 1000,-9125;
B 500 2250 750,-10125;
L ND; B 1500 2000 1500,-4750;
L NM; B 1000 2500 1250,-1250;
L NP; B 1000 1000 1250,-2000;
L NC; B 500 1000 1000,-8750;
B 500 500 1250,-2000;
L ND; B 2500 500 2250,-8250;
L NP; B 500 4000 1500,-4250;
B 1500 500 2000,-9000;
L NI; B 1500 1500 2000,-9000;
L ND; B 1000 1000 2000,-10750;
B 500 2750 2000,-9625;
L NC; B 500 500 2000,-10750;
L ND; B 1000 1000 2500,-3750;
B 1500 2000 2750,-6250;
L NC; B 500 500 2500,-3750;
L NP; B 500 3250 2750,-6125;
B 750 500 3125,-4750;
L NM; B 1000 1000 3250,-2000;
L NP; B 1000 1000 3250,-2000;
L NM; B 1000 2500 3250,-1250;
L NC; B 500 500 3250,-2000;
L ND; B 500 1750 3500,-7625;
L NP; B 500 2750 3500,-3625;
DF;

DS 31;
9 PlaClockedNorOut;
L NP; B 4000 500 2000,-1500;
L NM; B 4000 1000 2000,-4750;
B 4000 1000 2000,-11750;
L ND; B 500 3000 750,-7750;
L NM; B 1000 1500 1000,-9750;
L ND; B 1000 1000 1000,-9500;
L NP; B 1000 750 1000,-10125;
B 500 2250 750,-11125;
L ND; B 1000 1000 1250,-500;
L NM; B 1000 1000 1250,-500;
L ND; B 1000 1000 1250,-2500;
L NP; B 1000 750 1250,-3125;
L NM; B 1000 1500 1250,-2750;
L ND; B 1500 2000 1500,-5750;
L NC; B 500 1000 1000,-9750;
B 500 500 1250,-500;
L ND; B 500 1500 1250,-1500;
L NC; B 500 1000 1250,-2750;
L ND; B 2500 500 2250,-9250;
L NP; B 500 4000 1500,-5250;
B 1500 1000 2000,-10250;
L NI; B 1500 2000 2000,-10250;
L ND; B 1000 1000 2000,-11750;
B 500 2750 2000,-10625;
L NC; B 500 500 2000,-11750;
L ND; B 1500 2000 2750,-7250;
B 1000 1000 2500,-4750;
L NC; B 500 500 2500,-4750;
L NP; B 500 3250 2750,-7125;
L ND; B 1000 1000 3250,-500;
L NM; B 1000 1000 3250,-500;
L ND; B 1000 1000 3250,-2500;
L NP; B 1000 750 3250,-3125;
L NM; B 1000 1500 3250,-2750;
L NP; B 750 500 3125,-5750;
L NC; B 500 500 3250,-500;
L ND; B 500 1500 3250,-1500;
L NC; B 500 1000 3250,-2750;
L NP; B 500 2750 3500,-4625;
L ND; B 500 1750 3500,-8625;
DF;

DS 32;
9 Pla-4-8-8;
L NM; B 3750 1000 1875,-27250;
C 25 T 0,-11750;
C 14 T 0,-13750;
C 14 T 0,-17750;
C 14 T 0,-3750;
C 14 T 0,-7750;
B 1000 3750 500,-1875;
B 1000 5000 500,-24250;
B 22000 1000 12000,-500;
C 12 T 3750,-3750;
C 12 T 3750,-7750;
C 12 T 3750,-13750;
C 12 T 3750,-17750;
C 13 T 3750,-1750;
C 13 T 3750,-11750;
C 19 T 3750,-21750;
C 12 T 7750,-3750;
C 12 T 7750,-7750;
C 12 T 7750,-13750;
C 12 T 7750,-17750;
C 13 T 7750,-1750;
C 13 T 7750,-11750;
C 19 T 7750,-21750;
C 12 T 11750,-3750;
C 12 T 11750,-7750;
C 12 T 11750,-13750;
C 12 T 11750,-17750;
C 13 T 11750,-1750;
C 13 T 11750,-11750;
C 20 T 11750,-21750;
C 23 T 14750,-20000;
C 12 T 15750,-3750;
C 12 T 15750,-7750;
C 12 T 15750,-13750;
C 12 T 15750,-17750;
C 13 T 15750,-1750;
C 13 T 15750,-11750;
C 20 T 15750,-21750;
C 24 T 17500,-18000;
C 15 T 19750,-3750;
C 15 T 19750,-7750;

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C 15 T 19750,-13750;
C 15 T 19750,-17750;
C 16 T 19750,-1750;
C 16 T 19750,-11750;
C 28 T 19750,-21750;
C 12 R 0,-1 T 27000,-13750;
C 12 R 0,-1 T 27000,-17750;
C 12 R 0,-1 T 27000,-3750;
C 12 R 0,-1 T 27000,-7750;
C 17 T 23000,-11750;
C 14 R 0,-1 T 27000,0;
C 26 T 23000,-21750;
C 21 T 23750,-16750;
C 21 T 23750,-12750;
C 22 T 25750,-19500;
C 22 T 25750,-9500;
C 12 R 0,-1 T 31000,-13750;
C 12 R 0,-1 T 31000,-17750;
C 12 R 0,-1 T 31000,-3750;
C 12 R 0,-1 T 31000,-7750;
C 17 T 27000,-11750;
C 14 R 0,-1 T 31000,0;
C 27 T 27000,-20750;
C 13 R 0,-1 T 33000,-3750;
C 13 R 0,-1 T 33000,-7750;
C 13 R 0,-1 T 33000,-13750;
C 13 R 0,-1 T 33000,-17750;
C 18 T 31000,-11750;
C 25 R 0,-1 T 33000,0;
C 29 T 31000,-21750;
C 12 R 0,-1 T 37000,-13750;
C 12 R 0,-1 T 37000,-17750;
C 12 R 0,-1 T 37000,-3750;
C 12 R 0,-1 T 37000,-7750;
C 17 T 33000,-11750;
C 14 R 0,-1 T 37000,0;
C 30 T 33000,-21750;
C 12 R 0,-1 T 41000,-13750;
C 12 R 0,-1 T 41000,-17750;
C 12 R 0,-1 T 41000,-3750;
C 12 R 0,-1 T 41000,-7750;
C 17 T 37000,-11750;
C 14 R 0,-1 T 41000,0;
C 31 T 37000,-20750;
C 13 R 0,-1 T 43000,-3750;
C 13 R 0,-1 T 43000,-7750;
C 13 R 0,-1 T 43000,-13750;
C 13 R 0,-1 T 43000,-17750;
C 18 T 41000,-11750;
C 29 T 41000,-21750;
L NX; B 500 500 42750,-36000;
DF;

DS 33;
9 SuperBuffer;
L NM; B 5000 1000 2500,-7500;
B 5000 1500 2500,-3500;
B 5000 1500 2500,-750;
L ND; B 1000 2000 500,-3250;
B 1000 1500 500,-750;
B 500 11000 500,-8500;
L NC; B 500 1000 500,-3500;
B 500 1000 500,-750;
L ND; B 1500 2000 1250,-6250;
B 1500 1000 1250,-9500;
L NP; B 500 3250 1250,-6125;
B 1500 500 1750,-7750;
B 500 2750 1250,-9875;
L NM; B 3000 750 2500,-11875;
B 3000 750 2500,-13625;
L NP; B 500 4750 1500,-2625;
L ND; B 750 750 2125,-5625;
B 1000 500 2250,-9750;
L NP; B 500 1250 2250,-8125;
L NI; B 1500 1500 3000,-6500;
L NP; B 1500 500 3000,-6500;
L NI; B 1500 2000 3000,-8750;
L ND; B 500 4000 2500,-12000;
B 500 2750 2500,-1375;
L NP; B 1500 1000 3000,-8750;
L NM; B 1500 1000 3250,-5500;
L ND; B 1000 1000 3000,-6500;
L NM; B 1500 1000 3250,-10000;
L ND; B 1000 1000 3000,-10000;
L NC; B 500 500 3000,-5600;
L ND; B 500 4000 3000,-7750;
B 1000 1000 3250,-7500;
L NC; B 500 500 3000,-10000;
B 500 500 3250,-7500;
L NP; B 750 1000 3625,-5500;
L NC; B 500 500 3500,-5500;
L NP; B 500 5000 3500,-2750;
B 750 1000 3625,-10000;
L NC; B 500 500 3500,-10000;
L NP; B 500 1000 3750,-6250;
B 500 1250 3750,-8875;
L ND; B 1000 1500 4500,-750;
B 1000 2000 4500,-3250;
L NC; B 500 1000 4500,-3500;
B 500 1000 4500,-750;
DF;

DS 34;
9 InvertingSB;
C 33;
L NI; B 1500 1500 1500,-1000;
L ND; B 1750 500 1625,-1000;
B 1500 2000 3500,-3250;
DF;

DS 35;
9 InvertingSBPair;
C 34 M X T 5000,0;
C 34 T 4000,0;
DF;

DS 36;
9 NoninvertingSB;
C 33;
L ND; B 1500 2000 1500,-3250;
B 1750 500 3375,-1000;
L NI; B 1500 1500 3500,-1000;
DF;

DS 37;
9 NoninvertingSBPair;
C 36 M X T 5000,0;
C 36 T 4000,0;
DF;

DS 38;
9 SBExample;
C 35;
L NM; B 13000 750 6500,-11875;
B 13000 750 6500,-13625;
L NP; B 1000 1000 3500,-11750;
L NM; B 1000 1000 3500,-11750;
L NC; B 500 500 3500,-11750;
L NP; B 1000 1000 5500,-13500;
B 500 2000 5250,-12250;
L NM; B 1000 1000 5500,-13500;
L NC; B 500 500 5500,-13500;
C 37 T 8000,0;
L ND; B 1500 1000 11500,-10500;
B 1500 1000 11500,-13750;
L NP; B 1000 1000 11500,-11750;
B 1000 1000 11500,-11750;
L NM; B 1000 1000 11500,-11750;
L NC; B 500 500 11500,-11750;
L NP; B 500 3000 11500,-14250;

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L ND; B 1500 2000 13500,-14250;
L NP; B 1000 1000 13500,-11750;
L NM; B 1000 1000 13500,-11750;
L NC; B 500 500 13500,-11750;
L NP; B 500 3000 13500,-14250;
C 36 T 16000,0;
B 500 4500 17250,-13500;
DF;

DS 39;
9 ShiftCell;
L NM; B 1000 5000 500,-2500;
B 1000 1000 500,-1750;
L ND; B 1000 1000 500,-1750;
L NC; B 500 500 500,-1750;
L ND; B 3000 500 2000,-2000;
L NI; B 3250 1500 2375,-2000;
L NP; B 2250 1500 2375,-2000;
L NM; B 1500 1000 3500,-2000;
L NC; B 1000 500 3500,-2000;
L ND; B 1000 1000 3750,-2000;
B 500 1500 4000,-3000;
B 5000 500 6500,-3500;
B 2250 1000 5125,-2000;
L NP; B 500 2250 4750,-1875;
B 4500 500 7000,-1000;
L NM; B 1000 5000 5750,-2500;
L NC; B 500 500 5750,-2000;
L NP; B 1000 1000 7500,-2500;
L NM; B 1000 1000 7500,-2500;
B 750 5000 7625,-2500;
L NC; B 500 500 7500,-2500;
L NP; B 500 1500 7500,-3500;
L NM; B 1500 1000 9500,-1250;
B 1500 1000 9500,-3250;
L ND; B 1000 1000 9250,-3250;
L NP; B 750 1000 9125,-1250;
L NC; B 1000 500 9500,-1250;
B 1000 500 9500,-3250;
L ND; B 1000 1000 9750,-1250;
L NP; B 750 1000 9875,-3250;
B 2750 500 11125,-3000;
L ND; B 5000 500 12750,-1500;
L NP; B 1000 1000 11500,-500;
L NM; B 1000 1000 11500,-500;
B 750 5000 11375,-2500;
L NC; B 500 500 11500,-500;
L NP; B 500 1500 11500,-1500;
B 2250 500 13125,-3000;
L NM; B 1000 5000 13250,-2500;
L ND; B 2250 1000 13875,-4000;
L NC; B 500 500 13250,-4000;
L NP; B 500 2250 14250,-3875;
L ND; B 500 750 15000,-4625;
B 500 1500 15000,-750;
L NM; B 1500 1000 15500,-4000;
L ND; B 1000 1000 15250,-4000;
L NI; B 3250 1500 16625,-4000;
L NC; B 1000 500 15500,-4000;
L ND; B 3000 500 17000,-4000;
L NP; B 2250 1500 16625,-4000;
L NM; B 1000 5000 18500,-2500;
B 1000 1000 18500,-3750;
L ND; B 1000 1000 18500,-3750;
L NC; B 500 500 18500,-3750;
DF;

DS 40;
9 PSCell;
L ND; B 4000 500 2000,-1500;
L NP; B 1000 1000 500,-2500;
L NM; B 1000 1000 500,-2500;
B 750 5000 375,-2500;
L NC; B 500 500 500,-2500;
L NP; B 500 1750 500,-1625;
C 39 M X T 20750,0;

L NM; B 1000 1500 4250,-2000;
L NP; B 1000 750 4250,-2375;
L ND; B 1000 1000 4250,-1750;
L NP; B 2750 500 5375,-2500;
L NC; B 500 1000 4250,-2000;
DF;
{ End of Library79-250.cif. };
{ Demo design added October 23, 1979 };

DS 41;
9 Demo;
L ND; B 2750 500 1375,-53250;
L NM; B 1500 50250 1250,-43875;
B 42750 750 21875,-72875;
B 42750 750 21875,-74625;
L NP; B 500 500 1750,-73500;
B 1500 500 2250,-75500;
B 1250 500 2375,-49750;
L NM; B 2000 1000 3000,-38750;
B 1750 1000 2875,-56750;
B 750 1000 2375,-29250;
B 5500 1500 4750,-61750;
B 5500 1000 4750,-68600;
B 1000 1000 2500,-19250;
L NP; B 500 2000 2250,-74250;
B 1500 500 2750,-54000;
B 1500 500 2750,-56250;
L ND; B 500 5000 2500,-50500;
L NM; B 1000 1500 3000,-47750;
L ND; B 1000 1000 3000,-48000;
L NP; B 1000 750 3000,-47375;
B 500 3750 2750,-45125;
B 2250 500 3625,-43000;
B 500 1750 2750,-55125;
C 20 T 2750,-23750;
L NC; B 500 1000 3000,-47750;
L NP; B 500 1250 3000,-65875;
C 14 T 3000,-15750;
B 500 2750 3250,-22375;
B 2000 500 4000,-20750;
L NI; B 1500 3250 3750,-40625;
L NP; B 1500 2250 3750,-40625;
L NM; B 1000 1000 3500,-38750;
L ND; B 1000 1000 3500,-38750;
L NP; B 1000 1000 3500,-49750;
L NM; B 1000 1000 3500,-49750;
C 14 T 3000,-11750;
C 14 T 3000,-3750;
B 1000 2750 3500,-2375;
B 19000 1000 12500,-500;
C 14 T 3000,-7750;
L NP; B 750 500 3375,-73500;
B 500 1000 3250,-66500;
L ND; B 1000 3000 3750,-43000;
L NM; B 1000 1500 3750,-41750;
L NC; B 500 500 3500,-38750;
L NM; B 1000 1000 3750,-44000;
L NC; B 500 500 3500,-49750;
L NP; B 500 500 3500,-74000;
B 500 1000 3500,-67000;
L NC; B 500 500 3750,-44000;
B 500 1000 3750,-41750;
L ND; B 500 2500 3750,-40500;
L NP; B 500 1000 3750,-67500;
C 39 R 0,1 T 3750,-57250;
B 500 1000 4000,-67000;
B 500 1000 4250,-66500;
B 500 1250 4500,-65875;
L ND; B 500 500 4500,-42250;
L NP; B 500 750 4750,-73125;
B 1750 500 5375,-73750;
B 1250 500 5375,-72750;
B 1250 500 5375,-71750;
L NM; B 1750 1000 5875,-22500;
B 1750 1000 5875,-20500;
L NP; B 1000 1000 5500,-20500;
B 1000 1000 5500,-22500;

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B 500 750 5250,-23375;  
L ND; B 500 3750 5250,-40125;  
L NC; B 500 500 5500,-20500;  
B 500 500 5500,-22500;  
L NP; B 500 1000 6000,-72250;  
C 23 T 5750,-18000;  
C 23 T 5750,-14000;  
C 23 T 5750,-16000;  
C 23 T 5750,-12000;  
B 750 500 6875,-71750;  
C 12 T 6750,-15750;  
C 12 T 6750,-19750;  
C 20 T 6750,-23750;  
C 12 T 6750,-11750;  
C 12 T 6750,-3750;  
C 13 T 6750,-1750;  
C 12 T 6750,-7750;  
B 500 500 7000,-72250;  
C 35 T 7500,-61000;  
C 39 R 0,1 T 7750,-57250;  
C 24 T 8500,-10000;  
C 24 T 8500,-8000;  
C 24 T 8500,-6000;  
C 24 T 8500,-4000;  
L ND; B 500 3750 9250,-40125;  
L NM; B 2250 1000 10875,-59750;  
L ND; B 1000 1000 10250,-59750;  
B 500 750 10000,-60625;  
C 23 T 9750,-18000;  
C 23 T 9750,-16000;  
C 23 T 9750,-10000;  
C 23 T 9750,-8000;  
L NC; B 500 500 10250,-59750;  
L NP; B 1000 1000 11000,-74500;  
L NM; B 1000 1000 11000,-74500;  
C 12 T 10750,-15750;  
C 12 T 10750,-19750;  
C 20 T 10750,-23750;  
C 12 T 10750,-11750;  
C 12 T 10750,-3750;  
C 13 T 10750,-1750;  
C 12 T 10750,-7750;  
L NC; B 500 500 11000,-74500;  
L NP; B 500 1750 11250,-73125;  
B 1000 1000 11500,-59750;  
L NC; B 500 500 11500,-59750;  
L NP; B 500 1750 11750,-58375;  
C 39 R 0,1 T 11750,-57250;  
B 4000 500 14000,-57750;  
B 1000 1000 13000,-72750;  
L NM; B 1000 1000 13000,-72750;  
C 24 T 12500,-14000;  
C 24 T 12500,-12000;  
C 24 T 12500,-6000;  
C 24 T 12500,-4000;  
L NC; B 500 500 13000,-72750;  
L ND; B 500 3750 13250,-40125;  
L NM; B 2250 1000 14875,-59750;  
L ND; B 1000 1000 14250,-59750;  
B 500 750 14000,-60625;  
C 23 T 13750,-18000;  
C 23 T 13750,-14000;  
C 23 T 13750,-10000;  
C 23 T 13750,-6000;  
L NC; B 500 500 14250,-59750;  
C 12 T 14750,-15750;  
C 12 T 14750,-19750;  
C 20 T 14750,-23750;  
C 12 T 14750,-11750;  
C 12 T 14750,-3750;  
C 13 T 14750,-1750;  
C 12 T 14750,-7750;  
L NP; B 1000 1000 15500,-59750;  
L NC; B 500 500 15500,-59750;  
C 35 T 15500,-61000;  
L NP; B 500 750 15750,-58875;  
B 1000 1000 16250,-49750;  
L NM; B 1000 1000 16250,-49750;

L NP; B 500 7750 16250,-54125;  
L NC; B 500 500 16250,-49750;  
L NP; B 1500 500 16750,-58750;  
C 24 T 16500,-16000;  
C 24 T 16500,-12000;  
C 24 T 16500,-8000;  
C 24 T 16500,-4000;  
L ND; B 750 500 17125,-42250;  
L NM; B 7250 1000 20375,-56750;  
B 7250 1000 20375,-44000;  
B 3750 750 18625,-49625;  
B 500 750 17000,-45875;  
L ND; B 500 3750 17250,-40125;  
L NP; B 1000 1000 17750,-45750;  
L NM; B 1000 1000 17750,-45750;  
B 2250 1000 18375,-59750;  
L ND; B 1000 1000 17750,-59750;  
L NP; B 500 12750 17750,-52625;  
L NC; B 500 500 17750,-45750;  
B 500 500 17750,-59750;  
L ND; B 500 750 18000,-60625;  
B 2000 1000 19000,-74750;  
L NP; B 1000 1000 19000,-72750;  
L NM; B 1000 1000 19000,-72750;  
L NP; B 500 3750 18750,-75625;  
B 1000 1000 19000,-59750;  
C 15 T 18750,-15750;  
C 15 T 18750,-19750;  
C 28 T 18750,-23750;  
B 750 500 19125,-37750;  
C 15 T 18750,-11750;  
C 15 T 18750,-3750;  
C 16 T 18750,-1750;  
C 15 T 18750,-7750;  
L NC; B 500 500 19000,-72750;  
B 500 500 19000,-59750;  
L NM; B 1000 3250 19500,-36625;  
L NP; B 500 21250 19250,-48625;  
L NM; B 750 3000 20125,-47750;  
B 4250 750 21875,-45875;  
L ND; B 500 1500 20000,-75750;  
B 2000 1000 21000,-76500;  
L NP; B 500 36250 20750,-41625;  
B 1000 1000 21000,-74500;  
L NM; B 1000 1000 21000,-74500;  
L NP; B 500 1750 20750,-73125;  
L NM; B 2250 1000 21625,-59750;  
L NP; B 1000 1000 21000,-59750;  
L NC; B 500 500 21000,-74500;  
B 500 500 21000,-59750;  
L NP; B 500 2000 21250,-76500;  
B 1000 500 21500,-24250;  
B 1000 1000 22250,-37000;  
L NM; B 1000 1000 22250,-37000;  
L ND; B 1000 1000 22250,-59750;  
B 500 750 22000,-60625;  
B 500 1500 22000,-75750;  
C 12 R 0,-1 T 26000,-15750;  
C 12 R 0,-1 T 26000,-19750;  
L NP; B 500 21500 22250,-48250;  
L NC; B 500 500 22250,-37000;  
C 31 T 22000,-22750;  
C 12 R 0,-1 T 26000,-11750;  
C 12 R 0,-1 T 26000,-3750;  
C 14 R 0,-1 T 26000,0;  
C 12 R 0,-1 T 26000,-7750;  
B 500 500 22250,-59750;  
L NP; B 1500 500 23250,-58750;  
L NM; B 1250 750 23375,-36875;  
C 21 T 22750,-18750;  
L ND; B 1000 1000 23500,-44000;  
L NP; B 1000 1000 23750,-49750;  
L NM; B 1000 1000 23750,-49750;  
L NC; B 500 500 23500,-44000;  
L ND; B 500 1000 23500,-43000;  
B 750 500 23625,-42250;

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L NP; B 500 7750 23750,-54125;
L NC; B 500 500 23750,-49750;
C 35 T 23500,-61000;
C 40 M X R 0,1 T 24000,-36500;
L NP; B 4000 500 26000,-57750;
L NM; B 2250 1000 25125,-59750;
L NP; B 1000 1000 24500,-59750;
B 500 750 24250,-58875;
L NC; B 500 500 24500,-59750;
C 22 T 24750,-21500;
L ND; B 500 4250 25500,-34375;
B 1000 1000 25750,-59750;
L NC; B 500 500 25750,-59750;
L ND; B 500 750 26000,-60625;
C 12 R 0,-1 T 30000,-15750;
C 12 R 0,-1 T 30000,-19750;
C 31 T 26000,-22750;
C 12 R 0,-1 T 30000,-11750;
C 12 R 0,-1 T 30000,-3750;
C 14 R 0,-1 T 30000,0;
C 12 R 0,-1 T 30000,-7750;
B 2000 1000 27000,-74750;
L NP; B 500 2750 26750,-75125;
B 1000 1000 27000,-72750;
L NM; B 1000 1000 27000,-72750;
L NP; B 8250 500 30625,-76750;
C 21 T 26750,-18750;
L NC; B 500 500 27000,-72750;
C 40 M X R 0,1 T 28000,-36500;
L ND; B 2000 1000 29000,-74750;
L NM; B 2250 1000 29125,-59750;
L NP; B 1000 1000 28500,-59750;
B 500 1750 28250,-58375;
L NC; B 500 500 28500,-59750;
L NP; B 1000 1000 29000,-72750;
L NM; B 1000 1000 29000,-72750;
C 22 T 28750,-21500;
L NC; B 500 500 29000,-72750;
L NP; B 500 1750 29250,-74625;
B 3500 500 30750,-75750;
L ND; B 500 4250 29500,-34375;
B 1000 1000 29750,-59750;
L NC; B 500 500 29750,-59750;
L ND; B 500 750 30000,-60625;
C 12 R 0,-1 T 34000,-15750;
C 12 R 0,-1 T 34000,-19750;
C 31 T 30000,-22750;
C 12 R 0,-1 T 34000,-11750;
C 12 R 0,-1 T 34000,-3750;
C 14 R 0,-1 T 34000,0;
C 12 R 0,-1 T 34000,-7750;
C 21 T 30750,-18750;
C 40 M X R 0,1 T 32000,-36500;
L NM; B 9250 1500 37125,-64500;
L NP; B 1750 1000 33375,-69750;
L NM; B 1250 1000 33125,-68500;
B 1500 1000 33250,-71000;
L NP; B 750 1000 32875,-71000;
B 500 5750 32750,-73125;
C 22 T 32750,-21500;
L ND; B 1000 1000 33250,-68500;
L NI; B 1500 2000 33500,-69750;
L NC; B 1000 500 33250,-71000;
L ND; B 2500 1000 34250,-71000;
L NC; B 500 500 33250,-68500;
L ND; B 500 4250 33500,-34375;
B 500 2250 33500,-69625;
C 12 R 0,-1 T 38000,-15750;
C 12 R 0,-1 T 38000,-19750;
C 31 T 34000,-22750;
C 12 R 0,-1 T 38000,-11750;
C 12 R 0,-1 T 38000,-3750;
C 14 R 0,-1 T 38000,0;
C 12 R 0,-1 T 38000,-7750;
C 21 T 34750,-18750;
L NP; B 500 7500 35000,-73750;
L ND; B 1000 1000 35750,-64750;
B 500 6500 35750,-68250;

L NC; B 500 500 35750,-64750;
C 40 M X R 0,1 T 36000,-36500;
C 22 T 36750,-21500;
L ND; B 500 4250 37500,-34375;
C 13 R 0,-1 T 40000,-15750;
C 13 R 0,-1 T 40000,-19750;
C 29 T 38000,-23750;
C 13 R 0,-1 T 40000,-11750;
C 13 R 0,-1 T 40000,-3750;
C 13 R 0,-1 T 40000,-7750;
L NP; B 500 2250 39250,-62375;
B 1500 500 40000,-61250;
B 1500 500 40000,-63500;
L NM; B 3250 1000 41625,-27500;
L NP; B 1000 500 40500,-62500;
B 3250 500 42125,-39750;
B 500 500 40750,-61500;
B 500 1000 40750,-63000;
L NM; B 750 1000 41375,-51500;
B 750 1000 41375,-44000;
L NP; B 500 2250 41500,-37625;
B 1500 500 42250,-38750;
B 1500 500 42250,-36500;
L NM; B 1500 37250 42500,-46625;
L NP; B 500 2250 43000,-37625;
DF;
C 41;
End

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