Appendix E. Basic Library of Cells

[section contributed by Robert Baldwin, MIT, and Richard Lyon, Xerox PARC]

The purpose of a cell library is to make the design process easier, by saving redundant design and debugging time. For example, it would be a waste of time if each person had to redesign his own pad drivers. Some cells like pullups and butting contacts are easy to design quickly, but they're also easy to enter incorrectly. Forgetting the implant layer or the cover metal is a common mistake. By having a library of cells these problems can be avoided.

A library also encourages people to document and share their designs. A designer should tend to build his project out of existing symbols, and in turn should be encouraged to make his own cells easier to interface to, so other people could use them. A collection of designs is particularly useful to beginners, not only for their direct usage, but also as a set of examples which they could modify for their own purposes. See section 7.3 for an example of how the library can be used.

Managing a Library

In a library of reasonable size, problems of *naming* and *multiple versions* arise. For example, more than one person might contribute a cell called "adder", or a designer might modify one of his cells in such a way that projects which used the old version won't work with the new version. One way to handle these problems is to have each project make a copy of all the library cells that it uses. This raises the problem of *recalls* of library cells that are found to have problems. Whatever method of library access and distribution is used, careful personal attention by a library manager will be necessary to minimize such problems and to make the library a truly useful tool.

The cell library needs good documentation and an effective catalog. The PARC *Icarus* cell library has been created within our shared file system, using one file for the catalog or table of contents, and separate documentation and design files for each cell or family of cells. Contributors to the library are required to follow the standard of completing an on-line documentation form before their cells are added to the catalog by the library manager.

Specific Documented Cells

Due to the nature of our design system, none of the documentation specifies where a cell's origin is. In Icarus this is no problem, since cells are easily positioned after being drawn; in a different design system it may be necessary to know where the origin is. For the following examples the origin is usually in the upper left hand corner, but the butting contacts have the origin in the middle of the poly edge.

Most of the cells in the table of contents are documented in the pages that follow. Some PARC-specific information has been deleted for this version. For each file, CIF (version 2.0) code and Icarus checkplots are attached. The checkplots are similar to the ones shown in chapter 4 of [Mead 1978], but the stipple patterns which are used to represent the layers are different. The patterns used in the documentation are as shown here:

Metal	Diffusion	Implant
Contact Cut	Polysilicon	Overglass Cut

Cell Library
Table of Contents

This file (CellLib.TOC) is the table of contents for the cells in the library, with entries organized by function.

The template form.LibDoc is the standard for new symbol documentation, and must be completed before entries are added to this table of contents.

SymbolName	Description	Document File
Pads		
PadIn	Input pad with Lightning arrestor.	Pads.LibDoc
PadOut	Output pad with driver.	Pads.LibDoc
PadVdd	Input pad for Vdd.	Pads.LibDoc
PadGround	Input pad for Ground.	Pads.LibDoc
PadBlank	Blank pad used for spacing.	Pads.LibDoc
PadSample	Shows how to use these pads.	Pads.LibDoc
Inverters		
InverterPair	Two cascaded inverters	Inverters.LibDoc
InveterQuad	Two of the above back to back. This was designed for use with a two input general function block.	Inverters.LibDoc
BackwardInverterPair	Like InverterPair only data flows from right to left.	Inverters.LibDoc
BackwardInverterQuad	Like InverterQuad only data flows from right to left.	Inverters.LibDoc
Primitive Cells		
RtoG	Horizontal contact with red on left.	ButtingContacts.LibDoc
RdownG	Vertical contact with red on top.	ButtingContacts.LibDoc
GtoR	Same as RtoG, just rotated 180.	ButtingContacts.LibDoc
GdownR	Same as RdownG, just rotated 180.	ButtingContacts.LibDoc
VPullup4:1	Vertical pullup with L/W = 4.	Pullups.LibDoc
HPullup4:1	Horizontal pullup with L/W = 4. This is a mirrored and rotated version of VPullup4:1.	Pullups.LibDoc
VPullup2:1	Vertical pullup with L/W = 2.	Pullups.LibDoc
HPullup2:1	Horizontal pullup with L/W = 2. This is a mirrored and rotated version of VPullup2:1.	Pullups.LibDoc

PLA's

PlaCellPair	Two poly and two metal lines, with four diffusion contacts and a ground line.	PLA.LibDoc
PlaGround	For around the edges of PLA's, and in the middle of big ones.	PLA.LibDoc
PlaConnect	Connects AND-plane to OR-plane.	PLA.LibDoc
PlaIn	Clocked inverting and noninverting drivers.	PLA.LibDoc
PlaInPair	Two PlaIn's sharing a ground line.	PLA.LibDoc
PlaOut	Pair of clocked inverters for PLA output.	PLA.LibDoc
PullupPair	Pair of pullups for PLA diffusion lines.	PLA.LibDoc
PlaProgFlash	Connection for programming the PLA.	PLA.LibDoc
PLA-2-4-4	Shows how to put together a PLA.	PLA.LibDoc

Logic and Arithmetic

FuncBlock	This is the general Function Block which is described in Mead&Conway. It can be used to generate any function of two inputs.	FuncBlock.LibDoc
SerialAdder	Cell that adds or subtracts two serial numbers given LSB first.	SerialAdder.LibDoc
ExtAdder	Like SerialAdder except it can output a sign extension, and it does not produce a new LSBtime signal.	ExtAdder.LibDoc

Miscellaneous

SRCELL	The shift register cell from chapter 4 of Mead&Conway.	SRCELL.LibDoc

Starting Frame

Align	Six alignment marks, for seven total layers (includes BUR and OVG).	AlignMarks6.LibDoc
LayerNames	Layer names and critical dimension crosses.	AlignMarks6.LibDoc
EtchTest	Etch test patterns.	AlignMarks6.LibDoc
LayerAlign	Align, LayerNames, and EtchTest.	AlignMarks6.LibDoc
vertscribe, etc.	Various pieces of interior and exterior scribe lines.	ScribeLines.LibDoc

Documentation for Pads:
PadIn -- PadOut -- PadBlank
PadGround -- PadVdd -- PadSample

Date	August 7, 1978	Status	used in summer 1978 MPC
Designer	Dick Lyon	Address/Phone	PARC SSL x4325
Design Rules	Mead/Conway	Scale	λ = 3 μm
Info File	Pads.LibDoc	CIF File	Pads.cif
Dimensions	X: 86λ Y: 124λ	Replication	DX: 80λ DY: No

Further Info: See attached figures.

Function/Use: This is a family of general-purpose input and output pads.
PadIn: Input pad with lightning arrestor.
PadOut: Output pad with three-stage fast driver.
PadBlank: Plain metal pad for whatever.
PadGround: Pad connected to ground.
PadVdd: Pad connected to Vdd.
PadSample: Shows how they fit together.

Connections: Vdd runs along the top and sides. Ground runs along the bottom. Both are in 6λ metal. Pads should be overlapped by 6λ, so they share the Vdd strip along the sides of the pads.
PadIn: Connect to the diffusion at the bottom of the cell.
PadOut: The input is near the bottom right hand corner in poly, and a butting contact is provided so that a diffusion line can also be connected. The cell can be mirrored about Y to get inputs on the bottom left.
PadBlank: Connect directly to the pad in metal.
PadGround: The pad is connected to the ground stripe.
PadVdd: The pad is connected to the Vdd stripe.

Included Cells: None

Performance: PadOut: See section 2.4 of *A Guide to LSI Implementation.*

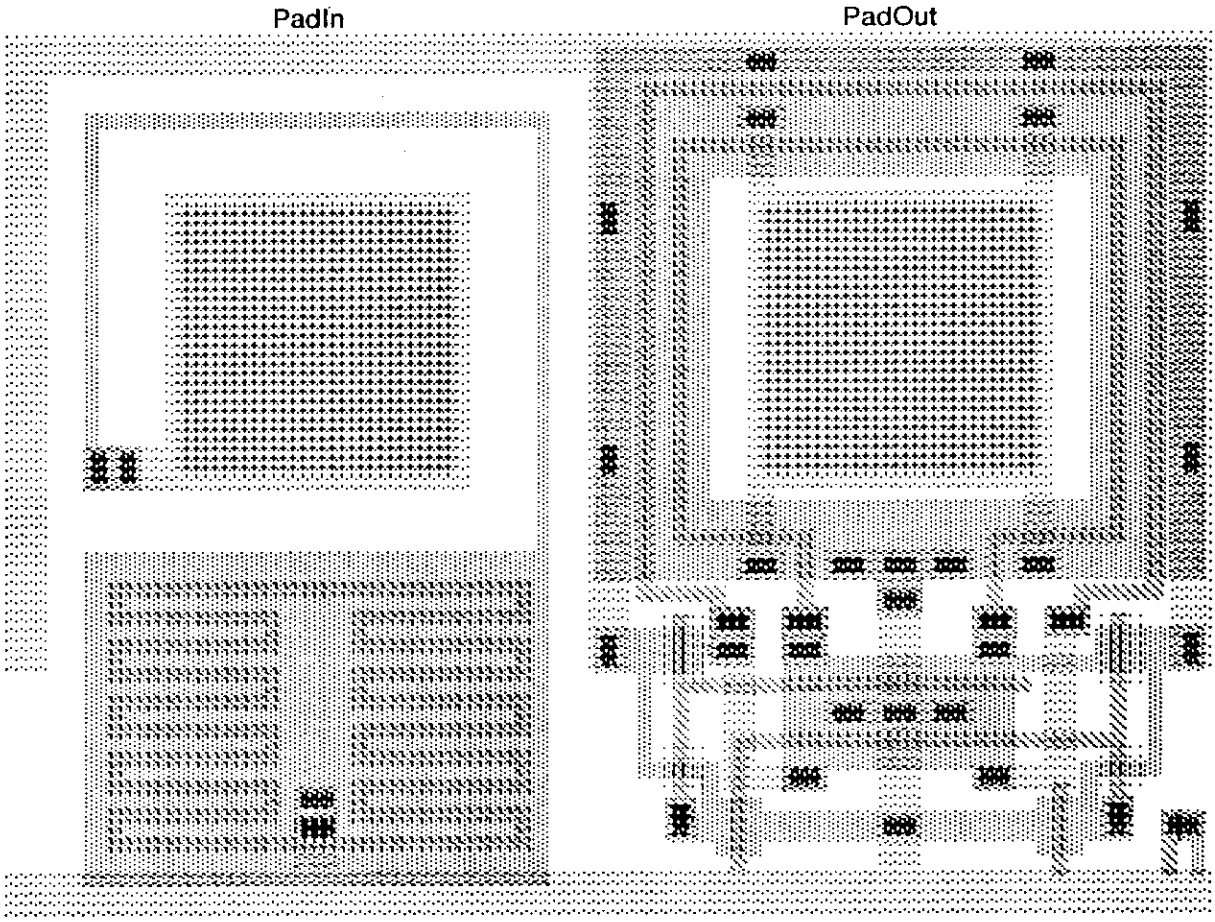
How it works: PadIn: The circuit consists of three parts: a metal bonding pad, which is

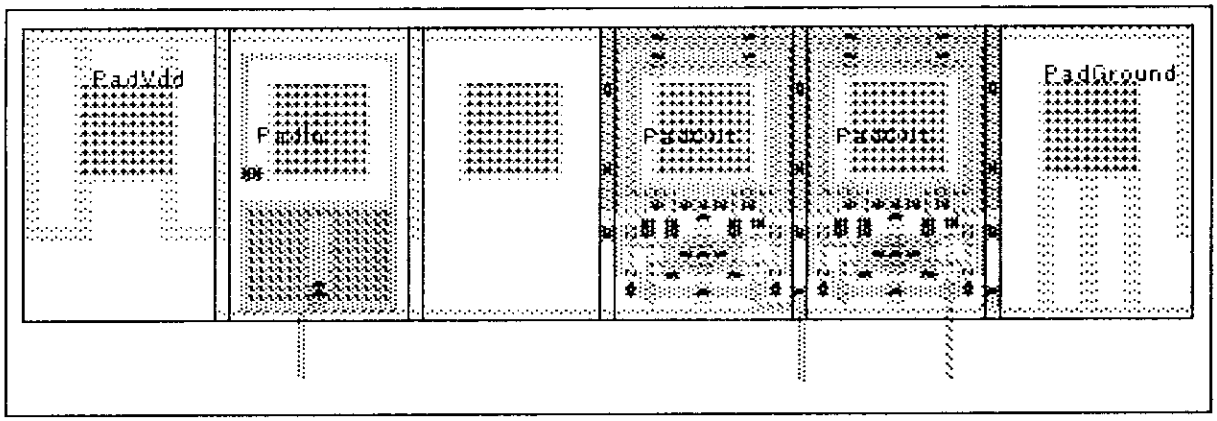
connected to a diffusion resistor, which is connected to a transistor, which is connected to ground. The output of the circuit is between the resistor and the transistor. Normally the transistor is off, since its gate is connected to ground, so the circuit behaves like a resistor connected to a bonding pad. But, if the voltage across the transistor becomes large (e.g., the input pad is struck by lightning) current will flow due to punch-through, dropping the overvoltage across the resistor. Punch-through occurs at a lower voltage than gate oxide breakdown, so gates are protected.

PadOut: The general strategy is to have a chain of inverters, each with a wider gate than the preceding one. Chapter 1 of [Mead 1978] describes this in more detail. This pad driver has three stages. The first stage contains two inverters in series which are used to drive the next stage, a pair of superbuffers. These, in turn, drive the last stage, a pair of wide enhancement mode transistors. The input gate is four times larger than the minimum gate area, so the pad driver looks like four minimum loads. The gates in the second stage are four times larger than in the first stage, so the inverters in the first stage have a fanout of five (remember that each inverter drives both superbuffers). The last stage has gates eight time larger than the previous gates, but since superbuffers are used, this is like a regular fanout of four. Thus by the third stage L/W = 128, which is large enough to drive a several TTL loads at 10 MHz or faster.

Design Decisions

The first set of decisions has to do with size. The pads have to be big enough and far enough apart that they are easy to bond to, but not so big as to take up all the space. As they are now, the minimum size of a project with sixteen pads is 1500 microns on a side (approximately 0.6 nanoacres). Another consideration is the spacing between the pad and the rest of the circuit. It has to be far enough away that the bonding wire does not short out or destroy any part of the circuit. Of course, if overglassing is used the pad can be placed closer, but overglassing is often omitted from prototype chips. It was decided that a pad size of 126 microns (114 microns with overglassing), and a pad spacing of 240 microns would be a reasonable compromise.


PadIn
PadOut



Gross View of PadSample,

Showing the general form of PadVdd, PadGround, and PadBlank

file: Pads.cif

```
( Created by Sif from Pads.ic );

DS 1;    ( Name: PadGround );
( 10 Items. );
Layer NMet;  Box  Len 25800  Wid 1800  Center 12900,-36300 ;
Layer NMet;  Box  Len 1800  Wid 25500  Center 900,-14250 ;
Layer NMet;  Box  Len 25800  Wid 1800  Center 12900,-900 ;
Layer NMet;  Box  Len 12600  Wid 12600  Center 12900,-12900 ;
Layer NMet;  Box  Len 1800  Wid 17700  Center 7500,-27450 ;
Layer NGls;  Box  Len 11400  Wid 11400  Center 12900,-12900 ;
( PadGround );
Layer NMet;  Box  Len 1800  Wid 17700  Center 12900,-27150 ;
Layer NMet;  Box  Len 1800  Wid 17700  Center 18300,-27450 ;
Layer NMet;  Box  Len 1800  Wid 25500  Center 24900,-14250 ;
DF;


DS 2;    ( Name: PadBlank );
( 6 Items. );
Layer NMet;  Box  Len 25800  Wid 1800  Center 12900,-36300 ;
Layer NMet;  Box  Len 1800  Wid 25500  Center 900,-14250 ;
Layer NMet;  Box  Len 25800  Wid 1800  Center 12900,-900 ;
Layer NMet;  Box  Len 12600  Wid 12600  Center 12900,-12900 ;
Layer NGls;  Box  Len 11400  Wid 11400  Center 12900,-12900 ;
Layer NMet;  Box  Len 1800  Wid 25500  Center 24900,-14250 ;
DF;


DS 3;    ( Name: PadOut );
( 121 Items. );
Layer NMet;  Box  Len 25800  Wid 1800  Center 12900,-36300 ;
Layer NMet;  Box  Len 1800  Wid 25500  Center 900,-14250 ;
Layer NMet;  Box  Len 25800  Wid 1800  Center 12900,-900 ;
Layer NDif;  Box  Len 4800  Wid 22500  Center 2700,-11850 ;
Layer NDif;  Box  Len 4500  Wid 1800  Center 2550,-26100 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 900,-26100 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 900,-18000 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 900,-7800 ;
Layer NDif;  Box  Len 3300  Wid 600  Center 3750,-31200 ;
Layer NDif;  Box  Len 600  Wid 4500  Center 2400,-28950 ;
Layer NPol;  Box  Len 600  Wid 21600  Center 2400,-13200 ;
Layer NPol;  Box  Len 21600  Wid 600  Center 12900,-2400 ;
Layer NPol;  Box  Len 3000  Wid 600  Center 3900,-23700 ;
Layer NImp;  Box  Len 1800  Wid 3000  Center 3900,-26100 ;
Layer NImp;  Box  Len 1800  Wid 1800  Center 3900,-31200 ;
Layer NDif;  Box  Len 2100  Wid 1200  Center 4350,-33600 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 3900,-33300 ;
Layer NPol;  Box  Len 1200  Wid 900  Center 3900,-32850 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 3900,-33300 ;
Layer NPol;  Box  Len 600  Wid 8100  Center 3900,-28650 ;
Layer NPol;  Box  Len 600  Wid 17100  Center 3900,-13050 ;
Layer NPol;  Box  Len 18600  Wid 600  Center 12900,-4800 ;
Layer NPol;  Box  Len 14400  Wid 600  Center 11100,-27600 ;
Layer NPol;  Box  Len 5400  Wid 600  Center 6600,-21300 ;
Layer NDif;  Box  Len 900  Wid 600  Center 4950,-26100 ;
Layer NDif;  Box  Len 600  Wid 2100  Center 5100,-32250 ;
Layer NDif;  Box  Len 16200  Wid 3300  Center 12900,-21450 ;
Layer NDif;  Box  Len 16200  Wid 5400  Center 12900,-3300 ;
Layer NMet;  Box  Len 1800  Wid 2400  Center 6000,-25500 ;
Layer NPol;  Box  Len 1800  Wid 1200  Center 6000,-24900 ;
Layer NPol;  Box  Len 600  Wid 1200  Center 5400,-24000 ;
Layer NDif;  Box  Len 1800  Wid 1200  Center 6000,-26100 ;
Layer NDif;  Box  Len 1800  Wid 2400  Center 6300,-33600 ;
( PadOut );
Layer NCut;  Box  Len 1200  Wid 600  Center 6000,-24900 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 6000,-26100 ;
Layer NMet;  Box  Len 1200  Wid 7200  Center 6300,-28500 ;
Layer NPol;  Box  Len 600  Wid 5700  Center 6300,-32550 ;
Layer NPol;  Box  Len 15600  Wid 600  Center 14100,-30000 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 7200,-22500 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 7200,-3600 ;
Layer NMet;  Box  Len 3300  Wid 1200  Center 8250,-31500 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 7200,-22500 ;
Layer NMet;  Box  Len 1200  Wid 3600  Center 7200,-20700 ;
Layer NMet;  Box  Len 12600  Wid 12600  Center 12900,-12900 ;
```

```
Layer NMet;  Box  Len 1200  Wid 3300  Center 7200,-5250 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 7200,-3600 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 7200,-1200 ;
Layer NDif;  Box  Len 12000  Wid 1200  Center 12900,-33600 ;
Layer NGls;  Box  Len 11400  Wid 11400  Center 12900,-12900 ;
Layer NDif;  Box  Len 1800  Wid 1200  Center 9000,-31500 ;
Layer NDif;  Box  Len 9600  Wid 4800  Center 12900,-28800 ;
Layer NMet;  Box  Len 1800  Wid 2400  Center 9000,-25500 ;
Layer NPol;  Box  Len 1800  Wid 1200  Center 9000,-24900 ;
Layer NDif;  Box  Len 1800  Wid 1200  Center 9000,-26100 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 9000,-31500 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 9000,-26100 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 9000,-24900 ;
Layer NPol;  Box  Len 600  Wid 4200  Center 9000,-23100 ;
Layer NMet;  Box  Len 6000  Wid 1200  Center 12900,-28800 ;
Layer NMet;  Box  Len 6000  Wid 1200  Center 12900,-22500 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 10800,-28800 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 10800,-22500 ;
Layer NMet;  Box  Len 1800  Wid 12900  Center 12900,-29250 ;
Layer NDif;  Box  Len 1800  Wid 1500  Center 12900,-23850 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 12900,-33600 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 12900,-28800 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 12900,-22500 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 12900,-24000 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 15000,-28800 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 15000,-22500 ;
Layer NDif;  Box  Len 1800  Wid 1200  Center 16800,-31500 ;
Layer NMet;  Box  Len 3300  Wid 1200  Center 17550,-31500 ;
Layer NMet;  Box  Len 1800  Wid 2400  Center 16800,-25500 ;
Layer NPol;  Box  Len 1800  Wid 1200  Center 16800,-24900 ;
Layer NDif;  Box  Len 1800  Wid 1200  Center 16800,-26100 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 16800,-31500 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 16800,-26100 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 16800,-24900 ;
Layer NPol;  Box  Len 600  Wid 4200  Center 16800,-23100 ;
Layer NPol;  Box  Len 5400  Wid 600  Center 19200,-21300 ;
Layer NDif;  Box  Len 3900  Wid 600  Center 19350,-26700 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 18600,-22500 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 18600,-3600 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 18600,-22500 ;
Layer NMet;  Box  Len 1200  Wid 3600  Center 18600,-20700 ;
Layer NMet;  Box  Len 1200  Wid 3300  Center 18600,-5250 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 18600,-3600 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 18600,-1200 ;
Layer NDif;  Box  Len 1800  Wid 2400  Center 19500,-33600 ;
Layer NMet;  Box  Len 1200  Wid 7800  Center 19500,-28200 ;
Layer NPol;  Box  Len 1800  Wid 1200  Center 19800,-24900 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 19800,-24900 ;
Layer NPol;  Box  Len 600  Wid 3900  Center 19500,-33750 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 19800,-24900 ;
Layer NDif;  Box  Len 2400  Wid 1200  Center 21300,-33600 ;
Layer NPol;  Box  Len 600  Wid 1200  Center 20400,-24000 ;
Layer NDif;  Box  Len 600  Wid 2100  Center 20700,-32250 ;
Layer NDif;  Box  Len 3300  Wid 600  Center 22050,-31200 ;
Layer NPol;  Box  Len 3000  Wid 600  Center 21900,-23700 ;
Layer NDif;  Box  Len 4800  Wid 22500  Center 23100,-11850 ;
Layer NDif;  Box  Len 4500  Wid 1800  Center 23250,-26100 ;
Layer NImp;  Box  Len 1800  Wid 3000  Center 21900,-26100 ;
Layer NImp;  Box  Len 1800  Wid 1800  Center 21900,-31200 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 21900,-33300 ;
Layer NPol;  Box  Len 1200  Wid 900  Center 21900,-32850 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 21900,-33300 ;
Layer NPol;  Box  Len 600  Wid 8100  Center 21900,-28650 ;
Layer NPol;  Box  Len 600  Wid 17100  Center 21900,-13050 ;
Layer NDif;  Box  Len 600  Wid 4500  Center 23400,-28950 ;
Layer NPol;  Box  Len 600  Wid 21600  Center 23400,-13200 ;
Layer NPol;  Box  Len 600  Wid 1800  Center 24000,-34800 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 24600,-33600 ;
Layer NPol;  Box  Len 900  Wid 1200  Center 24150,-33600 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 24600,-33600 ;
Layer NMet;  Box  Len 1800  Wid 25500  Center 24900,-14250 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 24900,-33600 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 24900,-26100 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 24900,-18000 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 24900,-7800 ;
Layer NDif;  Box  Len 600  Wid 1800  Center 25200,-34800 ;
DF;
```

```
DS 4:    ( Name: PadIn ):
( 59 Items. ):
Layer NMet:  Box  Len 25800  Wid 1800  Center 12900,-36300 ;
Layer NMet:  Box  Len 1800  Wid 25500  Center 900,-14250 ;
Layer NMet:  Box  Len 25800  Wid 1800  Center 12900,-900 ;
Layer NDif:  Box  Len 19200  Wid 14100  Center 12900,-28950 ;
Layer NDif:  Box  Len 600  Wid 14100  Center 3600,-10650 ;
Layer NDif:  Box  Len 19200  Wid 600  Center 12900,-3600 ;
Layer NMet:  Box  Len 3600  Wid 1800  Center 5100,-18300 ;
Layer NDif:  Box  Len 2400  Wid 1800  Center 4500,-18300 ;
Layer NCut:  Box  Len 600  Wid 600  Center 3900,-18000 ;
Layer NCut:  Box  Len 600  Wid 600  Center 3900,-18600 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4500,-33600 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4500,-31200 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4500,-28800 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4500,-26400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4500,-24000 ;
Layer NPol:  Box  Len 16800  Wid 600  Center 12900,-34200 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-33000 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-31800 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-30600 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-29400 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-28200 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-27000 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-25800 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-24600 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 7800,-23400 ;
Layer NCut:  Box  Len 600  Wid 600  Center 5100,-18000 ;
Layer NCut:  Box  Len 600  Wid 600  Center 5100,-18600 ;
( PadIn ):
Layer NMet:  Box  Len 12600  Wid 12600  Center 12900,-12900 ;
Layer NGls:  Box  Len 11400  Wid 11400  Center 12900,-12900 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 11100,-32400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 11100,-30000 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 11100,-27600 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 11100,-25200 ;
Layer NPol:  Box  Len 4200  Wid 600  Center 12900,-23400 ;
Layer NMet:  Box  Len 1800  Wid 4200  Center 12900,-33900 ;
Layer NPol:  Box  Len 1800  Wid 1200  Center 12900,-33600 ;
Layer NCut:  Box  Len 1200  Wid 600  Center 12900,-33600 ;
Layer NCut:  Box  Len 1200  Wid 600  Center 12900,-32400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 14700,-32400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 14700,-30000 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 14700,-27600 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 14700,-25200 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-33000 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-31800 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-30600 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-29400 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-28200 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-27000 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-25800 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-24600 ;
Layer NPol:  Box  Len 6600  Wid 600  Center 18000,-23400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 21300,-33600 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 21300,-31200 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 21300,-28800 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 21300,-26400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 21300,-24000 ;
Layer NDif:  Box  Len 600  Wid 18900  Center 22200,-13050 ;
Layer NMet:  Box  Len 1800  Wid 25500  Center 24900,-14250 ;
DF;

DS 5:    ( Name: PadVdd ):
( 12 Items. ):
Layer NMet:  Box  Len 1800  Wid 25500  Center 900,-14250 ;
Layer NMet:  Box  Len 25800  Wid 1800  Center 12900,-900 ;
Layer NMet:  Box  Len 6000  Wid 1800  Center 3900,-26100 ;
Layer NMet:  Box  Len 12600  Wid 12600  Center 12900,-12900 ;
Layer NMet:  Box  Len 1800  Wid 5700  Center 7500,-4050 ;
Layer NMet:  Box  Len 1800  Wid 8400  Center 7500,-22800 ;
Layer NGls:  Box  Len 11400  Wid 11400  Center 12900,-12900 ;
( PadVdd ):
Layer NMet:  Box  Len 1800  Wid 5700  Center 18300,-4050 ;
Layer NMet:  Box  Len 1800  Wid 8400  Center 18300,-22800 ;
Layer NMet:  Box  Len 6000  Wid 1800  Center 21600,-26100 ;
```

```
Layer NMet:  Box  Len 1800  Wid 25500  Center 24900,-14250 ;
DF;

DS 6;     ( Name: PadSample );
( 15 Items. );
Call 5 Trans 2100,-2400;
( Be sure to connect Vdd );
( and Gnd, if they're not );
( on the same strip );
Call 4 Trans 26100,-2400;
Layer NDif:  Box  Len 600  Wid 9600  Center 33600,-42600 ;
Call 2 Trans 50100,-2400;
Call 3 Trans 74100,-2400;
Layer NPol:  Box  Len 4500  Wid 600  Center 95850,-37800 ;
Call 3 Trans 98100,-2400;
Layer NDif:  Box  Len 600  Wid 9600  Center 99300,-42600 ;
( Notice that this symbol );
( is not symmetric );
Layer NPol:  Box  Len 600  Wid 9900  Center 117600,-42450 ;
Call 1 Trans 122100,-2400;
DF;

End
```

Documentation for Inverters:
InverterPair -- BackwardInverterPair
InverterQuad -- BackwardInverterQuad

Date	July 25, 1978	Status	used in summer 1978 MPC
Designer	Bob Baldwin	Address/Phone	PARC SSL
Info File	Inverters.LibDoc	CIF File	Inverters.cif
Design Rules	Mead/Conway	Scale	$\lambda = 3\ \mu m$

Dimensions and Replication

InverterPair	X: 41λ	Y: 16λ	DX: no	DY: no
Back...Pair	X: 37λ	Y: 16λ	DX: no	DY: no
InverterQuad	X: 41λ	Y: 28λ	DX: no	DY: 30λ
Back...Quad	X: 37λ	Y: 28λ	DX: no	DY: 30λ

Further Info — See section 7.3 of *A Guide to LSI Implementation.*

Function/Use — Produces the inverted and non-inverted value of a signal that has been routed though pass transistors (i.e. the first inverter has $Z_{pu}/Z_{pd} = 8$). For InverterPair, the input comes from the left, and both the true and complement output are available in red and green on the right. BackwardInverterPair has the input on the right, and output on the left.

...Quads are pairs of ...Pairs, sharing a ground line between them.

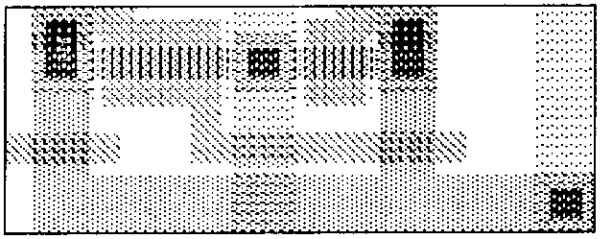
Connections — Vertical Vdd, Ground, and clocks in metal 4λ wide. Input is on the left (right) side in red 2λ wide. Both the true and complement output are avialible in red and green on the right (left) side.

Included Cells — None.

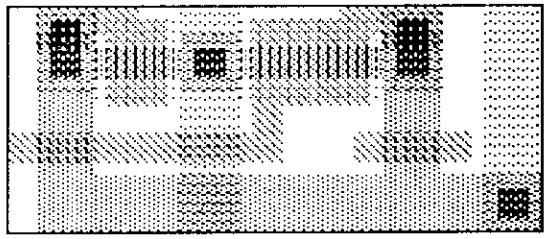
Loadings — Input load: $8\lambda^2$ gate = .03 pf (fanout of 1)
The complement output drives the second inverter, so it already has a load of 1 fanout.

Performance — True output time constant: $\sim(20k\Omega/2)\cdot C_{load}$ ~10ns/pf.
Internal delay: output rises $\sim((f_{comp}+1)+4f_{true})\tau$, falls $\sim(8(f_{comp}+1)+f_{true})\tau$.
Complement output time constant: $\sim(20k\Omega/4)\cdot(C_{load}+.03pf)$ ~5ns/pf.
Internal delay: output rises $\sim 8(f_{comp}+1)\tau$, output falls $\sim(f_{comp}+1)\tau$

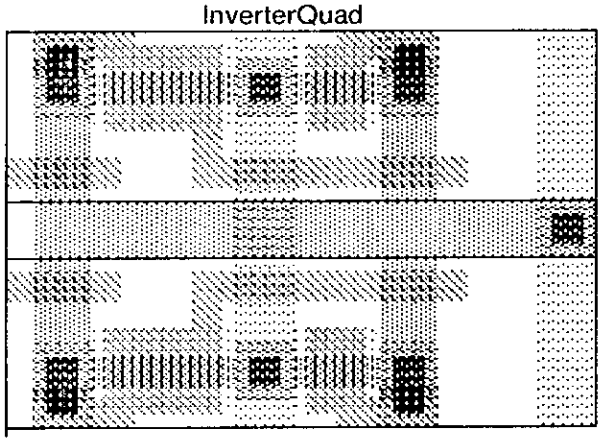
InverterPair



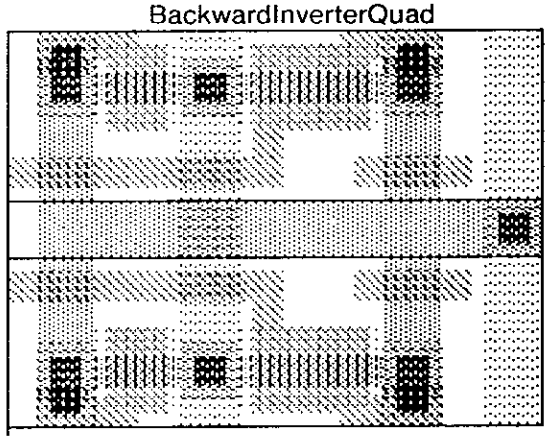
BackwardInverterPair



InverterQuad



BackwardInverterQuad



file: Inverters.cif

```
( Created by Sif from Inverters.ic ):

DS 1:    ( Name: InverterPair ):
( 27 Items. ):
Layer NPol:  Box  Len 2400  Wid 600  Center 1200,-3000 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 1200,-450 ;
Layer NDif:  Box  Len 1200  Wid 3000  Center 1200,-2100 ;
Layer NDif:  Box  Len 11700  Wid 1200  Center 6450,-4200 ;
Layer NMet:  Box  Len 1200  Wid 1800  Center 1200,-900 ;
Layer NCut:  Box  Len 600  Wid 600  Center 1200,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 1200,-1200 ;
Layer NPol:  Box  Len 1500  Wid 600  Center 1950,-300 ;
Layer NDif:  Box  Len 3600  Wid 600  Center 3300,-1200 ;
Layer NImp:  Box  Len 3000  Wid 1800  Center 3300,-1200 ;
Layer NPol:  Box  Len 2400  Wid 1800  Center 3300,-1200 ;
Layer NPol:  Box  Len 600  Wid 1200  Center 4200,-2100 ;
Layer NPol:  Box  Len 5700  Wid 600  Center 6750,-3000 ;
Layer NMet:  Box  Len 1200  Wid 4800  Center 5400,-2400 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 5400,-1200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 5400,-1200 ;
Layer NDif:  Box  Len 2700  Wid 600  Center 6750,-1200 ;
Layer NImp:  Box  Len 1800  Wid 1800  Center 6900,-1200 ;
Layer NPol:  Box  Len 1200  Wid 1800  Center 6900,-1200 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 7500,-300 ;
Layer NDif:  Box  Len 1200  Wid 3000  Center 8400,-2100 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 8400,-450 ;
Layer NMet:  Box  Len 1200  Wid 1800  Center 8400,-900 ;
Layer NCut:  Box  Len 600  Wid 600  Center 8400,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 8400,-1200 ;
Layer NMet:  Box  Len 1200  Wid 4800  Center 11700,-2400 ;
Layer NCut:  Box  Len 600  Wid 600  Center 11700,-4200 ;
DF;

DS 2:    ( Name: InverterQuad ):
( 4 Items. ):
Call 1 Trans 0,0;
Call 1 Mir Y  Trans 0,-8400;
Layer NMet:  Box  Len 1200  Wid 3600  Center 5400,-6600 ;
Layer NMet:  Box  Len 1200  Wid 3600  Center 11700,-6600 ;
DF;

DS 3:    ( Name: BackwardInverterPair ):
( 27 Items. ):
Layer NPol:  Box  Len 5700  Wid 600  Center 2850,-3000 ;
Layer NDif:  Box  Len 1200  Wid 3000  Center 1200,-2100 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 1200,-450 ;
Layer NMet:  Box  Len 1200  Wid 1800  Center 1200,-900 ;
Layer NDif:  Box  Len 10500  Wid 1200  Center 5850,-4200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 1200,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 1200,-1200 ;
Layer NDif:  Box  Len 2700  Wid 600  Center 2850,-1200 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 2100,-300 ;
Layer NImp:  Box  Len 1800  Wid 1800  Center 2700,-1200 ;
Layer NPol:  Box  Len 1200  Wid 1800  Center 2700,-1200 ;
Layer NMet:  Box  Len 1200  Wid 4800  Center 4200,-2400 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 4200,-1200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 4200,-1200 ;
Layer NDif:  Box  Len 3600  Wid 600  Center 6300,-1200 ;
Layer NImp:  Box  Len 3000  Wid 1800  Center 6300,-1200 ;
Layer NPol:  Box  Len 2400  Wid 1800  Center 6300,-1200 ;
Layer NPol:  Box  Len 600  Wid 1200  Center 5400,-2100 ;
Layer NPol:  Box  Len 1500  Wid 600  Center 7650,-300 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 8400,-3000 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 8400,-450 ;
Layer NDif:  Box  Len 1200  Wid 3000  Center 8400,-2100 ;
Layer NMet:  Box  Len 1200  Wid 1800  Center 8400,-900 ;
Layer NCut:  Box  Len 600  Wid 600  Center 8400,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 8400,-1200 ;
Layer NMet:  Box  Len 1200  Wid 4800  Center 10500,-2400 ;
Layer NCut:  Box  Len 600  Wid 600  Center 10500,-4200 ;
DF;
```

```
DS 4:     ( Name: BackwardInverterQuad ):
( 2 Items. ):
Call 3 Trans 0,0;
Call 3 Mir Y  Trans 0,-8400;
DF:

End
```

Documentation for Pullups:
HPullup4:1 -- HPullup2:1
VPullup4:1 -- VPullup2:1

Date	July 26, 1978	Status	used in summer 1978 MPC
Designer	Bob Baldwin	Address/Phone	PARC SSL
Design Rules	Mead/Conway	Scale	λ = 3 μm
Info File	Pullups.LibDoc	CIF File	Pullups.cif

Dimensions and Replication

HPullup4:1	X: 7λ	Y: 18λ	DX: no	DY: 9λ
HPullup2:1	X: 7λ	Y: 14λ	DX: no	DY: 9λ
VPullup4:1	X: 7λ	Y: 18λ	DX: 9λ	DY: no
VPullup2:1	X: 7λ	Y: 14λ	DX: 9λ	DY: no

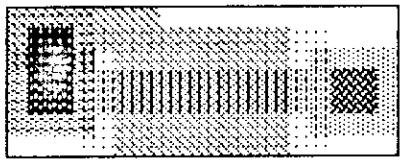
Further Info

Function/Use General purpose pullups with given L/W ratios.

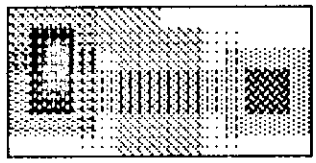
Connections The symbols contain diffusion and cut flashes for Vdd, without metal, and complete butting contacts for connection to the circuit.

Included Cells None

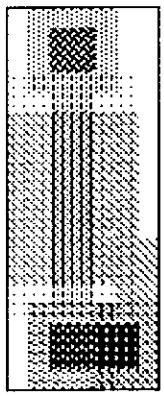
HPullup4:1



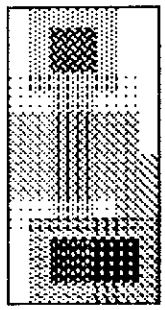
HPullup2:1



VPullup4:1



VPullup2:1



file: Pullups.cif

```
( Created by Sif from Pullups.ic );

DS 1;    ( Name: HPullup4:1 );
( 11 Items. ):
Layer NMet:  Box  Len 1200  Wid 1800  Center 600,-900 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 600,-450 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 600,-1200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 600,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 600,-1200 ;
Layer NPol:  Box  Len 1500  Wid 600  Center 1350,-300 ;
Layer NDif:  Box  Len 3600  Wid 600  Center 2700,-1200 ;
Layer NImp:  Box  Len 3400  Wid 1800  Center 2700,-1200 ;
Layer NPol:  Box  Len 2400  Wid 1800  Center 2700,-1200 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 4800,-1200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 4800,-1200 ;
DF;

DS 2;    ( Name: VPullup4:1 );
( 11 Items. ):
Layer NImp:  Box  Len 1800  Wid 3400  Center 900,-2700 ;
Layer NPol:  Box  Len 1800  Wid 2400  Center 900,-2700 ;
Layer NMet:  Box  Len 1800  Wid 1200  Center 1200,-4800 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 900,-4800 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 900,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 900,-4800 ;
Layer NDif:  Box  Len 600  Wid 3600  Center 900,-2700 ;
Layer NCut:  Box  Len 600  Wid 600  Center 900,-600 ;
Layer NPol:  Box  Len 900  Wid 1200  Center 1650,-4800 ;
Layer NCut:  Box  Len 600  Wid 600  Center 1500,-4800 ;
Layer NPol:  Box  Len 600  Wid 1500  Center 1800,-4050 ;
DF;

DS 3;    ( Name: VPullup2:1 );
( 11 Items. ):
Layer NImp:  Box  Len 1800  Wid 2200  Center 900,-2100 ;
Layer NPol:  Box  Len 1800  Wid 1200  Center 900,-2100 ;
Layer NMet:  Box  Len 1800  Wid 1200  Center 1200,-3600 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 900,-3600 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 900,-600 ;
Layer NDif:  Box  Len 600  Wid 2700  Center 900,-1950 ;
Layer NCut:  Box  Len 600  Wid 600  Center 900,-3600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 900,-600 ;
Layer NPol:  Box  Len 900  Wid 1200  Center 1650,-3600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 1500,-3600 ;
Layer NPol:  Box  Len 600  Wid 1200  Center 1800,-2700 ;
DF;

DS 4;    ( Name: HPullup2:1 );
( 11 Items. ):
Layer NMet:  Box  Len 1200  Wid 1800  Center 600,-900 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 600,-450 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 600,-1200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 600,-600 ;
Layer NCut:  Box  Len 600  Wid 600  Center 600,-1200 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 1500,-300 ;
Layer NDif:  Box  Len 2700  Wid 600  Center 2250,-1200 ;
Layer NImp:  Box  Len 2200  Wid 1800  Center 2100,-1200 ;
Layer NPol:  Box  Len 1200  Wid 1800  Center 2100,-1200 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 3600,-1200 ;
Layer NCut:  Box  Len 600  Wid 600  Center 3600,-1200 ;
DF;

End
```

Documentation for PLA:
PlaCellPair -- PlaConnect -- PlaGround
PlaIn -- PlaInPair -- PlaOut
PullupPair -- PlaProgFlash -- PLA-2-4-4

Date	August 29, 1978	Status	used in summer 1978 MPC
Designer	Dick Lyon	Address/Phone	PARC SSL x4325
Design Rules	Mead/Conway	Scale	λ = 3 μm
Info File	PLA.LibDoc	CIF File	PLA.cif

Dimensions and Replication

PlaCellPair	X: 14λ	Y: 14λ	DX: 14λ	DY: 14λ
PlaConnect	X: 16λ	Y: 14λ	DX: no	DY: 14λ
PlaGround	X: 14λ	Y: 10λ	DX: 14λ	DY: no
PlaIn	X: 16λ	Y: 53λ	DX: no	DY: no
PlaInPair	X: 28λ	Y: 53λ	DX: 28λ	DY: no
PlaOut	X: 14λ	Y: 68λ	DX: 14λ	DY: no
PullupPair	X: 29λ	Y: 14λ	DX: no	DY: 14λ
PlaProgFlash	X: 4λ	Y: 4λ	DX: no	DY: no
PLA-2-4-4	X: 114λ	Y: 139λ	DX: no	DY: no

Further Info: See [Mead 1978] chapter 3, section "The Programmable Logic Array."

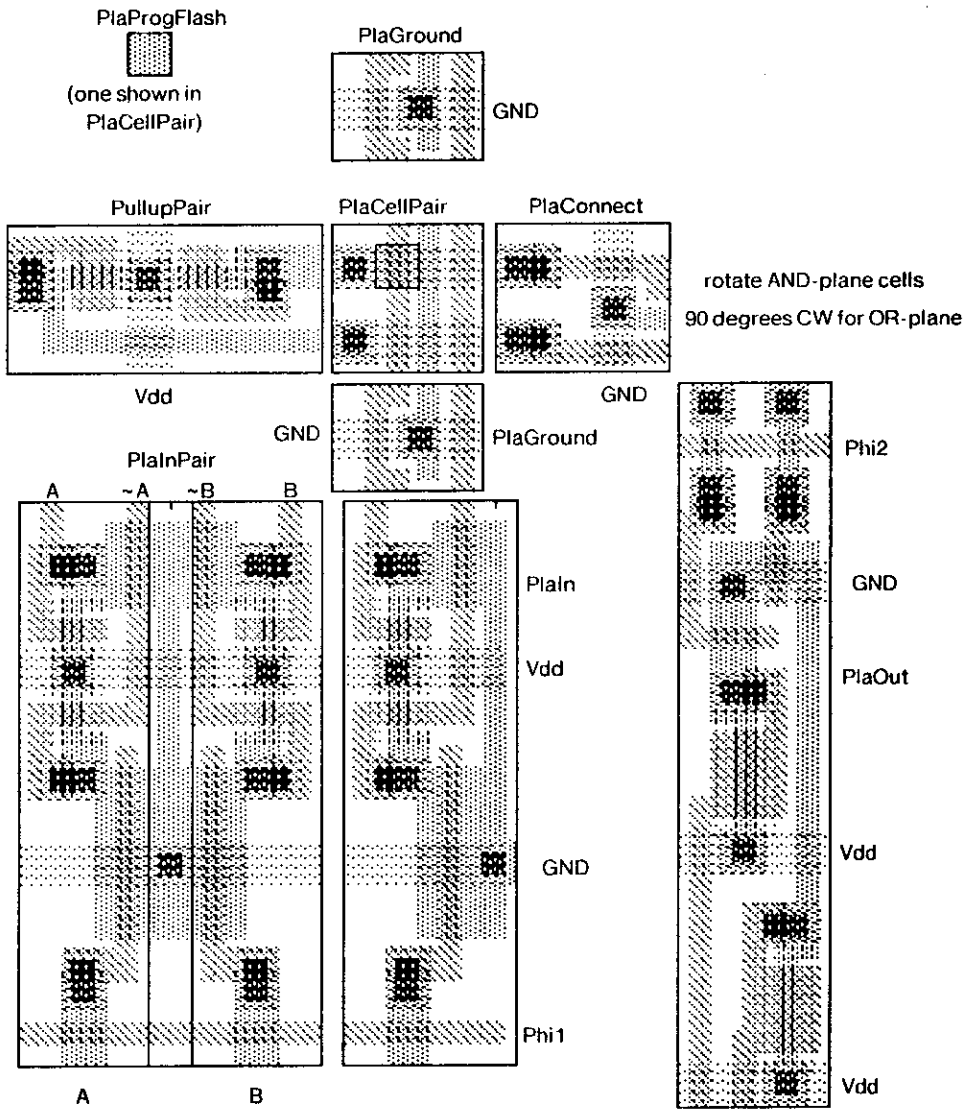
Function/Use: General logic and state machines.

Connections: See the checkplots of various cells, and of PLA-2-4-4, which has one output connected back to an input, for one bit of state.

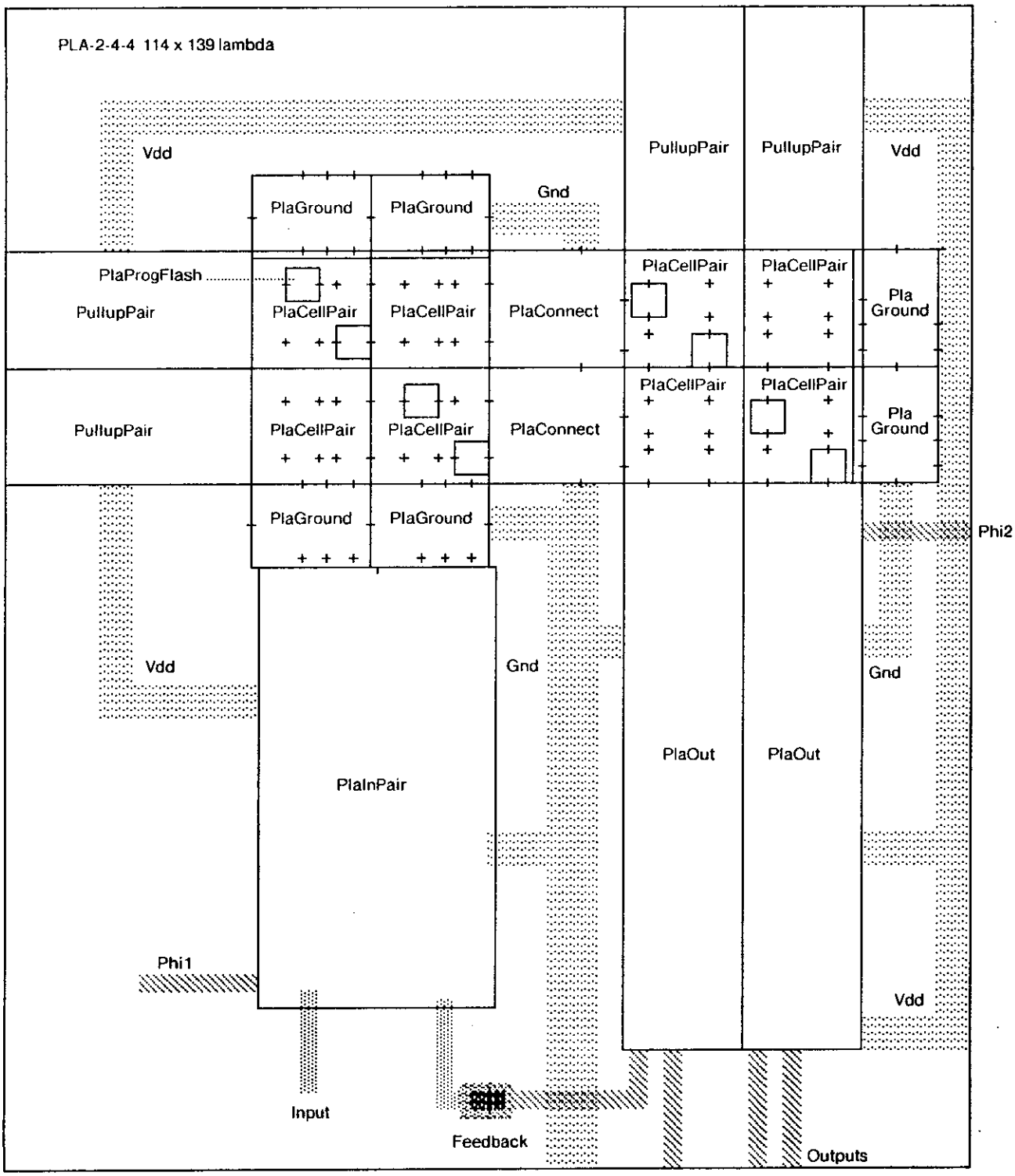
Loadings: Each input gate is $32\lambda^2$.
Phi1 drives $8\lambda^2$ per input.
Phi2 drives $4\lambda^2$ per output.
Outputs have Z=4 pullups.

Performance: Not computed, but limited by the Z=2 pullups on the minterm lines, which may have large fanouts.

How it works: The AND-plane is made of NOR gates, so programming flashes "PlaProgFlash" should be placed to form a path across the "~A" poly line to include "A" in a minterm, and vice versa. The OR-plane is also made of NOR gates, and since the minterms are non-inverted, just place a "PlaProgFlash" to include a minterm in an output. The output of the OR-plane is thus inverted, but PlaOut fixes it.


PlaProgFlash
(one shown in
PlaCellPair)
PlaGround
GND
PullupPair
PlaCellPair
PlaConnect
rotate AND-plane cells
90 degrees CW for OR-plane
Vdd
GND
GND
PlaGround
PlaInPair
A
~A
~B
B
PlaIn
Vdd
GND
Phi1
A
B
Phi2
GND
PlaOut
Vdd
Vdd

PLA Cells



Checkplot of PLA-2-4-4

file: PLA.cif

```
( Created by Sif from Pla.ic ):

DS 1;    ( Name: PlaCellPair ):
( 9 Items. ):
Layer NMet;  Box  Len 4200  Wid 1200  Center 2100,-1200 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 600,-1200 ;
Layer NMet;  Box  Len 4200  Wid 1200  Center 2100,-3300 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 600,-3300 ;
Layer NCut;  Box  Len 600  Wid 600  Center 600,-1200 ;
Layer NCut;  Box  Len 600  Wid 600  Center 600,-3300 ;
Layer NPol;  Box  Len 600  Wid 4200  Center 1800,-2100 ;
Layer NDif;  Box  Len 600  Wid 4200  Center 2700,-2100 ;
Layer NPol;  Box  Len 600  Wid 4200  Center 3600,-2100 ;
DF;

DS 2;    ( Name: PullupPair ):
( 22 Items. ):
Layer NDif;  Box  Len 1500  Wid 1200  Center 750,-1800 ;
Layer NPol;  Box  Len 1200  Wid 1200  Center 600,-900 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 600,-1500 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 600,-1500 ;
Layer NDif;  Box  Len 7800  Wid 600  Center 4800,-3300 ;
Layer NDif;  Box  Len 2700  Wid 600  Center 2250,-1500 ;
Layer NDif;  Box  Len 600  Wid 1500  Center 1200,-2850 ;
Layer NImp;  Box  Len 2400  Wid 1800  Center 2400,-1500 ;
Layer NPol;  Box  Len 1800  Wid 600  Center 2100,-600 ;
Layer NPol;  Box  Len 1200  Wid 1800  Center 2400,-1500 ;
Layer NMet;  Box  Len 1200  Wid 4200  Center 3900,-2100 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 3900,-1500 ;
Layer NCut;  Box  Len 600  Wid 600  Center 3900,-1500 ;
Layer NCut;  Box  Len 600  Wid 600  Center 3900,-1500 ;
Layer NDif;  Box  Len 2700  Wid 600  Center 5550,-1500 ;
Layer NImp;  Box  Len 2400  Wid 1800  Center 5400,-1500 ;
Layer NPol;  Box  Len 1200  Wid 1800  Center 5400,-1500 ;
Layer NPol;  Box  Len 1800  Wid 600  Center 5700,-2400 ;
Layer NDif;  Box  Len 2400  Wid 1200  Center 7500,-1200 ;
Layer NPol;  Box  Len 1200  Wid 1200  Center 7200,-2100 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 7200,-1500 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 7200,-1500 ;
DF;

DS 3;    ( Name: PlaConnect ):
( 17 Items. ):
Layer NMet;  Box  Len 1800  Wid 1200  Center 900,-1200 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 600,-1200 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 600,-3300 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 900,-3300 ;
Layer NCut;  Box  Len 600  Wid 600  Center 600,-1200 ;
Layer NCut;  Box  Len 600  Wid 600  Center 600,-3300 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1200,-1200 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1200,-3300 ;
Layer NPol;  Box  Len 900  Wid 1200  Center 1350,-1200 ;
Layer NPol;  Box  Len 900  Wid 1200  Center 1350,-3300 ;
Layer NPol;  Box  Len 3600  Wid 600  Center 3000,-3600 ;
Layer NPol;  Box  Len 3000  Wid 600  Center 3300,-1200 ;
Layer NMet;  Box  Len 1200  Wid 4200  Center 3300,-2100 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 3300,-2400 ;
Layer NCut;  Box  Len 600  Wid 600  Center 3300,-2400 ;
Layer NDif;  Box  Len 1500  Wid 600  Center 4050,-2700 ;
Layer NPol;  Box  Len 600  Wid 1200  Center 4500,-1500 ;
DF;

DS 4;    ( Name: PlaGround ):
( 8 Items. ):
Layer NMet;  Box  Len 4200  Wid 1200  Center 2100,-1500 ;
Layer NPol;  Box  Len 600  Wid 2400  Center 1200,-1500 ;
Layer NPol;  Box  Len 1200  Wid 600  Center 1500,-300 ;
Layer NPol;  Box  Len 1200  Wid 600  Center 1500,-2700 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 2400,-1500 ;
Layer NCut;  Box  Len 600  Wid 600  Center 2400,-1500 ;
Layer NDif;  Box  Len 600  Wid 2700  Center 2700,-1350 ;
Layer NPol;  Box  Len 600  Wid 3000  Center 3600,-1500 ;
```

```
DF;

DS 5;    ( Name: PlaIn );
( 35 Items. );
Layer NMet;  Box  Len 4500  Wid 1200  Center -1950,-4800 ;
Layer NMet;  Box  Len 4500  Wid 1200  Center -1950,-10200 ;
Layer NPol;  Box  Len 4500  Wid 600  Center -1950,-15000 ;
Layer NPol;  Box  Len 1200  Wid 1200  Center -3300,-7800 ;
Layer NPol;  Box  Len 600  Wid 1800  Center -3600,-6600 ;
Layer NPol;  Box  Len 600  Wid 1800  Center -3600,-3000 ;
Layer NPol;  Box  Len 1200  Wid 1200  Center -3300,-1800 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center -2700,-7800 ;
Layer NImp;  Box  Len 1800  Wid 1800  Center -2700,-6000 ;
Layer NPol;  Box  Len 2700  Wid 600  Center -2250,-6000 ;
Layer NImp;  Box  Len 1800  Wid 1800  Center -2700,-3600 ;
Layer NPol;  Box  Len 1800  Wid 600  Center -2700,-3600 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center -2700,-1800 ;
Layer NPol;  Box  Len 600  Wid 1500  Center -3300,-750 ;
Layer NCut;  Box  Len 1200  Wid 600  Center -2700,-7800 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center -2700,-4800 ;
Layer NCut;  Box  Len 1200  Wid 600  Center -2700,-1800 ;
Layer NDif;  Box  Len 1200  Wid 1800  Center -2400,-7500 ;
Layer NDif;  Box  Len 600  Wid 1800  Center -2700,-6000 ;
Layer NDif;  Box  Len 600  Wid 300  Center -2700,-6750 ;
Layer NCut;  Box  Len 600  Wid 600  Center -2700,-4800 ;
Layer NDif;  Box  Len 600  Wid 1800  Center -2700,-3900 ;
Layer NDif;  Box  Len 600  Wid 300  Center -2700,-2850 ;
Layer NDif;  Box  Len 1200  Wid 1800  Center -2400,-2100 ;
Layer NDif;  Box  Len 1200  Wid 2700  Center -2400,-14550 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center -2400,-13500 ;
Layer NPol;  Box  Len 2100  Wid 900  Center -1950,-13050 ;
Layer NCut;  Box  Len 600  Wid 1200  Center -2400,-13500 ;
Layer NDif;  Box  Len 2400  Wid 4800  Center -900,-9900 ;
Layer NDif;  Box  Len 2100  Wid 2400  Center -750,-1800 ;
Layer NPol;  Box  Len 600  Wid 6000  Center -1200,-9900 ;
Layer NPol;  Box  Len 600  Wid 6300  Center -900,-3150 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 0,-10200 ;
Layer NDif;  Box  Len 600  Wid 6000  Center 0,-4800 ;
Layer NCut;  Box  Len 600  Wid 600  Center 0,-10200 ;
DF;

DS 6;    ( Name: PlaInPair );
( 2 Items. );
Call 5 Trans 0,0;
Call 5 Mir X  Trans 0,0;
DF;

DS 7;    ( Name: PlaOut );
( 50 Items. );
Layer NPol;  Box  Len 4200  Wid 600  Center 2100,-1800 ;
Layer NPol;  Box  Len 600  Wid 3600  Center 300,-5400 ;
Layer NPol;  Box  Len 2700  Wid 600  Center 1350,-7200 ;
Layer NMet;  Box  Len 4200  Wid 1200  Center 2100,-5700 ;
Layer NMet;  Box  Len 4200  Wid 1200  Center 2100,-13200 ;
Layer NMet;  Box  Len 4200  Wid 1200  Center 2100,-19800 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 900,-600 ;
Layer NMet;  Box  Len 1200  Wid 1200  Center 900,-600 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 900,-3000 ;
Layer NPol;  Box  Len 1200  Wid 900  Center 900,-3750 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 900,-3300 ;
Layer NPol;  Box  Len 600  Wid 8700  Center 600,-16050 ;
Layer NCut;  Box  Len 600  Wid 600  Center 900,-600 ;
Layer NDif;  Box  Len 600  Wid 1800  Center 900,-1800 ;
Layer NCut;  Box  Len 600  Wid 1200  Center 900,-3300 ;
Layer NDif;  Box  Len 1200  Wid 3600  Center 1500,-6300 ;
Layer NMet;  Box  Len 1800  Wid 1200  Center 1800,-8700 ;
Layer NDif;  Box  Len 1200  Wid 1500  Center 1500,-8850 ;
Layer NPol;  Box  Len 1800  Wid 2400  Center 1800,-11100 ;
Layer NImp;  Box  Len 1800  Wid 3600  Center 1800,-11100 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1500,-5700 ;
Layer NCut;  Box  Len 1200  Wid 600  Center 1800,-8700 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 1800,-13200 ;
Layer NDif;  Box  Len 600  Wid 3900  Center 1800,-11250 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1800,-13200 ;
Layer NPol;  Box  Len 600  Wid 2100  Center 1800,-19350 ;
```

```
Layer NDif:  Box  Len 2100  Wid 1200  Center 2850,-5100 ;
Layer NPol:  Box  Len 1200  Wid 1200  Center 2400,-8700 ;
Layer NPol:  Box  Len 1200  Wid 1200  Center 2400,-15300 ;
Layer NPol:  Box  Len 600  Wid 3600  Center 2100,-17100 ;
Layer NMet:  Box  Len 1800  Wid 1200  Center 3000,-15300 ;
Layer NImp:  Box  Len 1800  Wid 3600  Center 3000,-17700 ;
Layer NPol:  Box  Len 1800  Wid 2400  Center 3000,-17700 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 3000,-600 ;
Layer NMet:  Box  Len 1200  Wid 1200  Center 3000,-600 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 3000,-3000 ;
Layer NPol:  Box  Len 1200  Wid 900  Center 3000,-3750 ;
Layer NMet:  Box  Len 1200  Wid 1800  Center 3000,-3300 ;
Layer NPol:  Box  Len 600  Wid 2400  Center 2700,-5100 ;
Layer NPol:  Box  Len 600  Wid 3600  Center 2700,-10500 ;
Layer NCut:  Box  Len 1200  Wid 600  Center 3000,-15300 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 3000,-19800 ;
Layer NCut:  Box  Len 600  Wid 600  Center 3000,-600 ;
Layer NDif:  Box  Len 600  Wid 1800  Center 3000,-1800 ;
Layer NCut:  Box  Len 600  Wid 1200  Center 3000,-3300 ;
Layer NDif:  Box  Len 1200  Wid 1500  Center 3300,-15450 ;
Layer NDif:  Box  Len 600  Wid 3900  Center 3000,-17550 ;
Layer NCut:  Box  Len 600  Wid 600  Center 3000,-19800 ;
Layer NCut:  Box  Len 600  Wid 600  Center 3000,-19800 ;
Layer NDif:  Box  Len 600  Wid 10200  Center 3600,-10500 ;
DF;

DS 8;    ( Name: PLA-2-4-4 );
( 42 Items. );
Call 2 Trans 0,-8700;
Call 2 Trans 0,-12900;
Layer NMet:  Box  Len 1200  Wid 5400  Center 3900,-6000 ;
Layer NMet:  Box  Len 1200  Wid 8400  Center 3900,-21300 ;
Layer NMet:  Box  Len 4500  Wid 1200  Center 6750,-24900 ;
Layer NMet:  Box  Len 17400  Wid 1200  Center 13200,-3900 ;
Layer NPol:  Box  Len 4200  Wid 600  Center 6900,-35100 ;
Call 1 Trans 8700,-8700;
Call 1 Trans 8700,-12900;
Call 1 Trans 12900,-8700;
Call 1 Trans 12900,-12900;
Call 4 Trans 8700,-17100;
Call 4 Trans 12900,-17100;
Call 4 Trans 8700,-6000;
Call 4 Trans 12900,-6000;
Call 6 Trans 13200,-20100;
Layer NDif:  Box  Len 600  Wid 3600  Center 10800,-37200 ;
Layer NDif:  Box  Len 600  Wid 3600  Center 15600,-37500 ;
Layer NDif:  Box  Len 1200  Wid 600  Center 15900,-39300 ;
Layer NMet:  Box  Len 1800  Wid 1200  Center 17100,-39300 ;
Layer NDif:  Box  Len 1200  Wid 1200  Center 16800,-39300 ;
Layer NCut:  Box  Len 600  Wid 600  Center 16800,-39300 ;
Call 3 Trans 17100,-8700;
Call 3 Trans 17100,-12900;
Layer NMet:  Box  Len 3900  Wid 1200  Center 19050,-18600 ;
Layer NMet:  Box  Len 3900  Wid 1200  Center 19050,-7500 ;
Layer NMet:  Box  Len 3300  Wid 1200  Center 18750,-30300 ;
Layer NCut:  Box  Len 600  Wid 600  Center 17400,-39300 ;
Layer NPol:  Box  Len 900  Wid 1200  Center 17550,-39300 ;
Layer NPol:  Box  Len 5100  Wid 600  Center 20250,-39300 ;
Layer NMet:  Box  Len 1800  Wid 22500  Center 20100,-30450 ;
Layer NMet:  Box  Len 1200  Wid 1500  Center 20400,-7950 ;
Layer NMet:  Box  Len 1200  Wid 1200  Center 20400,-17700 ;
Layer NMet:  Box  Len 1500  Wid 1200  Center 21150,-22800 ;
Call 1 Rot 0,-1  Trans 30300,-8700;
Call 1 Rot 0,-1  Trans 30300,-12900;
Call 1 Rot 0,-1  Trans 26100,-8700;
Call 1 Rot 0,-1  Trans 26100,-12900;
Call 2 Rot 0,-1  Trans 30300,0;
Call 2 Rot 0,-1  Trans 26100,0;
Call 7 Trans 21900,-17100;
Call 7 Trans 26100,-17100;
Layer NPol:  Box  Len 600  Wid 1800  Center 22500,-38400 ;
Layer NPol:  Box  Len 600  Wid 4200  Center 23700,-39600 ;
Layer NPol:  Box  Len 600  Wid 4200  Center 26700,-39600 ;
Layer NPol:  Box  Len 600  Wid 4200  Center 27900,-39600 ;
Call 4 Rot 0,-1  Trans 33000,-8700;
Call 4 Rot 0,-1  Trans 33000,-12900;
Layer NPol:  Box  Len 3900  Wid 600  Center 32250,-18900 ;
```

```
Layer NMet:  Box  Len 1800  Wid 1200  Center 31200,-22800 ;
Layer NMet:  Box  Len 2700  Wid 1200  Center 31650,-3900 ;
Layer NMet:  Box  Len 3000  Wid 1200  Center 31800,-30300 ;
Layer NMet:  Box  Len 3000  Wid 1200  Center 31800,-36900 ;
Layer NMet:  Box  Len 1200  Wid 6000  Center 31500,-20100 ;
Layer NMet:  Box  Len 1200  Wid 34200  Center 33600,-20400 ;
DF;

End
```

Documentation for SRCELL

Date	August 1, 1978	Status	Layout only
Designer	Lynn Conway	Address/Phone	PARC SSL
Design Rules	Mead/Conway	Scale	$\lambda = 3\ \mu m$
Info File	SRCELL.LibDoc	CIF File	SRCELL.cif
Dimensions	X: 21λ Y: 26λ	Replication Mirrored	DX: 21λ DY: 26λ DX: 21λ DY: 19λ*

Further Info: See Chapter 4 of Mead & Conway

Function/Use: Shift Register. Each cell contains an inverter and a pass gate control line.

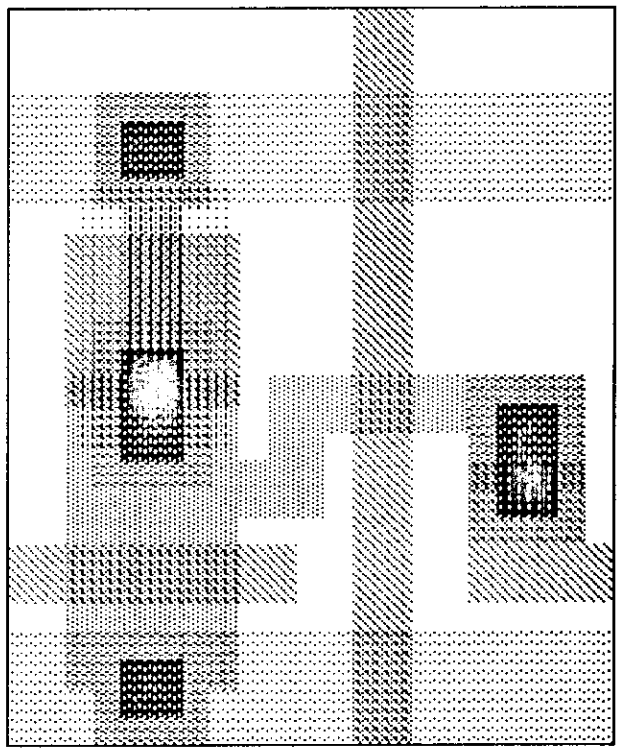
Connections: Horizontal power and ground in 4λ metal. Vertical clock/control line in 2λ poly. The input and output are horizontal in 2λ poly. The cell can be stacked in X and Y to form a shift register of arbitrary length and width. *The cells can be packed closer in the Y direction if every other cell is mirrored about the X axis, thus allowing adjacent cells to share power and/or ground buses.

Included Cells: None

Loadings: Input load: $12\lambda^2$ gate = .045pf. $Z_{pu}/Z_{pd} = 8$.
The output passes through a minimum pass transistor.

Performance: Fall time for output: $RC + f_T$ Rise time: $RC + 3f_T$. Where RC = time constant for the pass transistor.

SRCELL



file: SRCELL.cif

```
( Created by Sif from SRCELL.ic );

DS 1;    ( Name: SRCELL );
( 24 Items. );
Layer NMet;  Box  Len 6300  Wid 1200  Center 3150,-7200 ;
Layer NMet;  Box  Len 6300  Wid 1200  Center 3150,-1500 ;
Layer NPol;  Box  Len 3000  Wid 600  Center 1500,-6000 ;
Layer NDif;  Box  Len 1800  Wid 3300  Center 1500,-5550 ;
Layer NPol;  Box  Len 1800  Wid 1800  Center 1500,-3300 ;
Layer NImp;  Box  Len 1600  Wid 2800  Center 1500,-3300 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 1500,-7200 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 1500,-1500 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 1500,-4200 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1500,-7200 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1500,-1500 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1500,-3900 ;
Layer NCut;  Box  Len 600  Wid 600  Center 1500,-4500 ;
Layer NDif;  Box  Len 600  Wid 2100  Center 1500,-3150 ;
Layer NDif;  Box  Len 600  Wid 600  Center 2700,-5100 ;
Layer NDif;  Box  Len 600  Wid 1200  Center 3000,-4800 ;
Layer NDif;  Box  Len 2100  Wid 600  Center 3750,-4200 ;
Layer NPol;  Box  Len 600  Wid 7800  Center 3900,-3900 ;
Layer NPol;  Box  Len 1500  Wid 600  Center 5550,-6000 ;
Layer NPol;  Box  Len 1200  Wid 900  Center 5400,-5250 ;
Layer NDif;  Box  Len 1200  Wid 1200  Center 5400,-4500 ;
Layer NMet;  Box  Len 1200  Wid 1800  Center 5400,-4800 ;
Layer NCut;  Box  Len 600  Wid 600  Center 5400,-4500 ;
Layer NCut;  Box  Len 600  Wid 600  Center 5400,-5100 ;
DF;

Call 1 Trans 0,0;
End
```

Documentation for AlignMarks6:
Align -- LayerNames
EtchTest -- LayerAlign

Date	August 29, 1978	Status	similar to summer 1978 MPC
Designer	Hon, Lyon, and Davies	Address/Phone	PARC SSL x4325
Design Rules	Mead/Conway	Scale	$\lambda = 3\ \mu m$
Info File	AlignMarks6.LibDoc	CIF File	AlignMarks6.cif

Dimensions and Replication

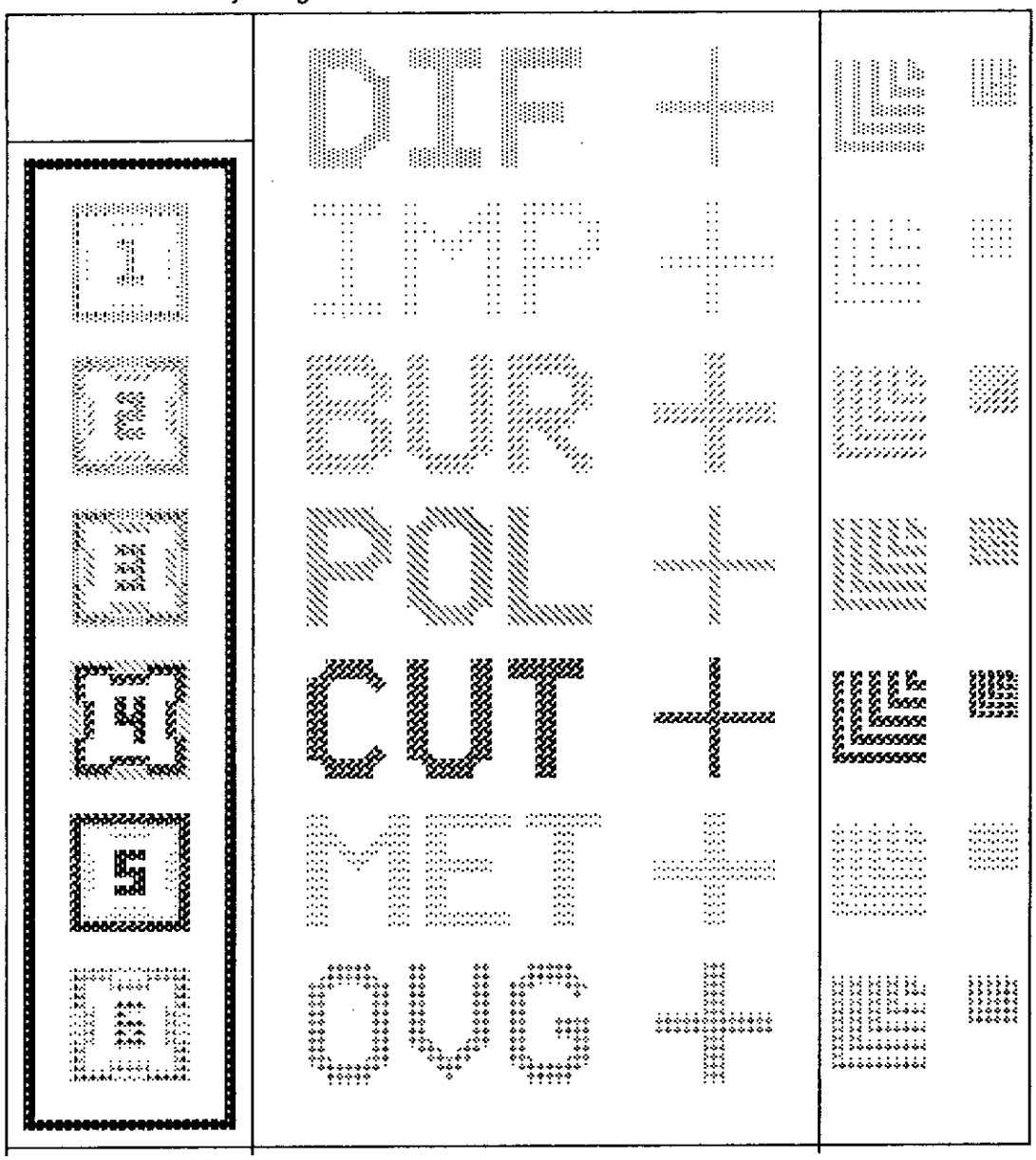
Align	X: 54λ	Y: 224λ	DX: no	DY: no
LayerNames	X: 124λ	Y: 232λ	DX: no	DY: no
EtchTest	X: 46λ	Y: 232λ	DX: no	DY: no
LayerAlign	X: 224λ	Y: 232λ	DX: no	DY: no

Further Info: See *A Guide to LSI Implementation*, chapter 7.

Function/Use: Starting frame artifacts for project chips. See attached figure.

Connections: none

LayerAlign



Align LayerNames EtchTest

AlignMarks6

file: AlignMarks6.cif

```
( Created by Sif from AlignMarks6.ic );

DS 1:    ( Name: EtchTest );
( 140 Items. );
Layer NGls:  Box  Len 600  Wid 5400  Center 1200,8400 ;
Layer NGls:  Box  Len 6000  Wid 600  Center 3900,5400 ;
Layer NMet:  Box  Len 600  Wid 5400  Center 1200,18600 ;
Layer NMet:  Box  Len 6000  Wid 600  Center 3900,15600 ;
Layer NCut:  Box  Len 600  Wid 5400  Center 1200,28800 ;
Layer NCut:  Box  Len 6000  Wid 600  Center 3900,25800 ;
Layer NPol:  Box  Len 600  Wid 5400  Center 1200,39000 ;
Layer NPol:  Box  Len 6000  Wid 600  Center 3900,36000 ;
Layer NBur:  Box  Len 600  Wid 5400  Center 1200,49200 ;
Layer NBur:  Box  Len 6000  Wid 600  Center 3900,46200 ;
Layer NImp:  Box  Len 600  Wid 5400  Center 1200,59400 ;
Layer NImp:  Box  Len 6000  Wid 600  Center 3900,56400 ;
Layer NDif:  Box  Len 600  Wid 5400  Center 1200,69600 ;
Layer NDif:  Box  Len 6000  Wid 600  Center 3900,66600 ;
Layer NGls:  Box  Len 600  Wid 4200  Center 2400,9000 ;
Layer NGls:  Box  Len 4800  Wid 600  Center 4500,6600 ;
Layer NMet:  Box  Len 600  Wid 4200  Center 2400,19200 ;
Layer NMet:  Box  Len 4800  Wid 600  Center 4500,16800 ;
Layer NCut:  Box  Len 600  Wid 4200  Center 2400,29400 ;
Layer NCut:  Box  Len 4800  Wid 600  Center 4500,27000 ;
Layer NPol:  Box  Len 600  Wid 4200  Center 2400,39600 ;
Layer NPol:  Box  Len 4800  Wid 600  Center 4500,37200 ;
Layer NBur:  Box  Len 600  Wid 4200  Center 2400,49800 ;
Layer NBur:  Box  Len 4800  Wid 600  Center 4500,47400 ;
Layer NImp:  Box  Len 600  Wid 4200  Center 2400,60000 ;
Layer NImp:  Box  Len 4800  Wid 600  Center 4500,57600 ;
Layer NDif:  Box  Len 600  Wid 4200  Center 2400,70200 ;
Layer NDif:  Box  Len 4800  Wid 600  Center 4500,67800 ;
Layer NGls:  Box  Len 600  Wid 3000  Center 3600,9600 ;
Layer NGls:  Box  Len 3600  Wid 600  Center 5100,7800 ;
Layer NMet:  Box  Len 600  Wid 3000  Center 3600,19800 ;
Layer NMet:  Box  Len 3600  Wid 600  Center 5100,18000 ;
Layer NCut:  Box  Len 600  Wid 3000  Center 3600,30000 ;
Layer NCut:  Box  Len 3600  Wid 600  Center 5100,28200 ;
Layer NPol:  Box  Len 600  Wid 3000  Center 3600,40200 ;
Layer NPol:  Box  Len 3600  Wid 600  Center 5100,38400 ;
Layer NBur:  Box  Len 600  Wid 3000  Center 3600,50400 ;
Layer NBur:  Box  Len 3600  Wid 600  Center 5100,48600 ;
Layer NImp:  Box  Len 600  Wid 3000  Center 3600,60600 ;
Layer NImp:  Box  Len 3600  Wid 600  Center 5100,58800 ;
Layer NDif:  Box  Len 600  Wid 3000  Center 3600,70800 ;
Layer NDif:  Box  Len 3600  Wid 600  Center 5100,69000 ;
Layer NGls:  Box  Len 600  Wid 1800  Center 4800,10200 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 5700,9000 ;
Layer NMet:  Box  Len 600  Wid 1800  Center 4800,20400 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 5700,19200 ;
Layer NCut:  Box  Len 600  Wid 1800  Center 4800,30600 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 5700,29400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4800,40800 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 5700,39600 ;
Layer NBur:  Box  Len 600  Wid 1800  Center 4800,51000 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 5700,49800 ;
Layer NImp:  Box  Len 600  Wid 1800  Center 4800,61200 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 5700,60000 ;
Layer NDif:  Box  Len 600  Wid 1800  Center 4800,71400 ;
Layer NDif:  Box  Len 2400  Wid 600  Center 5700,70200 ;
Layer NGls:  Box  Len 600  Wid 600  Center 6000,10800 ;
Layer NGls:  Box  Len 1200  Wid 600  Center 6300,10200 ;
Layer NMet:  Box  Len 600  Wid 600  Center 6000,21000 ;
Layer NMet:  Box  Len 1200  Wid 600  Center 6300,20400 ;
Layer NCut:  Box  Len 600  Wid 600  Center 6000,31200 ;
Layer NCut:  Box  Len 1200  Wid 600  Center 6300,30600 ;
Layer NPol:  Box  Len 600  Wid 600  Center 6000,41400 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 6300,40800 ;
Layer NBur:  Box  Len 600  Wid 600  Center 6000,51600 ;
Layer NBur:  Box  Len 1200  Wid 600  Center 6300,51000 ;
Layer NImp:  Box  Len 600  Wid 600  Center 6000,61800 ;
Layer NImp:  Box  Len 1200  Wid 600  Center 6300,61200 ;
Layer NDif:  Box  Len 600  Wid 600  Center 6000,72000 ;
Layer NDif:  Box  Len 1200  Wid 600  Center 6300,71400 ;
Layer NGls:  Box  Len 300  Wid 2700  Center 10050,9750 ;
```

```
Layer NGls:  Box  Len 3000  Wid 300  Center 11400,8250 ;
Layer NMet:  Box  Len 300  Wid 2700  Center 10050,19950 ;
Layer NMet:  Box  Len 3000  Wid 300  Center 11400,18450 ;
Layer NCut:  Box  Len 300  Wid 2700  Center 10050,30150 ;
Layer NCut:  Box  Len 3000  Wid 300  Center 11400,28650 ;
Layer NPol:  Box  Len 300  Wid 2700  Center 10050,40350 ;
Layer NPol:  Box  Len 3000  Wid 300  Center 11400,38850 ;
Layer NBur:  Box  Len 300  Wid 2700  Center 10050,50550 ;
Layer NBur:  Box  Len 3000  Wid 300  Center 11400,49050 ;
Layer NImp:  Box  Len 300  Wid 2700  Center 10050,60750 ;
Layer NImp:  Box  Len 3000  Wid 300  Center 11400,59250 ;
Layer NDif:  Box  Len 300  Wid 2700  Center 10050,70950 ;
Layer NDif:  Box  Len 3000  Wid 300  Center 11400,69450 ;
Layer NGls:  Box  Len 300  Wid 2100  Center 10650,10050 ;
Layer NGls:  Box  Len 2400  Wid 300  Center 11700,8850 ;
Layer NMet:  Box  Len 300  Wid 2100  Center 10650,20250 ;
Layer NMet:  Box  Len 2400  Wid 300  Center 11700,19050 ;
Layer NCut:  Box  Len 300  Wid 2100  Center 10650,30450 ;
Layer NCut:  Box  Len 2400  Wid 300  Center 11700,29250 ;
Layer NPol:  Box  Len 300  Wid 2100  Center 10650,40650 ;
Layer NPol:  Box  Len 2400  Wid 300  Center 11700,39450 ;
Layer NBur:  Box  Len 300  Wid 2100  Center 10650,50850 ;
Layer NBur:  Box  Len 2400  Wid 300  Center 11700,49650 ;
Layer NImp:  Box  Len 300  Wid 2100  Center 10650,61050 ;
Layer NImp:  Box  Len 2400  Wid 300  Center 11700,59850 ;
Layer NDif:  Box  Len 300  Wid 2100  Center 10650,71250 ;
Layer NDif:  Box  Len 2400  Wid 300  Center 11700,70050 ;
Layer NGls:  Box  Len 300  Wid 1500  Center 11250,10350 ;
Layer NGls:  Box  Len 1800  Wid 300  Center 12000,9450 ;
Layer NMet:  Box  Len 300  Wid 1500  Center 11250,20550 ;
Layer NMet:  Box  Len 1800  Wid 300  Center 12000,19650 ;
Layer NCut:  Box  Len 300  Wid 1500  Center 11250,30750 ;
Layer NCut:  Box  Len 1800  Wid 300  Center 12000,29850 ;
Layer NPol:  Box  Len 300  Wid 1500  Center 11250,40950 ;
Layer NPol:  Box  Len 1800  Wid 300  Center 12000,40050 ;
Layer NBur:  Box  Len 300  Wid 1500  Center 11250,51150 ;
Layer NBur:  Box  Len 1800  Wid 300  Center 12000,50250 ;
Layer NImp:  Box  Len 300  Wid 1500  Center 11250,61350 ;
Layer NImp:  Box  Len 1800  Wid 300  Center 12000,60450 ;
Layer NDif:  Box  Len 300  Wid 1500  Center 11250,71550 ;
Layer NDif:  Box  Len 1800  Wid 300  Center 12000,70650 ;
Layer NGls:  Box  Len 300  Wid 900  Center 11850,10650 ;
Layer NGls:  Box  Len 1200  Wid 300  Center 12300,10050 ;
Layer NMet:  Box  Len 300  Wid 900  Center 11850,20850 ;
Layer NMet:  Box  Len 1200  Wid 300  Center 12300,20250 ;
Layer NCut:  Box  Len 300  Wid 900  Center 11850,31050 ;
Layer NCut:  Box  Len 1200  Wid 300  Center 12300,30450 ;
Layer NPol:  Box  Len 300  Wid 900  Center 11850,41250 ;
Layer NPol:  Box  Len 1200  Wid 300  Center 12300,40650 ;
Layer NBur:  Box  Len 300  Wid 900  Center 11850,51450 ;
Layer NBur:  Box  Len 1200  Wid 300  Center 12300,50850 ;
Layer NImp:  Box  Len 300  Wid 900  Center 11850,61650 ;
Layer NImp:  Box  Len 1200  Wid 300  Center 12300,61050 ;
Layer NDif:  Box  Len 300  Wid 900  Center 11850,71850 ;
Layer NDif:  Box  Len 1200  Wid 300  Center 12300,71250 ;
Layer NGls:  Box  Len 300  Wid 300  Center 12450,10950 ;
Layer NGls:  Box  Len 600  Wid 300  Center 12600,10650 ;
Layer NMet:  Box  Len 300  Wid 300  Center 12450,21150 ;
Layer NMet:  Box  Len 600  Wid 300  Center 12600,20850 ;
Layer NCut:  Box  Len 300  Wid 300  Center 12450,31350 ;
Layer NCut:  Box  Len 600  Wid 300  Center 12600,31050 ;
Layer NPol:  Box  Len 300  Wid 300  Center 12450,41550 ;
Layer NPol:  Box  Len 600  Wid 300  Center 12600,41250 ;
Layer NBur:  Box  Len 300  Wid 300  Center 12450,51750 ;
Layer NBur:  Box  Len 600  Wid 300  Center 12600,51450 ;
Layer NImp:  Box  Len 300  Wid 300  Center 12450,61950 ;
Layer NImp:  Box  Len 600  Wid 300  Center 12600,61650 ;
Layer NDif:  Box  Len 300  Wid 300  Center 12450,72150 ;
Layer NDif:  Box  Len 600  Wid 300  Center 12600,71850 ;
DF;

DS 2:    ( Name: LayerNames ):
( 123 Items. ):
Layer NPol:  Box  Len 1200  Wid 7800  Center 4200,38700 ;
Layer NCut:  Box  Len 1200  Wid 5400  Center 4200,28500 ;
Layer NMet:  Box  Len 1200  Wid 7800  Center 4200,18300 ;
Layer NBur:  Box  Len 1200  Wid 7800  Center 4200,48900 ;
```

```
Layer NImp:  Box  Len 4800  Wid 1200  Center 6000,62400 ;
Layer NImp:  Box  Len 4800  Wid 1200  Center 6000,55800 ;
Layer NDif:  Box  Len 1200  Wid 7800  Center 4200,69300 ;
Layer NGls:  Box  Len 1200  Wid 5400  Center 4200,8100 ;
Layer NPol:  Box  Len 3600  Wid 1200  Center 6000,42000 ;
Layer NPol:  Box  Len 3600  Wid 1200  Center 6000,38400 ;
Layer NCut:  Box  Len 1697  Wid 1200  Center 4800,31200 Direction 1,1;
Layer NCut:  Box  Len 1697  Wid 1200  Center 4800,25800 Direction 1,-1;
Layer NMet:  Box  Len 4243  Wid 1200  Center 5700,20100 Direction 1,-1;
Layer NBur:  Box  Len 3600  Wid 1200  Center 6000,52200 ;
Layer NBur:  Box  Len 3600  Wid 1200  Center 6000,49200 ;
Layer NBur:  Box  Len 3600  Wid 1200  Center 6000,45600 ;
Layer NDif:  Box  Len 3000  Wid 1200  Center 5700,72600 ;
Layer NDif:  Box  Len 3000  Wid 1200  Center 5700,66000 ;
Layer NGls:  Box  Len 1697  Wid 1200  Center 4800,5400 Direction 1,-1;
Layer NGls:  Box  Len 1697  Wid 1200  Center 4800,10800 Direction 1,1;
Layer NCut:  Box  Len 3000  Wid 1200  Center 6300,31800 ;
Layer NCut:  Box  Len 3000  Wid 1200  Center 6300,25200 ;
Layer NGls:  Box  Len 3000  Wid 1200  Center 6300,4800 ;
Layer NGls:  Box  Len 3000  Wid 1200  Center 6300,11400 ;
Layer NImp:  Box  Len 1200  Wid 6600  Center 6000,59100 ;
Layer NMet:  Box  Len 4243  Wid 1200  Center 8100,20100 Direction 1,1;
Layer NDif:  Box  Len 2546  Wid 1200  Center 7500,71700 Direction 1,-1;
Layer NDif:  Box  Len 2546  Wid 1200  Center 7500,66900 Direction 1,1;
Layer NPol:  Box  Len 1697  Wid 1200  Center 7800,41400 Direction 1,-1;
Layer NPol:  Box  Len 1697  Wid 1200  Center 7800,39000 Direction 1,1;
Layer NCut:  Box  Len 1697  Wid 1200  Center 7800,31200 Direction 1,-1;
Layer NCut:  Box  Len 1697  Wid 1200  Center 7800,25800 Direction 1,1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 7800,46200 Direction 1,1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 7800,48600 Direction 1,-1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 7800,49800 Direction 1,1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 7800,51600 Direction 1,-1;
Layer NGls:  Box  Len 1697  Wid 1200  Center 7800,5400 Direction 1,1;
Layer NGls:  Box  Len 1697  Wid 1200  Center 7800,10800 Direction 1,-1;
Layer NPol:  Box  Len 1200  Wid 2400  Center 8400,40200 ;
Layer NBur:  Box  Len 1200  Wid 2400  Center 8400,47400 ;
Layer NBur:  Box  Len 1200  Wid 1800  Center 8400,50700 ;
Layer NDif:  Box  Len 1200  Wid 4200  Center 8400,69300 ;
Layer NGls:  Box  Len 1200  Wid 5400  Center 8400,8100 ;
Layer NMet:  Box  Len 1200  Wid 7800  Center 9600,18300 ;
Layer NImp:  Box  Len 1200  Wid 7800  Center 10200,59100 ;
Layer NPol:  Box  Len 1200  Wid 5400  Center 10800,38700 ;
Layer NCut:  Box  Len 1200  Wid 6600  Center 10800,29100 ;
Layer NBur:  Box  Len 1200  Wid 6600  Center 10800,49500 ;
Layer NImp:  Box  Len 4243  Wid 1200  Center 11700,60900 Direction 1,-1;
Layer NDif:  Box  Len 4800  Wid 1200  Center 12600,72600 ;
Layer NDif:  Box  Len 4800  Wid 1200  Center 12600,66000 ;
Layer NGls:  Box  Len 1200  Wid 5400  Center 10800,9300 ;
Layer NPol:  Box  Len 1697  Wid 1200  Center 11400,36000 Direction 1,-1;
Layer NPol:  Box  Len 1697  Wid 1200  Center 11400,41400 Direction 1,1;
Layer NCut:  Box  Len 1697  Wid 1200  Center 11400,25800 Direction 1,-1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 11400,46200 Direction 1,-1;
Layer NGls:  Box  Len 3394  Wid 1200  Center 12000,6000 Direction 1,-1;
Layer NPol:  Box  Len 3000  Wid 1200  Center 12900,42000 ;
Layer NPol:  Box  Len 3000  Wid 1200  Center 12900,35400 ;
Layer NCut:  Box  Len 3000  Wid 1200  Center 12900,25200 ;
Layer NMet:  Box  Len 1200  Wid 7800  Center 12000,18300 ;
Layer NBur:  Box  Len 3000  Wid 1200  Center 12900,45600 ;
Layer NMet:  Box  Len 4800  Wid 1200  Center 14400,15000 ;
Layer NMet:  Box  Len 4800  Wid 1200  Center 14400,21600 ;
Layer NMet:  Box  Len 3600  Wid 1200  Center 13800,18600 ;
Layer NDif:  Box  Len 1200  Wid 6600  Center 12600,69300 ;
Layer NImp:  Box  Len 4243  Wid 1200  Center 14100,60900 Direction 1,1;
Layer NGls:  Box  Len 3394  Wid 1200  Center 13800,6000 Direction 1,1;
Layer NPol:  Box  Len 1697  Wid 1200  Center 14400,36000 Direction 1,1;
Layer NPol:  Box  Len 1697  Wid 1200  Center 14400,41400 Direction 1,-1;
Layer NCut:  Box  Len 1697  Wid 1200  Center 14400,25800 Direction 1,1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 14400,46200 Direction 1,1;
Layer NPol:  Box  Len 1200  Wid 5400  Center 15000,38700 ;
Layer NCut:  Box  Len 1200  Wid 6600  Center 15000,29100 ;
Layer NBur:  Box  Len 1200  Wid 6600  Center 15000,49500 ;
Layer NGls:  Box  Len 1200  Wid 5400  Center 15000,9300 ;
Layer NImp:  Box  Len 1200  Wid 7800  Center 15600,59100 ;
Layer NDif:  Box  Len 1200  Wid 7800  Center 16800,69300 ;
Layer NPol:  Box  Len 1200  Wid 7800  Center 17400,38700 ;
Layer NCut:  Box  Len 4800  Wid 1200  Center 19200,31800 ;
Layer NBur:  Box  Len 1200  Wid 7800  Center 17400,48900 ;
Layer NDif:  Box  Len 4800  Wid 1200  Center 19200,72600 ;
```

```
Layer NDif:  Box  Len 3600  Wid 1200  Center 18600,69000 ;
Layer NGls:  Box  Len 1200  Wid 5400  Center 17400,8100 ;
Layer NPol:  Box  Len 4800  Wid 1200  Center 19800,35400 ;
Layer NBur:  Box  Len 3600  Wid 1200  Center 19200,48600 ;
Layer NBur:  Box  Len 3600  Wid 1200  Center 19200,52200 ;
Layer NImp:  Box  Len 1200  Wid 7800  Center 18000,59100 ;
Layer NGls:  Box  Len 1697  Wid 1200  Center 18000,5400 Direction 1,-1;
Layer NGls:  Box  Len 1697  Wid 1200  Center 18000,10800 Direction 1,1;
Layer NMet:  Box  Len 4800  Wid 1200  Center 20400,21600 ;
Layer NImp:  Box  Len 3600  Wid 1200  Center 19800,62400 ;
Layer NImp:  Box  Len 3600  Wid 1200  Center 19800,58800 ;
Layer NGls:  Box  Len 3000  Wid 1200  Center 19500,4800 ;
Layer NGls:  Box  Len 3000  Wid 1200  Center 19500,11400 ;
Layer NCut:  Box  Len 1200  Wid 7200  Center 19200,28200 ;
Layer NBur:  Box  Len 4243  Wid 1200  Center 20100,47100 Direction 1,-1;
Layer NMet:  Box  Len 1200  Wid 7200  Center 20400,18000 ;
Layer NGls:  Box  Len 2400  Wid 1200  Center 21000,7800 ;
Layer NBur:  Box  Len 1697  Wid 1200  Center 21000,51600 Direction 1,-1;
Layer NBur:  Box  Len 1697  Wid 1200  Center 21000,49200 Direction 1,1;
Layer NGls:  Box  Len 1697  Wid 1200  Center 21000,5400 Direction 1,1;
Layer NGls:  Box  Len 1697  Wid 1200  Center 21000,10800 Direction 1,-1;
Layer NBur:  Box  Len 1200  Wid 2400  Center 21600,50400 ;
Layer NBur:  Box  Len 1200  Wid 1200  Center 21600,45600 ;
Layer NImp:  Box  Len 1697  Wid 1200  Center 21600,59400 Direction 1,1;
Layer NImp:  Box  Len 1697  Wid 1200  Center 21600,61800 Direction 1,-1;
Layer NGls:  Box  Len 1200  Wid 2400  Center 21600,6600 ;
Layer NImp:  Box  Len 1200  Wid 2400  Center 22200,60600 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 30300,69300 ;
Layer NImp:  Box  Len 7800  Wid 1200  Center 30300,59100 ;
Layer NBur:  Box  Len 7800  Wid 1200  Center 30300,48900 ;
Layer NPol:  Box  Len 7800  Wid 600  Center 30300,38700 ;
Layer NCut:  Box  Len 7800  Wid 600  Center 30300,28500 ;
Layer NMet:  Box  Len 7800  Wid 1200  Center 30300,18300 ;
Layer NGls:  Box  Len 7800  Wid 1200  Center 30300,8100 ;
Layer NImp:  Box  Len 1200  Wid 7800  Center 30300,59100 ;
Layer NBur:  Box  Len 1200  Wid 7800  Center 30300,48900 ;
Layer NMet:  Box  Len 1200  Wid 7800  Center 30300,18300 ;
Layer NGls:  Box  Len 1200  Wid 7800  Center 30300,8100 ;
Layer NDif:  Box  Len 600  Wid 7800  Center 30300,69300 ;
Layer NPol:  Box  Len 600  Wid 7800  Center 30300,38700 ;
Layer NCut:  Box  Len 600  Wid 7800  Center 30300,28500 ;
DF;

DS 3:    ( Name: Align );
( 170 Items. );
Layer NDif:  Box  Len 600  Wid 64200  Center 1500,33900 ;
Layer NImp:  Box  Len 600  Wid 64200  Center 1500,33900 ;
Layer NPol:  Box  Len 600  Wid 64200  Center 1500,33900 ;
Layer NCut:  Box  Len 600  Wid 64200  Center 1500,33900 ;
Layer NMet:  Box  Len 600  Wid 64200  Center 1500,33900 ;
Layer NBur:  Box  Len 600  Wid 64200  Center 1500,33900 ;
Layer NImp:  Box  Len 13200  Wid 600  Center 7800,1500 ;
Layer NDif:  Box  Len 13200  Wid 600  Center 7800,1500 ;
Layer NPol:  Box  Len 13200  Wid 600  Center 7800,1500 ;
Layer NCut:  Box  Len 13200  Wid 600  Center 7800,1500 ;
Layer NMet:  Box  Len 13200  Wid 600  Center 7800,1500 ;
Layer NBur:  Box  Len 13200  Wid 600  Center 7800,1500 ;
Layer NDif:  Box  Len 13200  Wid 600  Center 8400,65700 ;
Layer NImp:  Box  Len 13200  Wid 600  Center 8400,65700 ;
Layer NPol:  Box  Len 13200  Wid 600  Center 8400,65700 ;
Layer NCut:  Box  Len 13200  Wid 600  Center 8400,65700 ;
Layer NMet:  Box  Len 13200  Wid 600  Center 8400,65700 ;
Layer NBur:  Box  Len 13200  Wid 600  Center 8400,65700 ;
Layer NMet:  Box  Len 7800  Wid 600  Center 8100,11700 ;
Layer NMet:  Box  Len 7800  Wid 600  Center 8100,4500 ;
Layer NMet:  Box  Len 600  Wid 6600  Center 4500,8100 ;
Layer NCut:  Box  Len 7800  Wid 600  Center 8100,21900 ;
Layer NCut:  Box  Len 7800  Wid 600  Center 8100,14700 ;
Layer NCut:  Box  Len 600  Wid 6600  Center 4500,18300 ;
Layer NPol:  Box  Len 7800  Wid 600  Center 8100,32100 ;
Layer NPol:  Box  Len 7800  Wid 600  Center 8100,24900 ;
Layer NPol:  Box  Len 600  Wid 6600  Center 4500,28500 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 8100,42300 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 8100,35100 ;
Layer NDif:  Box  Len 600  Wid 6600  Center 4500,38700 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 8100,52500 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 8100,45300 ;
```

```
Layer NDif:  Box  Len 600  Wid 6600  Center 4500,48900 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 8100,55500 ;
Layer NDif:  Box  Len 7800  Wid 600  Center 8100,62700 ;
Layer NDif:  Box  Len 600  Wid 6600  Center 4500,59100 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 5700,11400 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 5700,4800 ;
Layer NGls:  Box  Len 600  Wid 1800  Center 4800,10200 ;
Layer NGls:  Box  Len 600  Wid 1800  Center 4800,6000 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 5700,21600 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 5700,15000 ;
Layer NMet:  Box  Len 600  Wid 1800  Center 4800,20400 ;
Layer NMet:  Box  Len 600  Wid 1800  Center 4800,16200 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 5700,31800 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 5700,25200 ;
Layer NCut:  Box  Len 600  Wid 1800  Center 4800,30600 ;
Layer NCut:  Box  Len 600  Wid 1800  Center 4800,26400 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 5700,42000 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 5700,35400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4800,36600 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 4800,40800 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 5700,52200 ;
Layer NBur:  Box  Len 600  Wid 1800  Center 4800,51000 ;
Layer NBur:  Box  Len 600  Wid 1800  Center 4800,46800 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 5700,45600 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 5700,62400 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 5700,55800 ;
Layer NImp:  Box  Len 600  Wid 1800  Center 4800,61200 ;
Layer NImp:  Box  Len 600  Wid 1800  Center 4800,57000 ;
Layer NGls:  Box  Len 600  Wid 2400  Center 5400,8100 ;
Layer NMet:  Box  Len 600  Wid 2400  Center 5400,18300 ;
Layer NCut:  Box  Len 600  Wid 2400  Center 5400,28500 ;
Layer NPol:  Box  Len 600  Wid 2400  Center 5400,38700 ;
Layer NBur:  Box  Len 600  Wid 2400  Center 5400,48900 ;
Layer NImp:  Box  Len 600  Wid 2400  Center 5400,59100 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 8100,10800 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 8100,5400 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 8100,21000 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 8100,15600 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 8100,31200 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 8100,25800 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 8100,41400 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 8100,36000 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 8100,51600 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 8100,46200 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 8100,61800 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 8100,56400 ;
Layer NImp:  Box  Len 1800  Wid 600  Center 8100,57900 ;
Layer NDif:  Box  Len 1800  Wid 600  Center 8100,57900 ;
Layer NImp:  Box  Len 600  Wid 600  Center 7500,60300 ;
Layer NDif:  Box  Len 600  Wid 600  Center 7500,60300 ;
Layer NBur:  Box  Len 1800  Wid 600  Center 8100,47700 ;
Layer NDif:  Box  Len 1800  Wid 600  Center 8100,47700 ;
Layer NBur:  Box  Len 600  Wid 600  Center 7500,48300 ;
Layer NDif:  Box  Len 600  Wid 1200  Center 7500,48600 ;
Layer NBur:  Box  Len 1800  Wid 600  Center 8100,48900 ;
Layer NBur:  Box  Len 1200  Wid 600  Center 7800,50100 ;
Layer NDif:  Box  Len 1200  Wid 600  Center 7800,50100 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 7800,37500 ;
Layer NDif:  Box  Len 1200  Wid 600  Center 7800,37500 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 7800,38700 ;
Layer NDif:  Box  Len 1200  Wid 600  Center 7800,38700 ;
Layer NPol:  Box  Len 1200  Wid 600  Center 7800,39900 ;
Layer NDif:  Box  Len 1200  Wid 600  Center 7800,39900 ;
Layer NCut:  Box  Len 1200  Wid 600  Center 7800,28500 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 7500,29100 ;
Layer NCut:  Box  Len 600  Wid 1200  Center 7500,29400 ;
Layer NMet:  Box  Len 1800  Wid 600  Center 8100,17100 ;
Layer NCut:  Box  Len 1800  Wid 600  Center 8100,17100 ;
Layer NMet:  Box  Len 1200  Wid 600  Center 7800,18300 ;
Layer NCut:  Box  Len 1800  Wid 600  Center 8100,18300 ;
Layer NMet:  Box  Len 600  Wid 1200  Center 7500,19200 ;
Layer NCut:  Box  Len 600  Wid 1200  Center 7500,19200 ;
Layer NGls:  Box  Len 1200  Wid 600  Center 7800,6900 ;
Layer NMet:  Box  Len 600  Wid 3000  Center 7500,8100 ;
Layer NGls:  Box  Len 600  Wid 2400  Center 7500,8400 ;
Layer NImp:  Box  Len 600  Wid 2400  Center 8100,59400 ;
Layer NDif:  Box  Len 600  Wid 2400  Center 8100,59400 ;
Layer NDif:  Box  Len 600  Wid 600  Center 8100,48900 ;
```

```
Layer NPol:  Box  Len 600  Wid 600  Center 8100,28500 ;
Layer NMet:  Box  Len 1200  Wid 600  Center 8400,19500 ;
Layer NCut:  Box  Len 1200  Wid 600  Center 8400,19500 ;
Layer NMet:  Box  Len 600  Wid 600  Center 8100,6900 ;
Layer NGls:  Box  Len 1200  Wid 600  Center 8400,8100 ;
Layer NMet:  Box  Len 600  Wid 600  Center 8100,8100 ;
Layer NGls:  Box  Len 1200  Wid 600  Center 8400,9300 ;
Layer NMet:  Box  Len 1200  Wid 600  Center 8400,9300 ;
Layer NDif:  Box  Len 600  Wid 1800  Center 8700,49500 ;
Layer NBur:  Box  Len 600  Wid 1200  Center 8700,49800 ;
Layer NPol:  Box  Len 600  Wid 3000  Center 8700,38700 ;
Layer NDif:  Box  Len 600  Wid 3000  Center 8700,38700 ;
Layer NCut:  Box  Len 600  Wid 3000  Center 8700,28500 ;
Layer NPol:  Box  Len 600  Wid 3000  Center 8700,28500 ;
Layer NMet:  Box  Len 600  Wid 1200  Center 8700,18000 ;
Layer NCut:  Box  Len 600  Wid 600  Center 8700,17700 ;
Layer NGls:  Box  Len 600  Wid 1200  Center 8700,7200 ;
Layer NMet:  Box  Len 600  Wid 1800  Center 8700,7500 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 10500,11400 ;
Layer NGls:  Box  Len 2400  Wid 600  Center 10500,4800 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 10500,21600 ;
Layer NMet:  Box  Len 2400  Wid 600  Center 10500,15000 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 10500,31800 ;
Layer NCut:  Box  Len 2400  Wid 600  Center 10500,25200 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 10500,42000 ;
Layer NPol:  Box  Len 2400  Wid 600  Center 10500,35400 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 10500,52200 ;
Layer NBur:  Box  Len 2400  Wid 600  Center 10500,45600 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 10500,62400 ;
Layer NImp:  Box  Len 2400  Wid 600  Center 10500,55800 ;
Layer NGls:  Box  Len 600  Wid 2400  Center 10800,8100 ;
Layer NMet:  Box  Len 600  Wid 2400  Center 10800,18300 ;
Layer NCut:  Box  Len 600  Wid 2400  Center 10800,28500 ;
Layer NPol:  Box  Len 600  Wid 2400  Center 10800,38700 ;
Layer NBur:  Box  Len 600  Wid 2400  Center 10800,48900 ;
Layer NImp:  Box  Len 600  Wid 2400  Center 10800,59100 ;
Layer NGls:  Box  Len 600  Wid 1800  Center 11400,10200 ;
Layer NGls:  Box  Len 600  Wid 1800  Center 11400,6000 ;
Layer NMet:  Box  Len 600  Wid 1800  Center 11400,20400 ;
Layer NMet:  Box  Len 600  Wid 1800  Center 11400,16200 ;
Layer NCut:  Box  Len 600  Wid 1800  Center 11400,30600 ;
Layer NCut:  Box  Len 600  Wid 1800  Center 11400,26400 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 11400,40800 ;
Layer NPol:  Box  Len 600  Wid 1800  Center 11400,36600 ;
Layer NBur:  Box  Len 600  Wid 1800  Center 11400,51000 ;
Layer NBur:  Box  Len 600  Wid 1800  Center 11400,46800 ;
Layer NImp:  Box  Len 600  Wid 1800  Center 11400,57000 ;
Layer NImp:  Box  Len 600  Wid 1800  Center 11400,61200 ;
Layer NMet:  Box  Len 600  Wid 6600  Center 11700,8100 ;
Layer NCut:  Box  Len 600  Wid 6600  Center 11700,18300 ;
Layer NPol:  Box  Len 600  Wid 6600  Center 11700,28500 ;
Layer NDif:  Box  Len 600  Wid 6600  Center 11700,38700 ;
Layer NDif:  Box  Len 600  Wid 6600  Center 11700,48900 ;
Layer NDif:  Box  Len 600  Wid 6600  Center 11700,59100 ;
Layer NDif:  Box  Len 600  Wid 64200  Center 14700,33300 ;
Layer NImp:  Box  Len 600  Wid 64200  Center 14700,33300 ;
Layer NPol:  Box  Len 600  Wid 64200  Center 14700,33300 ;
Layer NCut:  Box  Len 600  Wid 64200  Center 14700,33300 ;
Layer NMet:  Box  Len 600  Wid 64200  Center 14700,33300 ;
Layer NBur:  Box  Len 600  Wid 64200  Center 14700,33300 ;
DF;

DS 4;    ( Name: LayerAlign );
( 3 Items. );
Call 3 Trans 0,0;
Call 2 Trans 16200,0;
Call 1 Trans 53400,0;
DF;

End
```

Documentation for ScribeLines:
vertscribe -- horiscribe -- plus
rightscribe -- leftscribe -- topscribe -- bottomscribe
rightee -- leftee -- toptee -- bottomtee
nwcorner -- necorner -- secorner -- swcorner

Date	August 29, 1978	Status	used in summer 1978 MPC
Designer	Hon, Johannsen	Address/Phone	PARC SSL
Design Rules	Mead/Conway	Scale	$\lambda = 3\ \mu m$
Info File	ScribeLines.LibDoc	CIF File	ScribeLines.cif

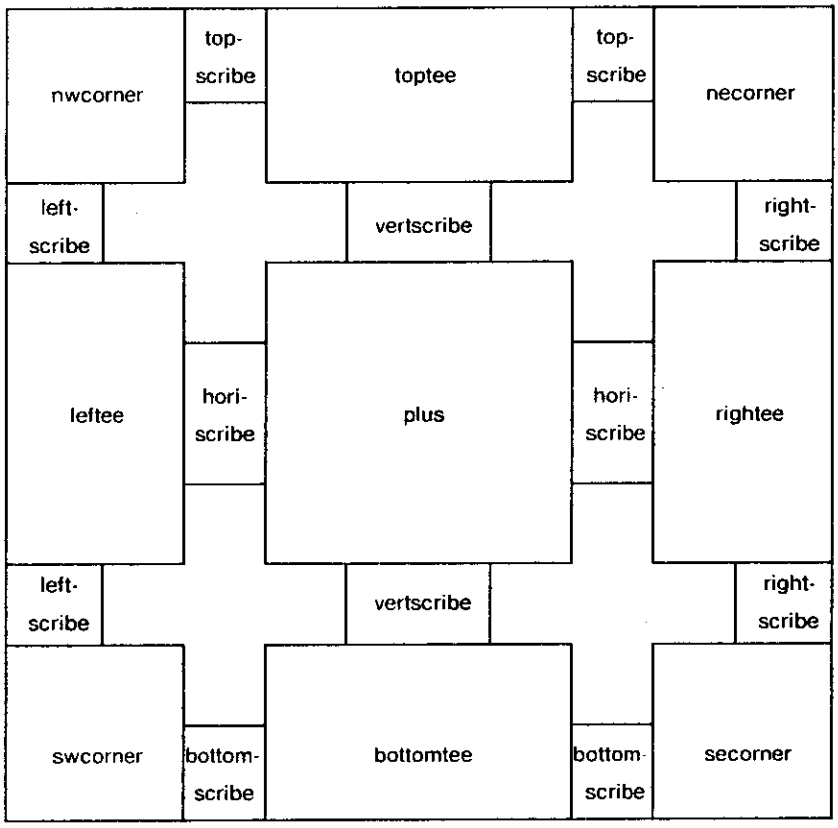
Dimensions and Replication

vertscribe	X: 60λ	Y: 34λ	DX: no	DY: 34λ
horiscribe	X: 34λ	Y: 60λ	DX: 34λ	DY: no
plus	X: 128λ	Y: 128λ	DX: no	DY: no
rightscribe	X: 40λ	Y: 34λ	DX: no	DY: 34λ
leftscribe	X: 40λ	Y: 34λ	DX: no	DY: 34λ
topscribe	X: 34λ	Y: 40λ	DX: 34λ	DY: no
bottomscribe	X: 34λ	Y: 40λ	DX: 34λ	DY: no
rightee	X: 74λ	Y: 128λ	DX: no	DY: no
leftee	X: 74λ	Y: 128λ	DX: no	DY: no
toptee	X: 128λ	Y: 74λ	DX: no	DY: no
bottomtee	X: 128λ	Y: 74λ	DX: no	DY: no
nwcorner	X: 74λ	Y: 74λ	DX: no	DY: no
necorner	X: 74λ	Y: 74λ	DX: no	DY: no
secorner	X: 74λ	Y: 74λ	DX: no	DY: no
swcorner	X: 74λ	Y: 74λ	DX: no	DY: no

Further Info: See *A Guide to LSI Implementation*, chapter 7.

Function/Use: Starting frame scribelines for multi-project chips. See attached figure.

Connections: none



Scribe Lines

file: ScribeLines.cif

```
( Created by Sif from ScribeLines.ic ):

DS 1;    ( Name: vertscribe );
( 5 Items. ):
Layer NMet;  Box  Len 3000  Wid 10200  Center 1500,-5100 ;
Layer NDif;  Box  Len 16200  Wid 10200  Center 9000,-5100 ;
Layer NCut;  Box  Len 14400  Wid 10200  Center 9000,-5100 ;
Layer NGls;  Box  Len 10200  Wid 10200  Center 9000,-5100 ;
Layer NMet;  Box  Len 3000  Wid 10200  Center 16500,-5100 ;
DF;

DS 2;    ( Name: horiscribe );
( 1 Items. ):
Call 1 Rot 0,-1  Trans 10200,0;
DF;

DS 3;    ( Name: rightscribe );
( 1 Items. ):
Call 15 Rot 0,-1  Trans 12000,0;
DF;

DS 4;    ( Name: bottomscribe );
( 1 Items. ):
Call 15 Rot -1,0  Trans 10200,-12000;
DF;

DS 5;    ( Name: leftscribe );
( 1 Items. ):
Call 15 Rot 0,1  Trans 0,-10200;
DF;

DS 6;    ( Name: nwcorner );
( 9 Items. ):
Call 5 Trans 0,-12000;
Layer NDif;  Box  Len 11100  Wid 12000  Center 5550,-6000 ;
Layer NGls;  Box  Len 8100  Wid 12000  Center 4050,-6000 ;
Layer NCut;  Box  Len 10200  Wid 12000  Center 5100,-6000 ;
Layer NGls;  Box  Len 4200  Wid 8100  Center 9900,-4050 ;
Layer NMet;  Box  Len 3000  Wid 3000  Center 10500,-10500 ;
Layer NCut;  Box  Len 1800  Wid 10200  Center 11100,-5100 ;
Layer NDif;  Box  Len 1200  Wid 11100  Center 11400,-5550 ;
Call 15 Trans 12000,0;
DF;

DS 7;    ( Name: necorner );
( 1 Items. ):
Call 6 Rot 0,-1  Trans 22200,0;
DF;

DS 8;    ( Name: secorner );
( 1 Items. ):
Call 6 Rot -1,0  Trans 22200,-22200;
DF;

DS 9;    ( Name: swcorner );
( 1 Items. ):
Call 6 Rot 0,1  Trans 0,-22200;
DF;

DS 10;    ( Name: plus );
( 17 Items. ):
Call 2 Trans 0,-10200;
Call 1 Trans 10200,0;
Call 1 Trans 10200,-28200;
Layer NMet;  Box  Len 3000  Wid 3000  Center 11700,-11700 ;
Layer NMet;  Box  Len 3000  Wid 3000  Center 11700,-26700 ;
```

```
Layer NGls:  Box  Len 18000  Wid 10200  Center 19200,-19200 ;
Layer NDif:  Box  Len 18000  Wid 16200  Center 19200,-19200 ;
Layer NCut:  Box  Len 18000  Wid 14400  Center 19200,-19200 ;
Layer NDif:  Box  Len 16200  Wid 900  Center 19200,-10650 ;
Layer NDif:  Box  Len 16200  Wid 900  Center 19200,-27750 ;
Layer NCut:  Box  Len 14400  Wid 1800  Center 19200,-11100 ;
Layer NCut:  Box  Len 14400  Wid 1800  Center 19200,-27300 ;
Layer NGls:  Box  Len 10200  Wid 3900  Center 19200,-12150 ;
Layer NGls:  Box  Len 10200  Wid 3900  Center 19200,-26250 ;
Layer NMet:  Box  Len 3000  Wid 3000  Center 26700,-11700 ;
Layer NMet:  Box  Len 3000  Wid 3000  Center 26700,-26700 ;
Call 2 Trans 28200,-10200;
DF;

DS 11:    ( Name: toptee );
( 11 Items. );
Call 15 Trans 0,0;
Call 1 Trans 10200,-12000;
Layer NGls:  Box  Len 18000  Wid 8100  Center 19200,-4050 ;
Layer NMet:  Box  Len 3000  Wid 3000  Center 11700,-10500 ;
Layer NDif:  Box  Len 18000  Wid 11100  Center 19200,-5550 ;
Layer NCut:  Box  Len 18000  Wid 10200  Center 19200,-5100 ;
Layer NDif:  Box  Len 16200  Wid 900  Center 19200,-11550 ;
Layer NCut:  Box  Len 14400  Wid 1800  Center 19200,-11100 ;
Layer NGls:  Box  Len 10200  Wid 3900  Center 19200,-10050 ;
Layer NMet:  Box  Len 3000  Wid 3000  Center 26700,-10500 ;
Call 15 Trans 28200,0;
DF;

DS 12:    ( Name: rightee );
( 1 Items. );
Call 11 Rot 0,-1  Trans 22200,0;
DF;

DS 13:    ( Name: bottomtee );
( 1 Items. );
Call 11 Rot -1,0  Trans 38400,-22200;
DF;

DS 14:    ( Name: leftee );
( 1 Items. );
Call 11 Rot 0,1  Trans 0,-38400;
DF;

DS 15:    ( Name: topscribe );
( 4 Items. );
Layer NMet:  Box  Len 10200  Wid 3000  Center 5100,-10500 ;
Layer NDif:  Box  Len 10200  Wid 11100  Center 5100,-5550 ;
Layer NCut:  Box  Len 10200  Wid 10200  Center 5100,-5100 ;
Layer NGls:  Box  Len 10200  Wid 8100  Center 5100,-4050 ;
DF;

Call 14 Trans -32400,0;
Call 6 Trans -32400,32400;
Call 5 Trans -32400,10200;
Call 15 Rot 0,1  Trans -32400,-48600;
Call 6 Rot 0,1  Trans -32400,-70800;
Call 2 Trans -10200,-10200;
Call 15 Mir Y  Trans -10200,-70800;
Call 5 Rot 0,1  Trans -10200,-70800;
Call 15 Trans -10200,32400;
Call 10 Trans 0,0;
Call 11 Trans 0,32400;
Call 13 Trans 0,-48600;
Call 1 Trans 10200,10200;
Call 1 Trans 10200,-38400;
Call 2 Trans 38400,-10200;
Call 5 Rot 0,-1  Trans 48600,32400;
Call 15 Rot -1,0  Trans 48600,-70800;
Call 12 Trans 48600,0;
Call 6 Rot 0,-1  Trans 70800,32400;
Call 6 Rot -1,0  Trans 70800,-70800;
Call 15 Rot 0,-1  Trans 70800,10200;
```

```
Call 5 Rot -1.0 Trans 70800,-48600;
End
```