AutoCAD LT
Quick Start Guide

Nathan Kupp
Princeton University
PRISM REU Program 2006

1. Introduction

This guide is intended to supply the AutoCAD LT user with a tutorial and reference for quickly gaining proficiency with the AutoCAD LT software layout tool. Similar to the L-Edit guide, this guide does not provide an exhaustive reference to all the features of AutoCAD LT, as a complete documentation of these features is provided in the AutoCAD LT Help menu. Since this guide is focused on layout-driven design, many of AutoCAD's features are superfluous as it is geared toward a very wide range of CAD applications. For layout, only a few features are required, which accelerates the learning curve of AutoCAD.

2. User Interface

The user interface provided by AutoCAD LT is similar to that of many other CAD and layout design software packages. Upon starting AutoCAD LT, a dialog is displayed asking whether the user wants to open or create a drawing. For the purposes of layout, we will "Start from Scratch" and create a metric drawing. Select this option from the menu as shown below.
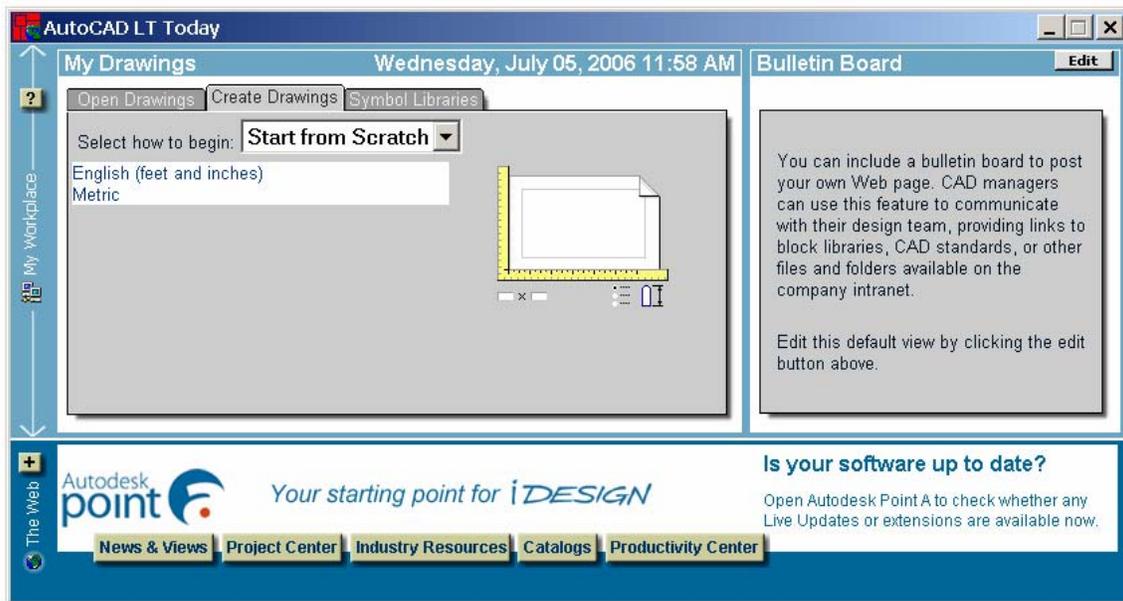

Figure 1. AutoCAD LT Today Dialog

At this point AutoCAD LT will display a white drawing area with a set of toolbars. The important buttons and features on these toolbars are shown in the figure below. Again, since we are only concerned with layout, the majority of AutoCAD's design tools will be unnecessary.
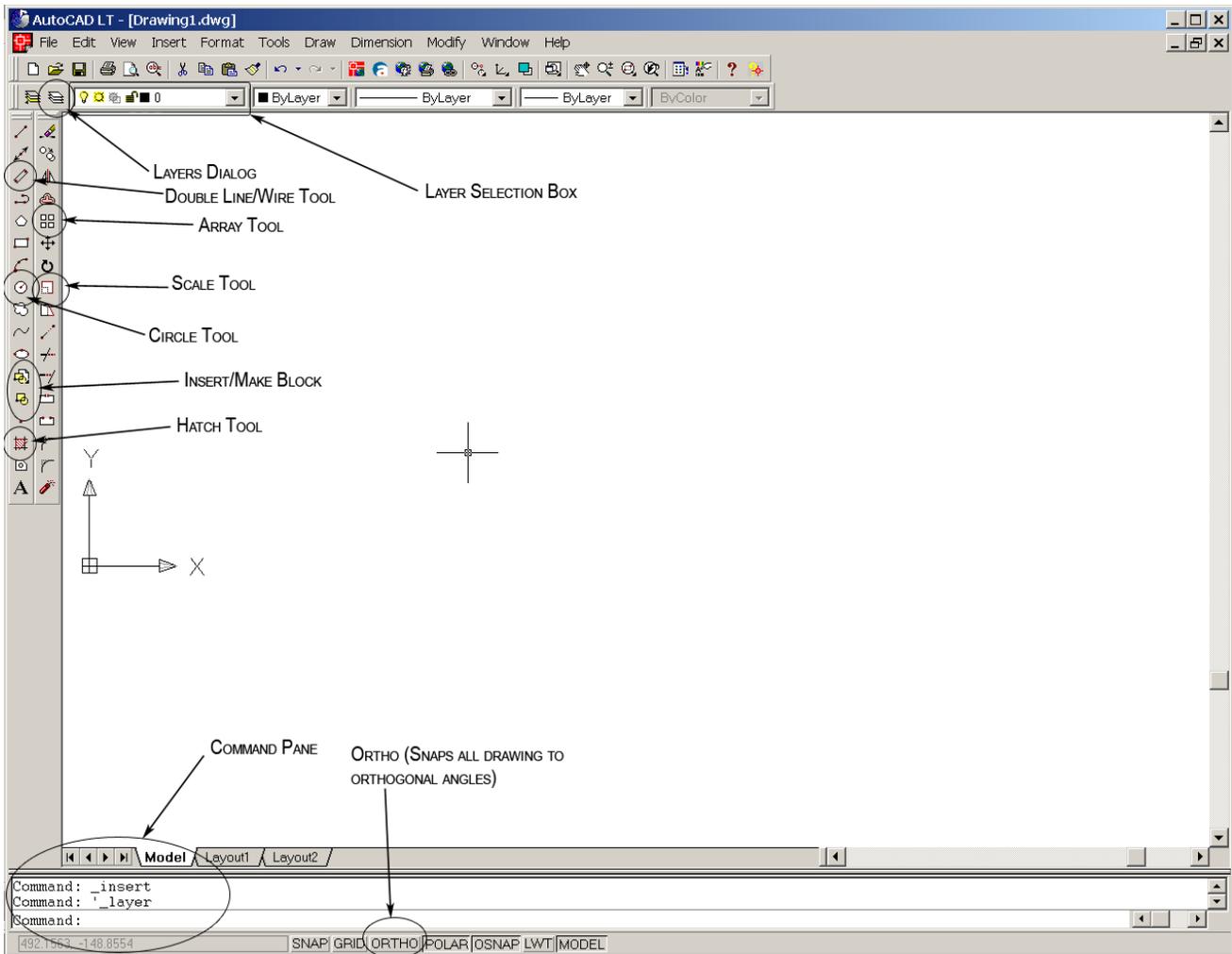
Figure 2. AutoCAD Main Window

3. Layers

Layout-driven design in AutoCAD LT is similar to L-Edit, in that both programs make use of layers. The Layers button at the top left of the screen opens the Layer Properties Manager, which allows the user to manage the layers present in the design. There are no pre-formatted layer setups in AutoCAD LT as there are in L-Edit, and you will need to generate your own layers based on what masks you want to create for your design. The Layer Properties Manager is shown below with only the default layer in the design. New layers can be added with the New button. The user will likely want to change the color of each layer to distinguish it from the rest of the layers in the design. To change the color of a layer, just click on the colored square for that layer in the Layer Properties Manager and select a new color.
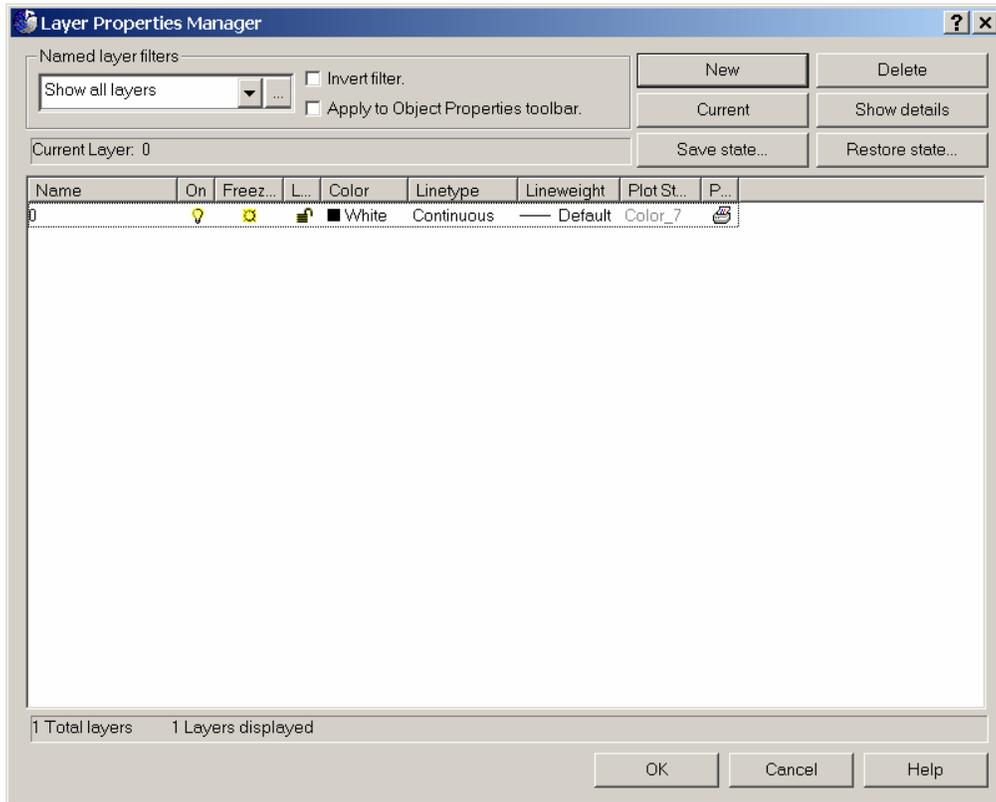
Figure 3. Layer Properties Manager

After the layers have been set up, the Layer Selection Box at the top left of the screen will drop down with a list of the layers in the design. A layer can be selected in this box to create design objects on. If the layers have been set up with different colors, when objects are drawn on the active layer they will have boundary lines of the color selected in the Layer Properties Manager. The objects can be filled with the layer color or with hatching by selecting the Hatch tool in the toolbar on the left of the screen. To use the hatch tool on an object, click Select Objects in the Boundary Hatch dialog, and then click on the object you want to hatch. Press Enter, and select the hatch pattern in the Boundary Hatch dialog, and then click OK to draw the hatch on the object.

Note: The layer 0 cannot be drawn on, as a design constraint of the DWL66 mask writer.

4. Drawing

To create objects on this layer, the toolbar on the left provides a collection of rectangle, wire, line, and circle tools. Note that the Ortho button at the bottom of the screen provides cursor-snapping to orthogonal lines, and the command pane which displays command-line versions of the buttons you select, with extended options. For example, when the double-line (wire) tool is selected, the user has the option to select the width of the line by typing "Width" in the command pane followed by the desired width, e.g. "Width 50", as shown in the figure below. To change the size of objects you've drawn, you can modify the (x,y) coordinates of the individual vertices of an object by left clicking the object to select it, right clicking it, and then selecting Properties. This presents a

dialog displaying the x and y values of a vertex under the "Geometry" heading, and a "Vertex" button to move through all vertices of the currently selected object. By changing the x and y coordinates of each of the vertices, the size of the object can be precisely specified. AutoCAD also provides a "Stretch" tool, which can be used as follows:

1. Select Modify → Stretch.
2. Drag a box across the object you want to stretch, **moving from right to left.** This will select your edge to stretch. Press Enter.
3. Select a "Base Point" by clicking on one of the vertices of the geometry you are stretching.
4. Move the mouse to stretch the object, left clicking when it has been moved to the correct position to "drop" it there.

```
Command: *Cancel*
Command:
Command:
Command: _dline
Break/Caps/Dragline/Offset/Snap/Undo/Width/<start point>: Width
New DLINE width <1>: 50
```
-153.5847,-144.3521 SNAP GRID ORTHO POLAR OSNAP LWT MODEL

Figure 4. Wire Width Specification

5. Tutorial #1: NMOS Design & Layout

In the first tutorial, the design of an n-type MOSFET on a p-type substrate is presented. An NMOS transistor consists of an n-type source and drain regions, a gate terminal, and a substrate terminal. Remember, a MOSFET is a four terminal device, requiring not only connections to the Source, Drain, and Gate, but the Substrate as well.

Process:

1. Select Format → Units and change units to microns. Then go to Dimension → Style... and then Modify... and finally click on the Fit tab. In the Scale for Dimension Features box, enter 1. This will scale your drawing to µm. Also, Select the Tools menu and click on Drafting Settings... and select both Snap On and Grid On, and set the distance for both in the x and y directions to 1. This will snap the cursor to the (now displayed) grid, with units of 1 micron. Finally, we need to set up the layers. Select the Layer Properties Manager button at the top left of the screen and create the layers as shown in the figure below.
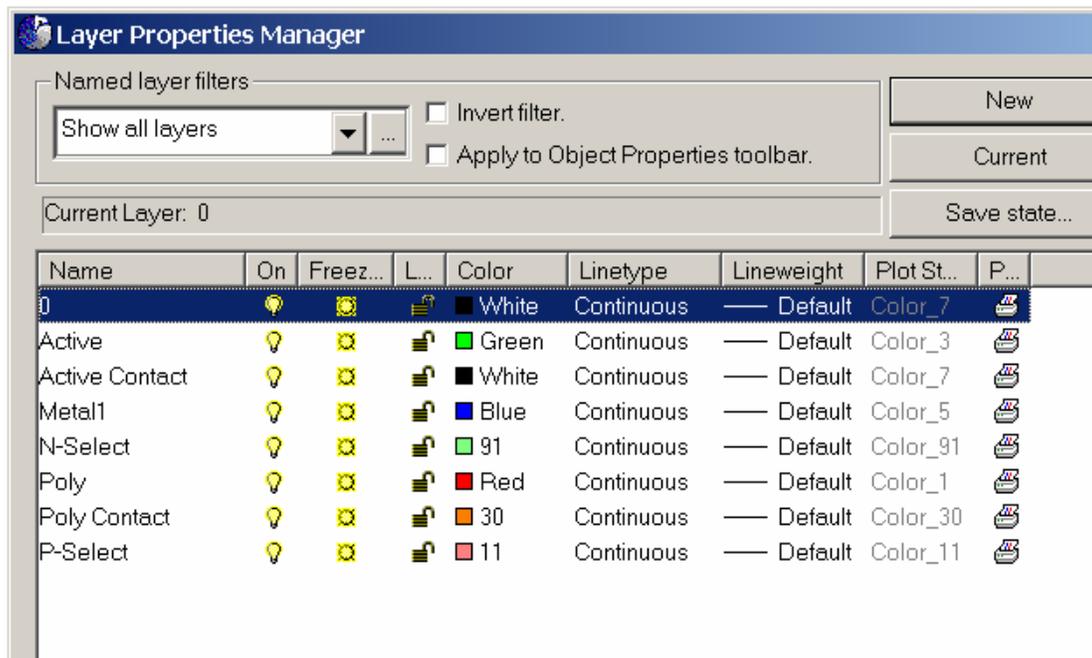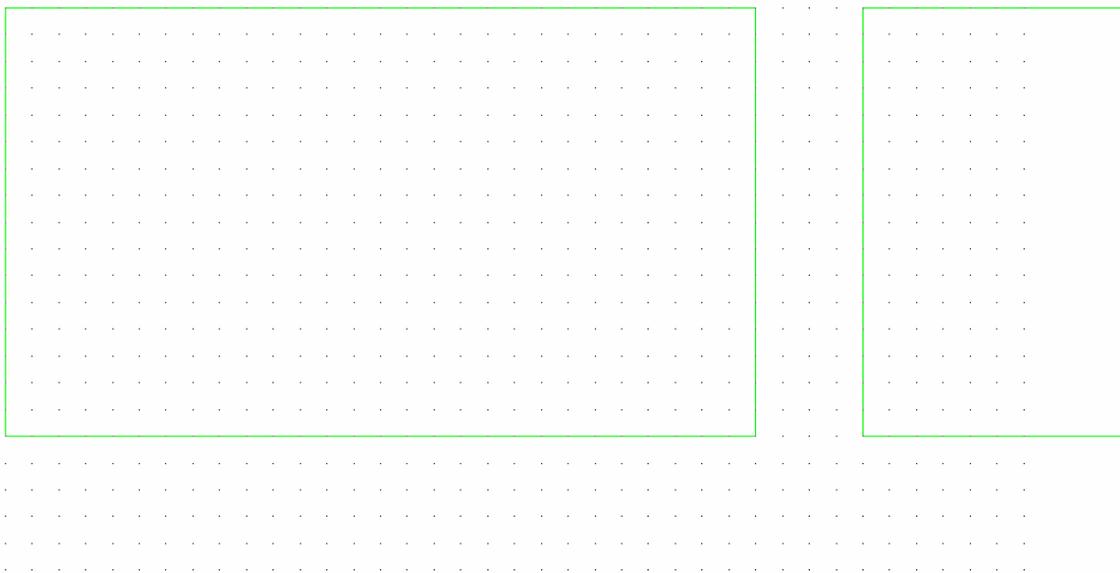

Figure 5. Layer Properties Manager

2. Draw two Active regions both inside and outside of the n-well, within the n-/p-select areas. The Active layer denotes an opening in the field oxide through which n-type and p-type depositions can be made – we need an area for the source and drain of the transistor, as well as a connection for the substrate.

Figure 6. Active Areas

3. Draw N-select/P-select regions to form source/drain and substrate regions, respectively. The substrate can never be directly connected to metal layers, so we need to create select layers where we want to make connections to the substrate.
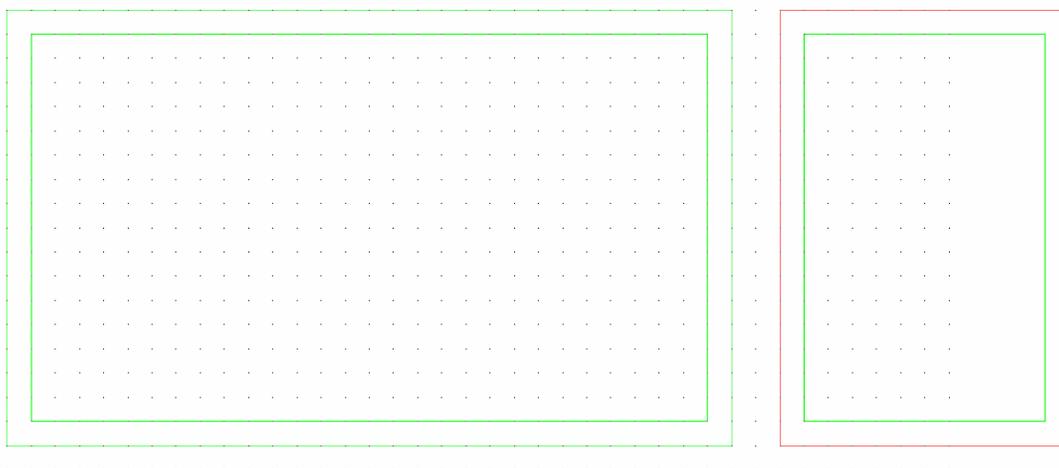
Figure 7. N-Select and P-Select Regions

4. Draw Poly layer. The gate of a MOSFET is typically created out of polysilicon, represented by the Poly layer. To create a gate for our NMOS transistor, we need to draw a Poly layer rectangle over the active region of the source/drain.
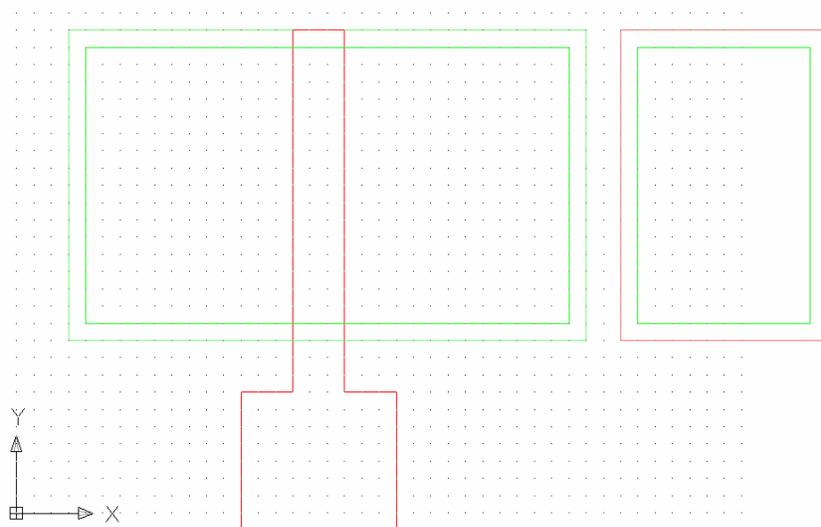

Figure 8. Poly Layer

5. Draw Active contacts at the source, drain, and substrate, and a Poly contact at the gate. We now need to create an opening in the gate oxide to wire up our transistor. This is denoted by the Active Contact layer and the Poly Contact layer – the Active Contact layer makes connections to the Active layer, and the Poly Contact layer makes connections to the Poly layer.
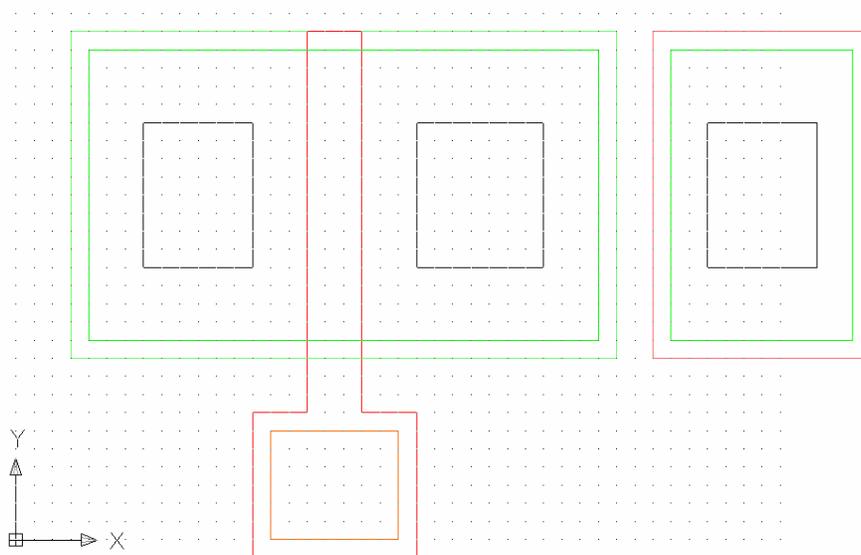

Figure 9. Active and Poly Contacts

6. Draw Metal1 layer connections to each of the four contact points. We now need wires for the transistor to be useful. These can be created by either selecting the wire tool and drawing a wire, or using the rectangle tool to create a rectangular wire segment. Again, we cannot see the Metal1 wire on the gate because of the location of the cross-section. Note that it is common to connect one terminal of the n-type MOSFET to the substrate and then to ground.
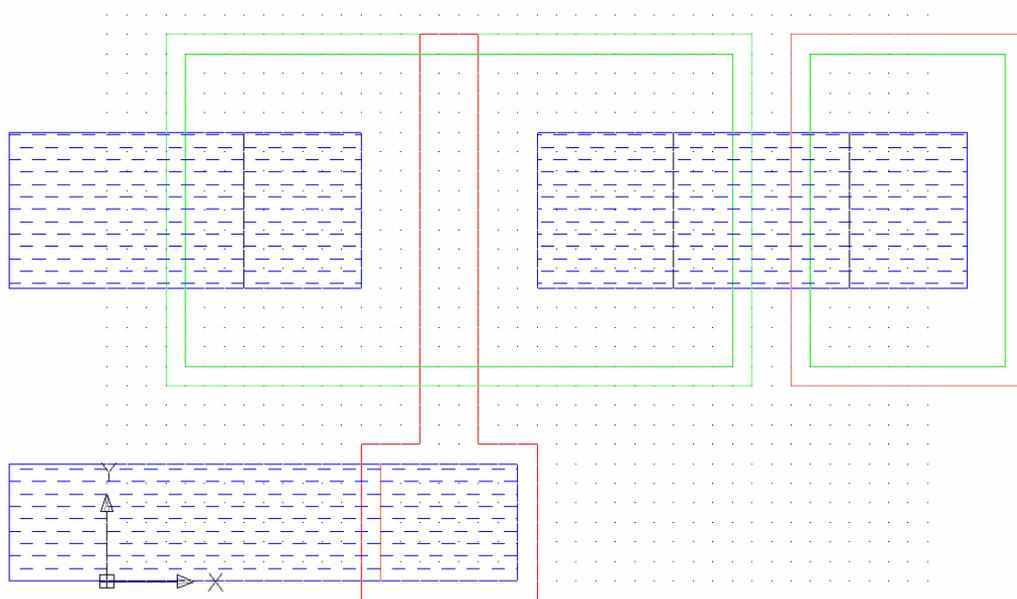

Figure 10. Metal1 Layer

Now we have a working NMOS transistor! You can insert a text label with the transistor by clicking Draw → Multiline/Single Line Text... and inputting the text you'd like to appear on your drawing.

Note: AutoCAD LT uses elements called "blocks" instead of "cells" in L-Edit to generate hierarchical designs. AutoCAD blocks can be contained in either separate files or within one master file. The most straightforward way to generate a hierarchical design is to generate a block containing one part of a design, save it in a .DXF, and repeat until all the fundamental blocks are created for your design. A master .DXF can then be created to incorporate all these blocks into one design. To export a file to a .DXF, just click File → Save As... and change the file type to .DXF.