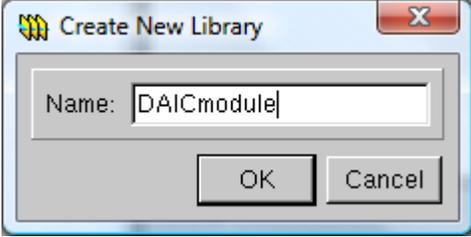


# Inverter Design example with DAIC

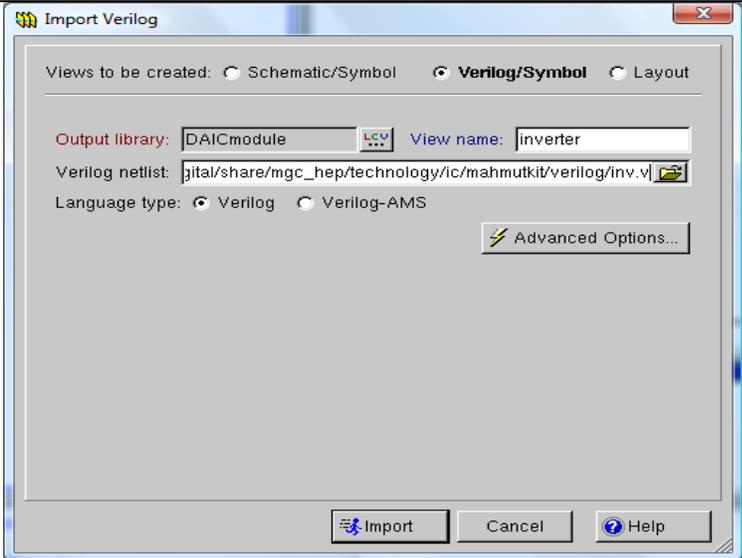
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This exercise will show you how to make a functional symbol and schematic for an inverter.

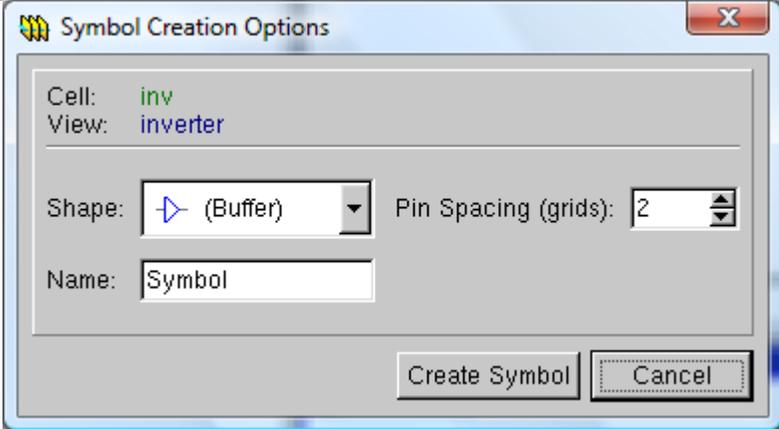
## Step 1:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Start ICstudio</li><li>2. Go to File→New→Library</li><li>3. Enter DAICmodule for the name.</li><li>4. Click OK</li></ol>	

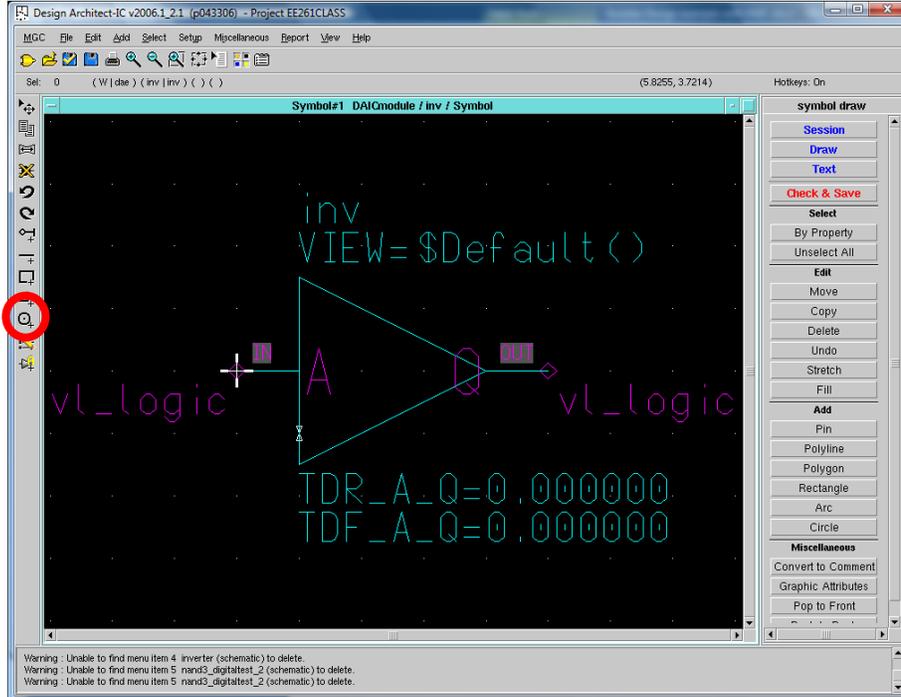
## Step 2:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Select the DAICmodule library and Go to File→Import→Verilog</li><li>2. Select Verilog/Symbol and enter inverter for view name and enter the path /ece/digital/share/mgc_hep/technology/ic/mahmutkit/verilog/inv.v under Verilog netlist.</li><li>3. Click on “Import”</li></ol>	

### Step 3:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Select Buffer when the Symbol window pops up.</li><li>2. Click "Create Symbol"</li><li>3. Double click on the symbol that appears in the view-pane</li></ol>	

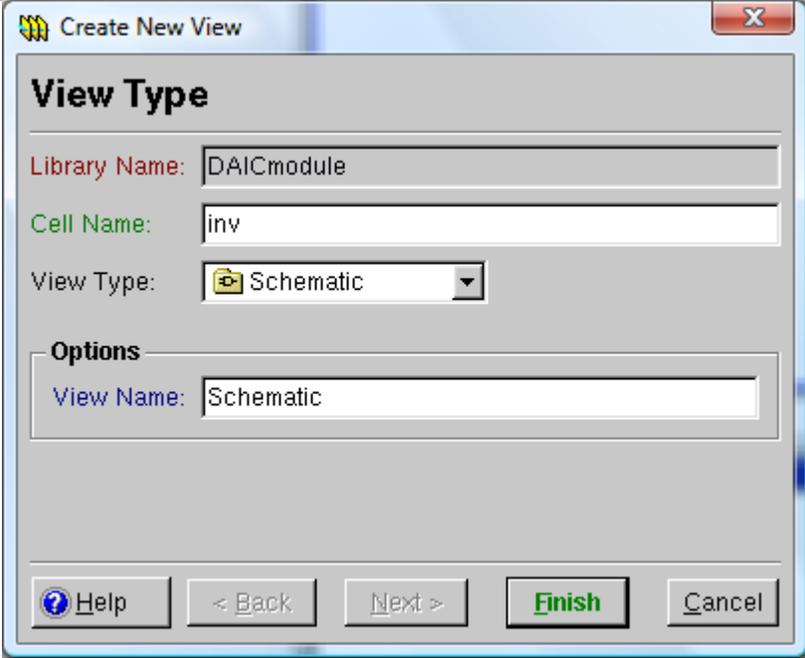
### Step 4:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Go to Setup → Select Filter and click "Set All"</li><li>2. Press the circle button on the left to add a circle to the symbol.</li></ol>	

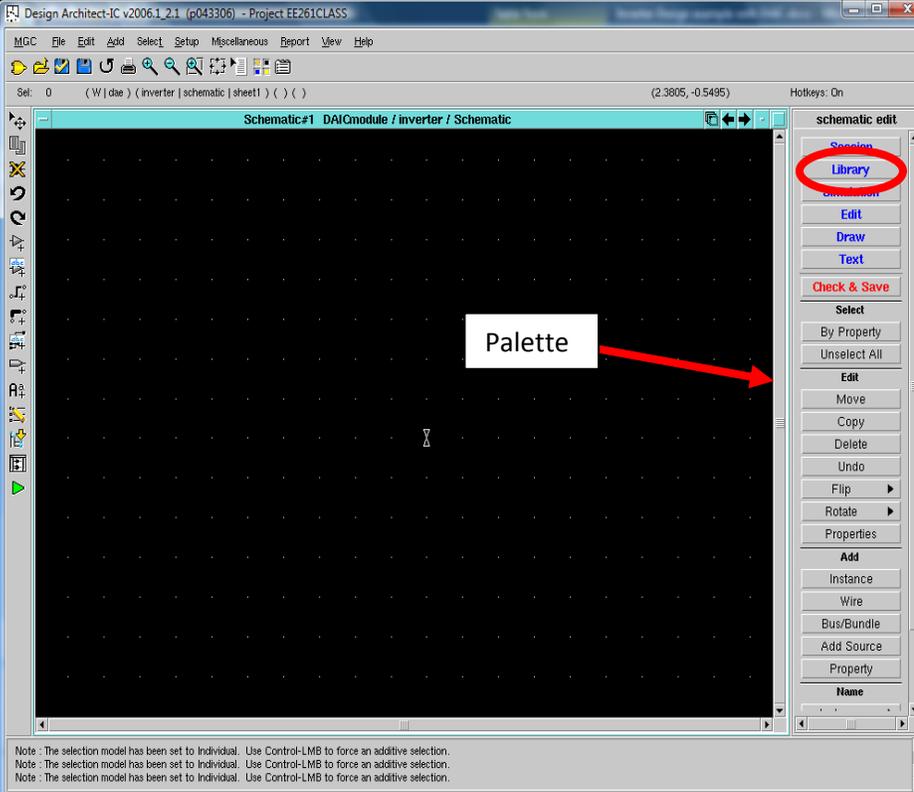
## Step 5:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Place the circle in between the pin and the symbol as shown.</li><li>2. Right click the pin and click stretch to shorten the pin.</li><li>3. Remember to keep the purple part of the pin all the way to the right.</li><li>4. Click on Check and Save for the symbol.</li><li>5. Close DAIC</li></ol>	<p>Design Architect-IC v2006.1_2.1 (p043306) - Project EE261CLASS</p> <p>MGC File Edit Add Select Setup Miscellaneous Report View Help</p> <p>Set: 0 (inv   inv) ( ) ( )</p> <p>bol#1 DAICmodule / inv / Symbol (-2.6771, 4.3365) Hotkeys: Dn</p> <p>symbol draw</p> <p>Session Draw Text Check &amp; Save</p> <p>Select By Property Unselect All</p> <p>Edit Move Copy Delete Undo Stretch Fill</p> <p>Add Pin Polyline Polygon Rectangle Arc Circle</p> <p>Miscellaneous Convert to Comment Graphic Attributes Pop to Front</p> <p>Note : Symbol \$DAICmoduledefault.group.logic.views/inv/inv is registered with interface inv , Labeled 'default_sym' Note : No electrical edits were made since last symbol write Note : Version 2 of symbol \$DAICmoduledefault.group.logic.views/inv/inv has been written</p>

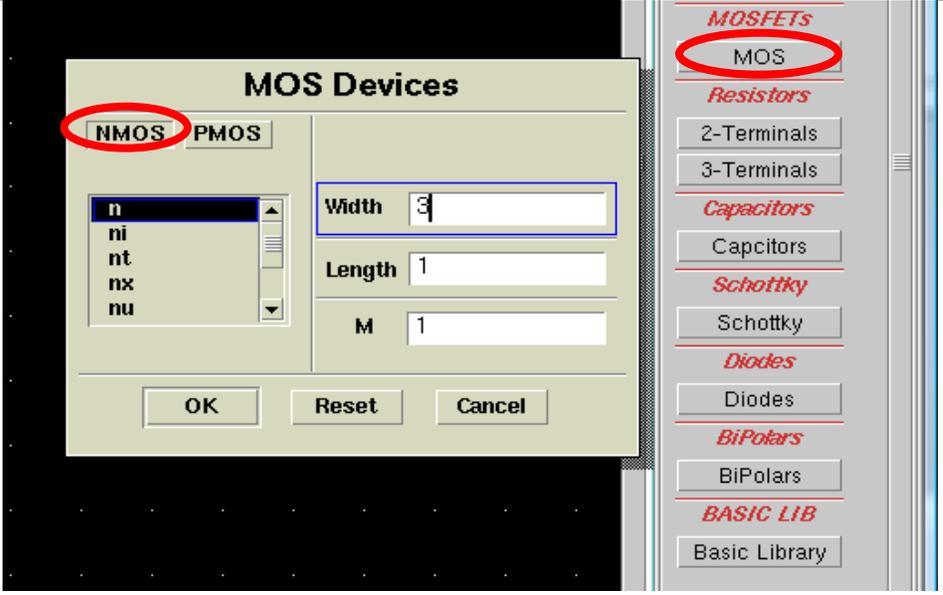
## Step 6:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Right-click the inverter verilog and select "Check HDL" to check for consistency.</li><li>2. Right-click on the view-pane and select New View</li><li>3. In the next window, use the following values: Cell Name – inv View Type – Schematic View Name – Schematic</li><li>4. Click "Finish"</li><li>5. DAIC will be opened.</li></ol>	

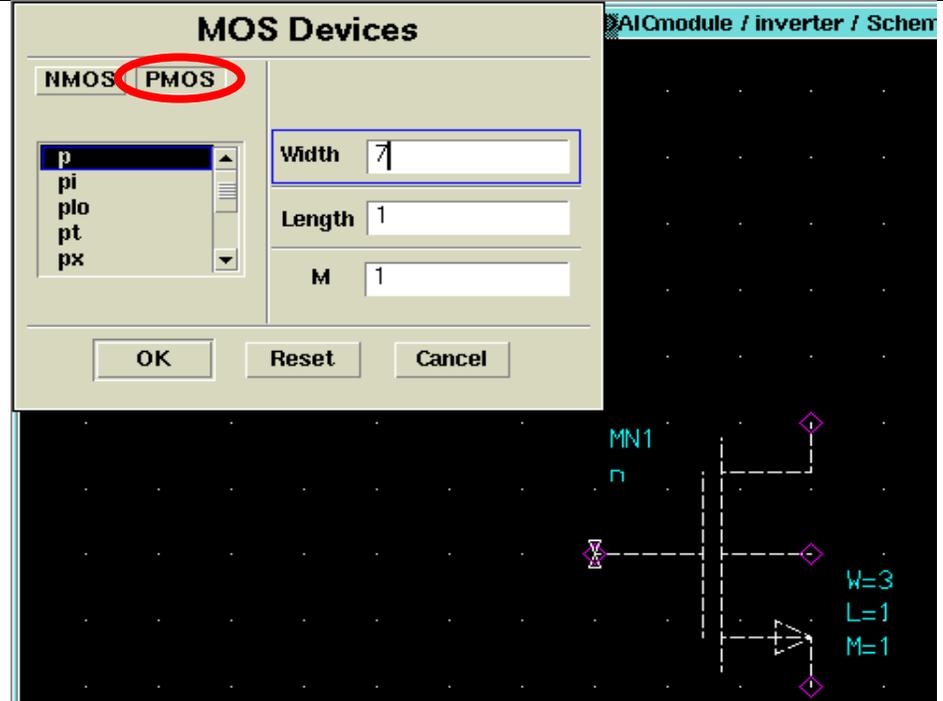
## Step 7:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Go to MGC → Setup and select “Show Palette”</li><li>2. Then click “Library” on the palette.</li></ol>	 <p>The screenshot shows the Design Architect-IC software interface. The main window is titled "Schematic#1 DAICmodule / inverter / Schematic". The toolbar on the right, labeled "schematic edit", contains various buttons. The "Library" button is circled in red. A white box with the text "Palette" and a red arrow points to the "Library" button. The main workspace is a dark grid. At the bottom, there are three lines of text: "Note : The selection model has been set to Individual. Use Control-LMB to force an additive selection."</p>

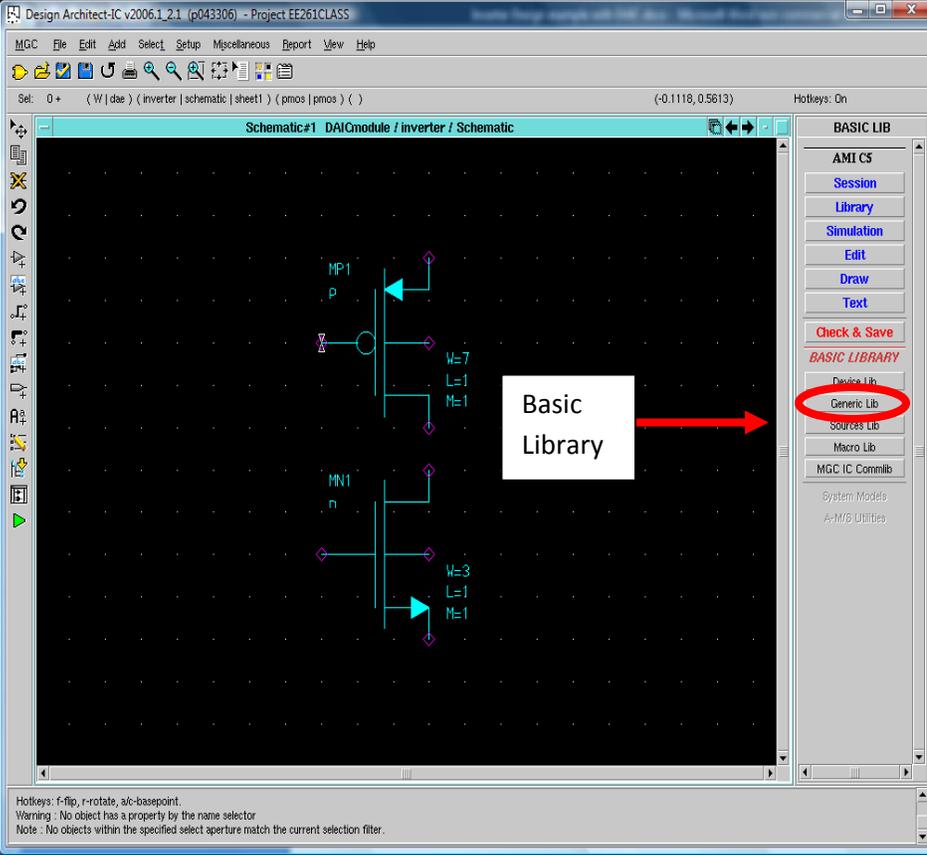
### Step 8:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Select MOS in the next palette menu</li><li>2. Select NMOS, select "n" and enter 3 for the width.</li><li>3. Click "OK"</li><li>4. Left-click to place the device.</li></ol>	

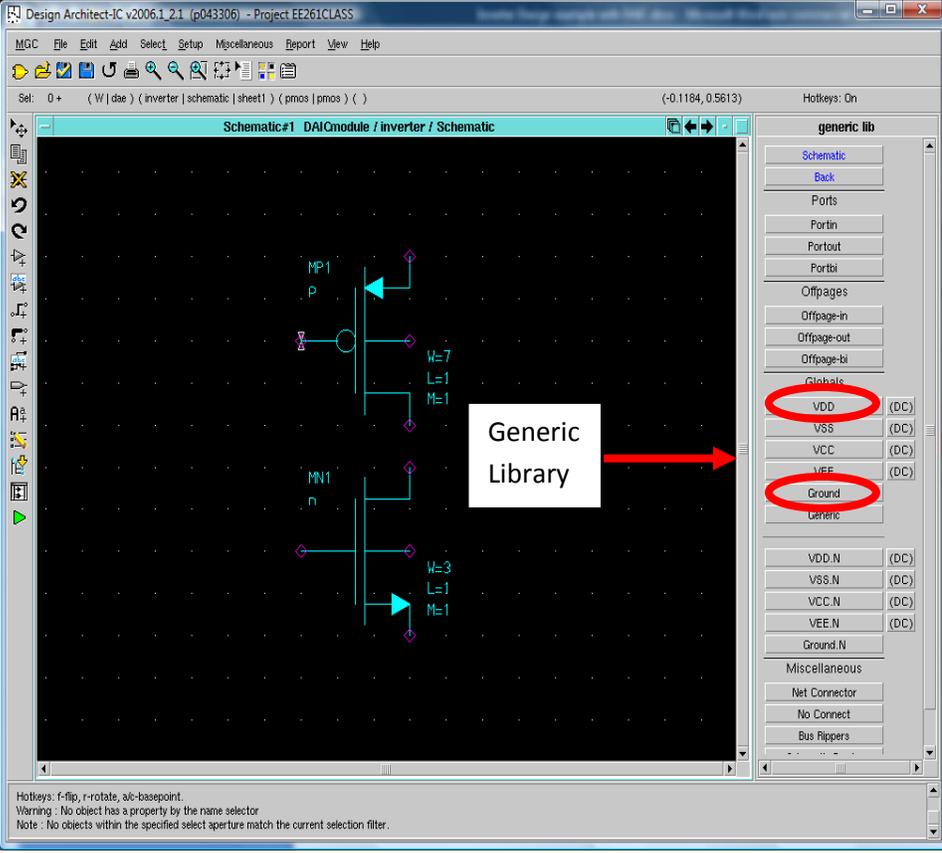
### Step 9:

Description	Screenshot
<ol style="list-style-type: none"><li>1. The MOS window should pop up again</li><li>2. Select PMOS, select "p" and enter 7 for the width.</li><li>3. Click "OK"</li><li>4. Left-click to place the device.</li><li>5. Place the device directly above the NMOS device</li><li>6. Click Cancel on the MOS window when it pops up again</li></ol>	

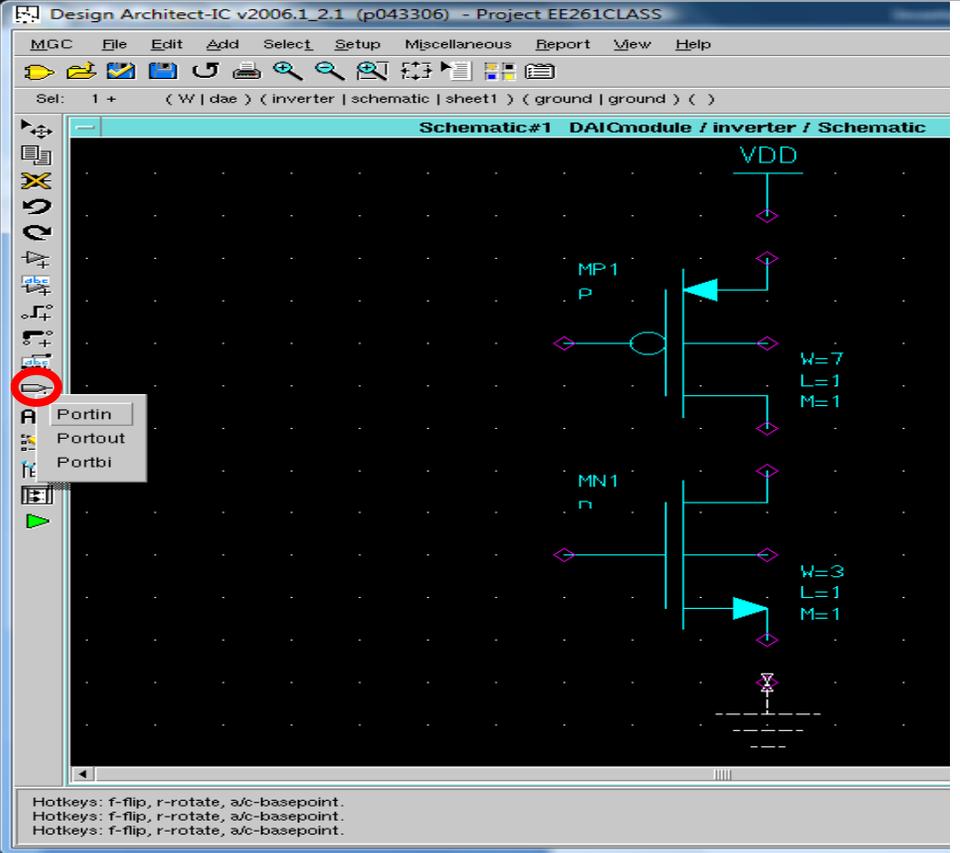
## Step 10:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Click “Basic Library” in the palette near the bottom.</li><li>2. Click “Generic Lib” in the next menu.</li></ol>	 <p>The screenshot shows the Design Architect-IC v2006.1.21 (p043306) - Project EE261CLASS interface. The main workspace displays a schematic diagram with two components, MP1 and MN1, connected to a central node. The MP1 component has parameters H=7, L=1, and H=1. The MN1 component has parameters H=3, L=1, and H=1. On the right side, the 'BASIC LIBRARY' palette is visible, with the 'Generic Lib' option highlighted by a red circle. A red arrow points from a white box labeled 'Basic Library' to this option. The bottom status bar contains the following text: Hotkeys: f-flip, r-rotate, x/-basepoint. Warning: No object has a property by the name selector. Note: No objects within the specified select aperture match the current selection filter.</p>

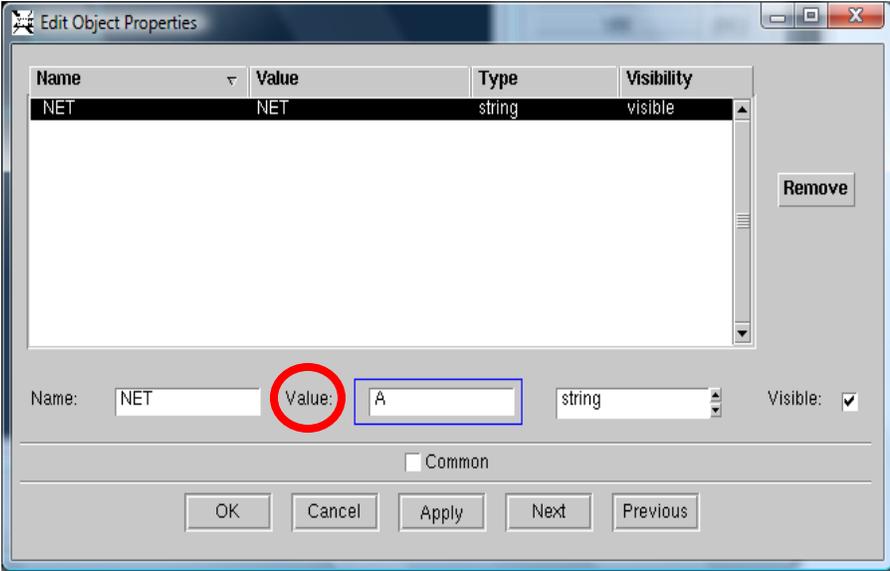
## Step 11:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Click on "VDD" and place the VDD marker above the PMOS device</li><li>2. Click on "Ground" and place the Ground marker below the NMOS device.</li></ol>	 <p>The screenshot shows the Design Architect-IC v2006.1.2.1 interface. The main window displays a schematic of an inverter circuit. The PMOS device (MP1) is at the top, and the NMOS device (MN1) is at the bottom. A red arrow points from a white box labeled "Generic Library" to the "VDD" and "Ground" entries in the "generic lib" panel on the right. The "VDD" and "Ground" entries are circled in red. The "VDD" entry is labeled "(DC)" and the "Ground" entry is labeled "(DC)".</p> <p>Hotkeys: F-flip, r-rotate, alc-basepoint. Warning : No object has a property by the name selector Note : No objects within the specified select aperture match the current selection filter.</p>

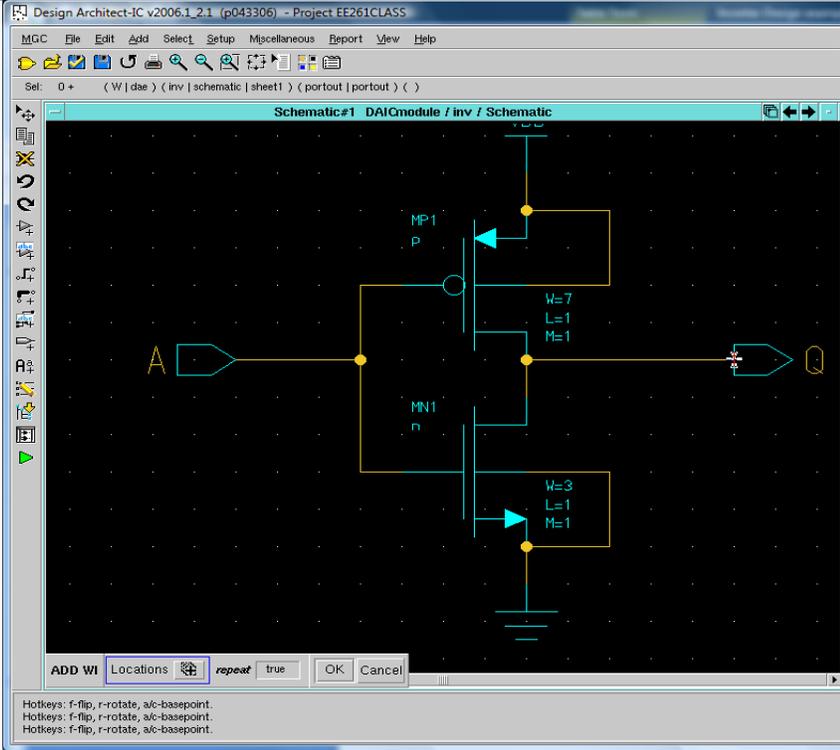
## Step 12:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Click on the port button on the left side to place the input and output ports.</li><li>2. Place the portin to the left of the MOS devices and place the portout to the right of them.</li></ol>	 <p>The screenshot displays the Design Architect-IC v2006.1_2.1 software interface. The main window shows a schematic titled "Schematic#1 DAIQmodule / inverter / Schematic". The schematic contains two MOSFETs: a PMOS transistor labeled "MP1" and an NMOS transistor labeled "MN1". The PMOS gate is connected to a portin symbol, and the NMOS drain is connected to a portout symbol. A VDD supply is connected to the gates of both transistors. The portin symbol is circled in red, and a context menu is open over it, showing options: Portin, Portout, and Portbi. The bottom of the window displays hotkey information: "Hotkeys: f-flip, r-rotate, a/c-basepoint."</p>

### Step 13:

Description	Screenshot								
<ol style="list-style-type: none"><li>1. Select each port and press “q” to edit their names.</li><li>2. Name the portin “A” and the portout “Q” by selecting the first row in the object properties box and typing those names in the Value box for each port.</li><li>3. Click OK when done.</li></ol>	 <p>The screenshot shows the 'Edit Object Properties' dialog box. It features a table with the following data:</p> <table border="1"><thead><tr><th>Name</th><th>Value</th><th>Type</th><th>Visibility</th></tr></thead><tbody><tr><td>NET</td><td>NET</td><td>string</td><td>visible</td></tr></tbody></table> <p>Below the table, the 'Name' field contains 'NET', the 'Value' field contains 'A', the 'Type' dropdown is set to 'string', and the 'Visible' checkbox is checked. The 'Value' field is circled in red. At the bottom, there are buttons for 'OK', 'Cancel', 'Apply', 'Next', and 'Previous'.</p>	Name	Value	Type	Visibility	NET	NET	string	visible
Name	Value	Type	Visibility						
NET	NET	string	visible						

## Step 14:

Description	Screenshot
<ol style="list-style-type: none"><li>1. Wire up the components in the inverter as shown by pressing “w”</li><li>2. Once “w” is pressed, click once to start a wire, click again to change direction and double-click to stop the wire.</li><li>3. Hit “esc” to end wiring mode.</li><li>4. Click “Check and Save” to check for consistency with the symbol.</li><li>5. You now have a complete symbol and schematic for an inverter.</li></ol>	 <p>The screenshot displays the Design Architect-IC v2006.1.2.1 (p043306) - Project EE261CLASS interface. The main window shows a schematic titled "Schematic#1 DAICmodule / inv / Schematic". The circuit consists of an input port 'A' connected to the gate of an NMOS transistor (MN1) and the gate of a PMOS transistor (MP1). The gates of both transistors are connected to each other. The drain of the PMOS transistor (MP1) is connected to the drain of the NMOS transistor (MN1), which is connected to an output port 'Q'. The source of the PMOS transistor (MP1) is connected to a power supply, and the source of the NMOS transistor (MN1) is connected to ground. The schematic includes labels for the transistors (MP1, MN1) and their parameters (W=7, L=1, M=1 for MP1; W=3, L=1, M=1 for MN1). The interface also shows a menu bar (MGC, File, Edit, Add, Select, Setup, Miscellaneous, Report, View, Help) and a toolbar with various icons. At the bottom, there is an "ADD WI" dialog box with "Locations" selected and "repeat" set to "true". Hotkeys for flipping and rotating components are listed at the bottom of the window.</p>