L-Edit v12

T-Cell Builder

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1.1. mosfet

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The T-Cell Builder features, accessed from the Cell > T-Cell... menu, allow T-Cell code views to be automatically generated from layout views. The resulting T-Cells are parameterized, and contain geometry elements whose appearance can depend on these parameters. Because the user does not need to write any UPI code directly, this feature is very useful for those users who are unfamiliar with UPI programming.

The code view is constructed by executing the Cell>T-Cell>Construct T-Cell... command. This command analyzes the geometry of the current cell, and creates a code view for that cell. An existing code view will be (optionally) overwritten. Geometry in the layout view will be generated by the code view. Optionally, geometry elements can be stretched, moved or repeated according to the T-Cell's parameters, and they can be optionally included and/or have their layers set (again, as a function of the T-Cell's parameters).

Stretching elements and defining parameters

A common desired operation is that a dimension of some object(s) is set by a cell parameter. For example, a simple MOSFET is parameterized by its channel length and width. To create this T-Cell, we first create the template in Figure 1. Note that stretch axes are defined by ports on a (user-selectable) layer. These ports define both the name of the parameter that controls the stretch, the direction of the stretch, and the default value of the stretch. The default value of the parameter is taken from the size of the port, or by declaring it in the port string in the form "parameterName=defaultValue". These ports must be line ports (i.e. have exactly one dimension and be non-zero). By default, all objects which are intersected by this port, extended to infinity in both directions, will be stretched. Objects that are entirely on one side of the port may be moved, depending on the direction of the stretch. The direction of the stretch is controlled by the port text orientation; in general, geometry on the same side of the port as the port text will move in the direction of the port text (if the port text is center aligned, then geometry on both sides of the port will be modified).
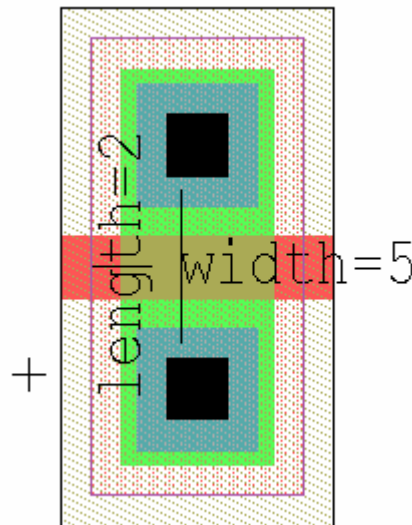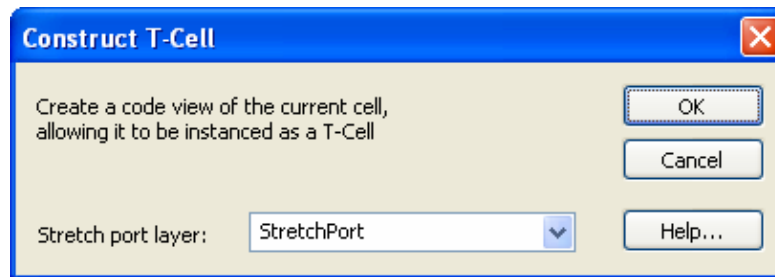

Figure 1: Raw geometry in cell mosfet to create T-Cell

Invoke **Cell > T-Cell > Construct T-Cell…** to create a T-Cell from the above layout. The following dialog will appear.

After Constructing the T-Cell, you can instance it into layout by invoking **Cell > Instance…** (I). Here we change the default width to a width of 20.
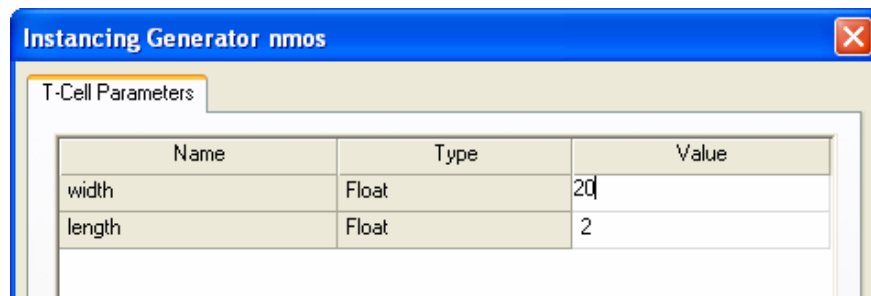

Figure 2: Setting parameters while instancing nmos T-Cell

The layout below will get generated.

Figure 3: Instance of mosfet with width = 20 and length =2

Repeating elements instead of stretching

Sometimes it is not appropriate to simply stretch elements, but instead it is necessary to repeat them. This operation is accomplished by first selecting the objects in question, and then executing **Cell > T-Cell.> Define Repeat Group...**

The options to defining a repeat group are:

Horizontal/Vertical Repeat	**None:** if selected, the object in question is neither repeated, nor is it stretched. This choice is appropriate for items such as contacts, which must remain a specific size. **Count**: the parameter is taken to be an integer, and determines the number of times the object is repeated **Fill:** the object is iterated to fill the distance specified by the named parameter **Stretch**: this is the default, and confirms that this object is free to stretch in the indicated direction, if it is intersected by a stretch axis
Parameter Name	The parameter that controls this repeat
Stepping Distance	The pitch between adjacent repeated objects
Repeat Direction	The original object is the "anchor" object; new objects are created to the left, to the right, or equally to the left and right.

Select the two contact boxes in cell mosfet, invoke **Cell > T-Cell > Define Repeat Group…**, and apply the following setting to define their repeat parameters.

Figure 4: Repeat Group settings for Contacts in cell mosfet.

Invoke **Cell > T-Cell > Construct T-Cell…** to create the T-Cell, or to regenerate the T-Cell code if it had been previously created. Now instancing the mosfet T-Cell, with Width = 20, we get the layout below.

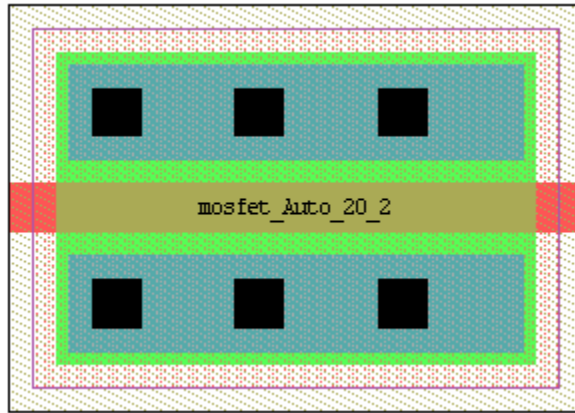**Figure 5: T-Cell generated with Repeat Groups for contacts**

Choose Layer

The layer that an object is placed on can be made into a parameter of the T-Cell by selecting the object and invoking **Cell > T-Cell > Choose Layer…**. If applied to an object, the layer of that object becomes a parameter to the T-Cell.

Select the box on layer N Select and assign it a layer parameter called "Select Layer" and regenerate the T-Cell to pick up this change.
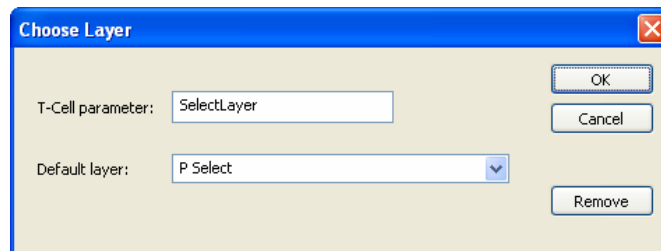

Figure 6: Assigning a Layer parameter using the Choose Layer dialog.

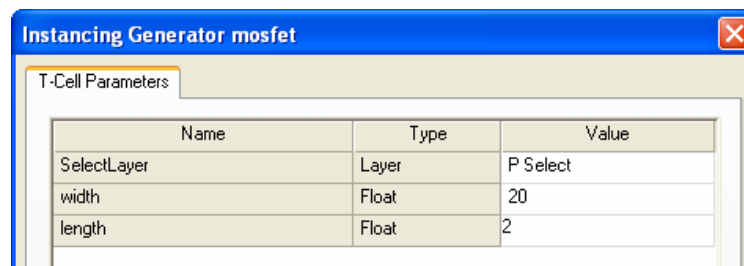Now when we instance the mosfet, SelectLayer is a parameter to the T-Cell. We can change from P Select to N Select.

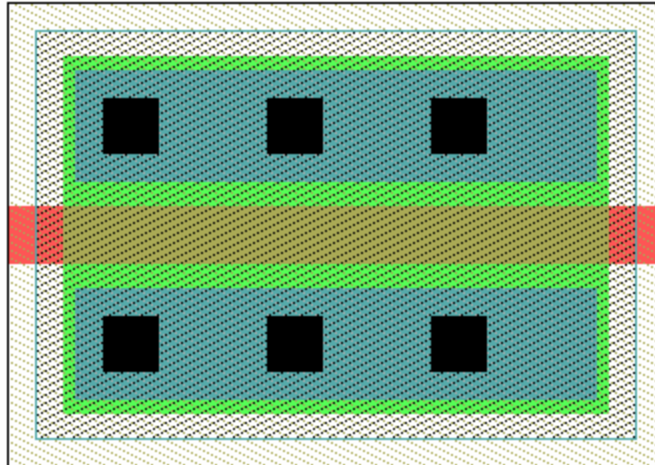**Figure 7: Choose Layer makes the layer of an object into a parameter of the T-Cell.**

Figure 8: Instance of the mosfet with SelectLayer set to N Select

Define Conditional Inclusion

An object can be included or excluded based on a Boolean or a logical condition. Select the box on layer HV-Oxide and apply a condition parameter called HighVoltage, with a default value of True, and regenerate the mosfet T-Cell.
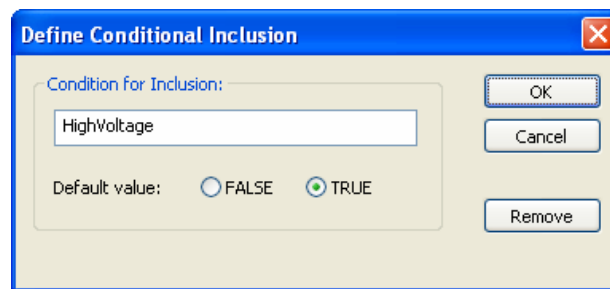
Now when the T-Cell is instanced, HighVoltage is a parameter to the T-Cell. Selecting True will include the object on that layer when the T-Cell is generated, selecting false will exclude it.
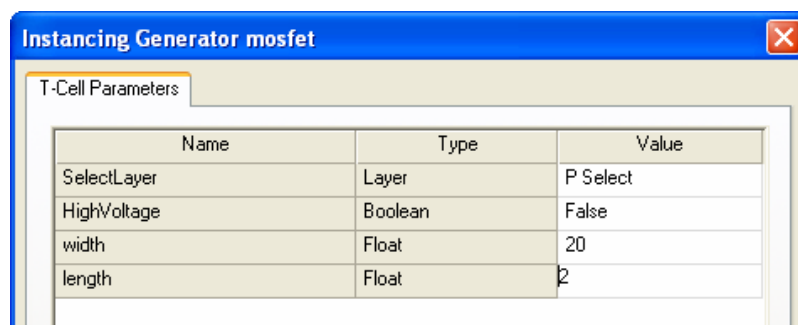
Conditional exclusion can also be based on a logical expression by entering an expression such as width >10. Here width is a parameter that may be previously defined by ports on the layout. In this case the default value is not relevant. If the condition is true then the object is included.

Figure 9: Instance of the mosfet T-Cell with HighVoltage set to False.
Box on HV-Oxide is not included.

Select T-Cell Objects

This operation causes all objects which have been tagged for repeat, conditional inclusion or layer parameterization to be selected. This operation is useful to find these objects, in order to understand how the T-Cell will be created.

1.2. resistor

Design   **tcellbuilder**
Cell   **res**

This example illustrates a resistor device generator. The boxes on Poly are part of a repeat group, as shown in the figure below.
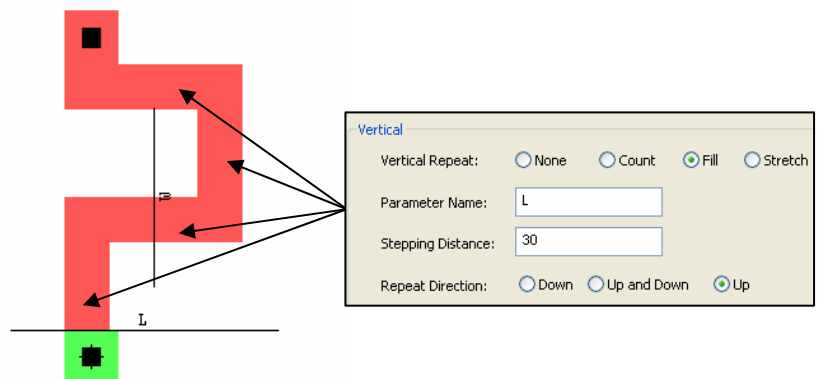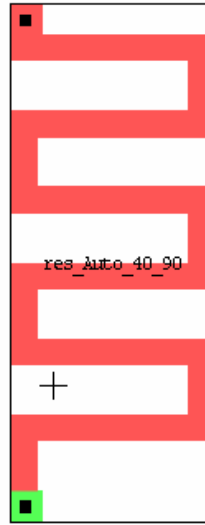

Figure 10: Resistor device generator.

Figure 11: Instance of resistor created by T-Cell builder, with W=40, L=90.