

# Magic VLSI Cheatsheet

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This cheat sheet compiles useful commands (to be entered in the Tcl console) and bind keys (in the layout window) as well as a summary of the mouse operations for the different tool modes. This compilation relates to Magic 8.3 (see <https://github.com/RTimothyEdwards/magic>).

A comprehensive Magic documentation and description of all macros can be found at <http://opencircuitdesign.com/magic/userguide.html>.

The command `macro layout` in the Magic Tcl console lists all defined macros.

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Useful commands:	
<code>addpath [path]</code>	add search <i>path</i> of cells
<code>antennacheck</code>	run antenna check on cell
<code>array xsize ysize</code>	array the selection <i>xsize</i> -times in X, <i>ysize</i> -times in Y, spacing by box
<code>box [options]</code>	print information about the box like <b>b</b> , or manipulate it in various ways
<code>cif [options]</code>	powerful command with various options (like generating mask layers, calculate density, etc.). Consult online help.
<code>contact type</code>	create contact inside box of intersecting layers
<code>copy [to x y]</code>	<b>copy</b> to current cursor position or to <i>x/y</i> -position
<code>corner dir1 dir2</code>	draws a corner inside box, first in <i>dir1</i> , then in <i>dir2</i> (cf. <b>fill</b> )
<code>drc find</code>	locate DRC error
<code>drc why</code>	explain DRC errors in box
<code>dump cell</code>	copy given <i>cell</i> into current layout cell
<code>erase layers</code>	erase comma-separated list of <i>layers</i> in box
<code>erase *</code>	all layers but not labels
<code>erase \$</code>	erase everything (like CTRL-D)
<code>erase labels</code>	erase selected label(s) in box
<code>fill dir</code>	extend layers from one side of box to the other in the given <i>direction</i> (cf. <b>corner</b> )
<code>findlabel label</code>	center the box on the <i>label</i>
<code>flatten cell</code>	flatten the current edit cell incl. hierarchy into a new <i>cell</i>
<code>flush</code>	revert edit cell to last state on disk
<code>get cell</code>	instantiate <i>cell</i> into current edit cell
<code>goto nodename</code>	move box to net <i>nodename</i> , throw error if not existing
<code>help [pattern]</code>	shows help for various commands
<code>identify cell-id</code>	name the selected cell as <i>cell-id</i>
<code>iroute</code>	interactive point-to-point router, from cursor to box
<code>label string [position [layer]]</code>	create a point, line or box label
<code>load cell</code>	open the <i>cell</i> in the layout window

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Useful commands (cont'd):

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<b>macro</b> [ <i>window_type</i> ]	new macro definition
[ <i>key</i> [ <i>value</i> ]]	
<b>measure</b> [ <i>hor ver auto</i> ]	create a ruler in the box
<b>move</b> <i>x y</i>	<b>move</b> the selection to the <i>x,y</i> coordinate, or relative by specifying direction and distance; parameters are in lambda or in <i>um</i>
<b>paint</b> <i>layers</i>	paint the comma-separated list of <i>layers</i> in box
<b>plot</b> <i>type filename</i>	plots a layout, either as <i>pnm</i> or <i>svg</i> type
<b>plow</b> <i>dir</i>	move layout structures incl. connectivity in <i>direction</i> , see manual
<b>port make</b>	create a port from selected label
<b>port index</b> <i>number</i>	assign a port index (must match the number from schematic)
<b>quit</b> [-nocheck]	exit magic (using <b>-nocheck</b> discards unsaved changes)
<b>see</b> [no] <i>layers</i>	show or hide comma-separated list of <i>layers</i>
<b>see</b> [no] *	show or hide all layers
<b>select save</b> <i>file</i>	Save selection as new <i>file.mag</i>
<b>select short</b> <i>label1 label2</i>	Find the path that electrically connects (shorts) the nodes labeled <i>label1</i> and <i>label2</i> .
<b>straighten</b> <i>dir</i>	try to repair jogs by pulling in <i>direction</i>
<b>tool</b>	changes the currently used <b>tool</b> to (box, wiring, netlist, pick)
<b>redraw</b>	redraws the window
<b>unmeasure</b>	remove all rulers in box
<b>what</b>	print information about the current selection
<b>xload</b> <i>cell</i>	open the <i>cell</i> in the layout window unexpanded
<b>xview</b>	full view, with unexpanded cells

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Bind keys:

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a	select everything in box
A	select additional objects in box
CTRL-A	deselect objects in box
b	print information about the box
B	center window on the box
c	<b>copy</b>
d	<b>delete</b> selection
CTRL-D	delete all layers and labels in box selected by cursor
e	makes the selected cell the new <b>edit</b> cell
F	flip the selection upside-down
g	toggle <b>grid</b>
G	toggle <b>grid 2</b>
i	select instance under cursor
I	select additional instance under cursor
CTRL-I	deselect instance under cursor
m	<b>move</b> selection to cursor position
o	<b>openwindow</b> (with current selection)
r	<b>rotate</b> 90 degree
R	<b>rotate</b> -90 degree
s	<b>select</b> objects under cursor
S	<b>select</b> additional objects under cursor
CTRL-S	deselect objects under cursor
u	<b>undo</b> the last operation
U	<b>redo</b> the last undo
v	<b>view</b> , full view of layout
w	<b>writeall</b> changed cells to disk
x	<b>expand</b> cells (make visible) in box
X	<b>unexpand</b> cells (hide) inside the box
CTRL-X	toggle the visibility of cells in box
y	<b>drc why</b>
z	zoom out
Z	zoom in
CTRL-Z	zoom in on box
>	edit the selected cell in layout window (cf. <)
<	return from editing a cell (cf. >)
,	clear selection
:	directly jump to command window (like VI)
SPACE	change the tool
SHIFT + SPACE	change to the box tool
KEYPAD-2	move selection south, equivalent to 'move s 1'
SHIFT + KEYPAD-2	stretch selection south, equivalent to 'stretch s 1'
KEYPAD-4	move selection west, equivalent to 'move w 1'
SHIFT + KEYPAD-4	stretch selection west, equivalent to 'stretch w 1'
KEYPAD-6	move selection east, equivalent to 'move e 1'
SHIFT + KEYPAD-6	stretch selection east, equivalent to 'stretch e 1'
KEYPAD-8	move selection north, equivalent to 'move n 1'
SHIFT + KEYPAD-8	stretch selection north, equivalent to 'stretch n 1'

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Bind keys (IIC add-on):

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f	full layout view
CTRL-F	flip the selection sideways
k	measure (ruler)
K	remove rulers
p	draw a wiring path
q	open poperty dialog of p-cell
?	show what is contained in box
=	find DRC error(s) and zoom to it (thanks M. Guthaus)
0	show locali
!	show metal-1
@	show metal-2
#	show metal-3
\$	show metal-4
%	show metal-5
9	show all layers

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Mouse operations:	
Box tool:	
LEFT	set lower-left corner of box
RIGHT	set upper-right corner of box
MIDDLE	<b>paint</b> layer pointed with cursor in box
SHIFT + MIDDLE	<b>erase</b> layer pointed with cursor in box
Layer selection tool:	
LEFT	show selected layer, cf. <b>see</b>
RIGHT	hide selected layer, cf. <b>see</b> no
Wiring tool:	
LEFT	pick wire material and size from cursor
MIDDLE	place wire at cursor
RIGHT	cancel wire
SHIFT + LEFT	change to higher layer (e.g. m1 to m2)
SHIFT + RIGHT	change to lower layer (e.g. m2 to m1)
SHIFT + MIDDLE	place a contact at cursor and continue on higher layer
Pick tool:	
LEFT	remove current selection and follow cursor
MIDDLE	place a copy and continue
RIGHT	cancel
SHIFT + MIDDLE	make a copy of selection and follow cursor

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