IsoCAM 2.0

Bungard Elektronik

IsoCAM

Version 2.0

Printing history

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Table of contents

Introduction

Instead of making a PCB by using etching, milling of copper is also a possibility. An example is shown in the figure below. The milling tool will follow a way around the copper objects. After milling the three connected copper objects are separated from the rest. After all copper is removed arround the different nets (connected copper objects), the electrical functionality will be the same as when the PCB was etched.
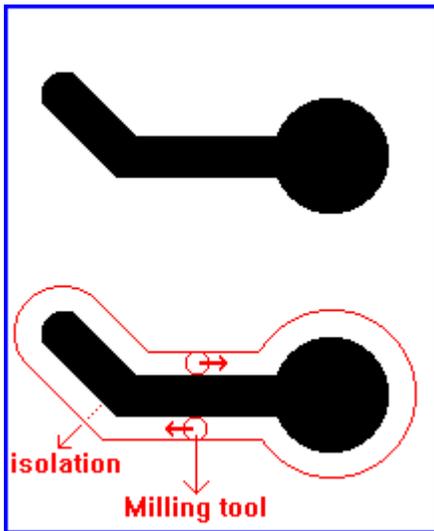
File

Make new plot file

	Press **New** button
	Sub menu **File** menu item **New**

In the next dialogbox there is a listbox with three items.

Those items:

- New gerber file
- New HPGL file
- New drill file

New gerber file

A new gerber file using the global apertures will be made.

New HPGL file

A new HPGL file using the default pensizes will be made.

New drill file

A new drill file using the global drill tools will be made.

Load file

Mainmenu	Sub menu **File** menu item **Load files**
Keyboard	Press **F3**
	Press **Open** button

In the next dialogbox a number of files can be selected. After pressing the **Open** button a new dialogbox will be visible showing the files selected. For every selected file the program will try to identify the file (Gerber/HPGL/drill/apertures/drill tools). If the file could be identified, the type will be visible in the listbox. The files (Gerber/HPGL drill) will be loaded on the next available layer(s). If necessary the user can view the file in ascii format by pressing the **View** button.
After pressing the **OK** button the files will read.

Load gerber file

When the file is in the RS274X format, the file loaded will be loaded directly. The apertures found in this file will be private for this layer.
When the gerber file is in the old gerber format (RS274D) the program needs the help of the user. In the next dialogbox the gerber format parameters will be listed. The parameters listed are the startup parameters gerber.

See also Edit startup info

By pressing the **Hint by program** button parameters found by the program will be filled in. After pressing the **OK** button the gerber file will be loaded on the current layer.
During loading of the gerber file different apertures will be used. When an aperture for the current layer does not exist, the global aperture list will be used. After loading of the gerber file a report will be displayed if apertures do not exist, however it will be possible to load the apertures for this layer, or the loading the global apertures. By doing so the program will ask the user if the layer(s) should be reloaded (resizing objects).
Pad objects based on a not existing aperture will default to **Round 40 mils**
Trace objects based on a not existing aperture will default to **Round 10 mils**.

See also Load apertures
See also Load global apertures

Load HPGL file

The file will be loaded in the HPGL format. The objects on the layer will be created with the current pens.

See also Edit penplot sizes

Load drill file

In the next dialogbox the drill format parameters will be listed. The parameters listed are the startup parameters drill.

See also Edit startup info

By pressing the **Hint by program** button parameters found by the program will be filled in. If necessary some parameters can be changed. After pressing the **OK** button the drill file will be loaded on the current layer. After loading of the drill file a report will be displayed if drill tools do not exist, however it will be possible to load the global drill tools. By doing so the program will ask the user if the layer(s) should be reloaded (resizing objects).
Drills based on a drill tool which does not exist will default to **1.0 mm**.

See also Load global drill tools

Load global apertures
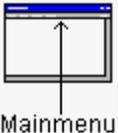
Mainmenu	Sub menu **File** menu item **Load global apertures**

After selecting a filename in the next filename dialogbox, a new dialogbox will be shown. In this dialogbox the gerber parameters will be listed. The parameters listed are the startup parameters gerber

See also Edit startup info

By pressing the **Hint by program** button parameters found by the program will be filled in. If necessary the user can change some parameters. The parameters that can be modified are :
-        Skipping a number of lines from the beginning
-        Dcode Column
-        Aperture object type (shape) column
-        X size or diameter column
-        Y size column
-        Units

Columns should separated by one or more spaces or a komma. When in a certain line the column string (X size, Y size) is non numerical, this string will be skipped and the string on the next column will be used.

After pressing the **Read apertures** button the program will read the apertures for the current layer or the global layer.

The aperture object type supported are **Rectangle, Square, Round** and **Oblong**.

Synonyms for the **Round** bject type are "**circle**,**c**,**round**,**r**,**rd**,**rnd**,**line**,**l**,**rounded**,**donut**"

Synonyms for the **Rectangle** object type are "**rectangle**,**rect**,**rec**,**rectangular**"

Synonyms for the **Square** object type are "**square**,**sq**,**sqr**"

Synonyms for the **Oblong** object type are "**oblong**,**obround**,**o**"

All synonyms are case insensitive.

Load global drill tools
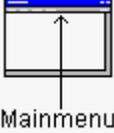
	Sub menu **File** menu item **Load global drill tools**

After selecting a filename In the next filename dialogbox, a new dialogbox will be shown. In this dialogbox the drill tool parameters will be listed. The parameters listed are the startup parameters drill.

See also Edit startup info

If necessary the user can change some parameters. The parameters that can be modified are :
  - Skipping a number of lines from the beginning
  - Use a maximum of lines
  - Tool code Column
  - Diameter column
- Units

Columns should separated by one or more spaces or a komma

After pressing the **Read drill tools** button the program will read the drill tools.

Load job file
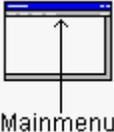
	Sub menu **File** menu item **Load job**

In the dialogbox a job file can be selected and loaded. A job file is a file which contains all information of a project.

This information:
- All layers (Gerber/HPGL/drill)
- All apertures gerber files
- All drill tools drill files
- The milling lines of all layers
- The milling settings
- Penplot diameters

Save job file

Mainmenu	Sub menu **File** menu item **Save job**

In the dialogbox a file can be selected or typed, and in this job file all information of the current project will be written.

Save gerber file

Mainmenu	Sub menu **File** menu item
	
	    Save
	    Save as -> **Gerber files**

Keyboard	Press **Ctrl s**
	Press **Save** button

!!! First select the layer to be saved as a gerber file.
First the program will create new apertures if necessary. In the next dialogbox the apertures used will be listed. The parameters at the time the gerber file was loaded will be used for the gerber output parameters. The gerber output parameters can be modified if necessary.
After pressing the **OK** button the objects on the current layer will be saved in the gerber file format.

If necessary the apertures used can also be edited, by using the function **Save gerber file (User apertures)**.

See also Edit startup info

Save gerber file (User apertures)

Mainmenu	Sub menu **File** menu item **Save as** -> **Gerber files (User apertures)**

!!! First select the layer to be saved as a gerber file.
After selecting a filename in the next filename dialogbox,a new dialogbox will be shown. The apertures used will be listed. To modify the used apertures press the **Edit apertures** button. The parameters at the time the gerber file was loaded will be used for the gerber output parameters. The gerber output parameters can be modified if necessary. After pressing the **OK** button the program will check if all objects can be saved by using the current set of apertures. Objects who are to small to fit by an aperture will be selected, and saving will be aborted.

See also Edit apertures
See also Edit startup info

Save HPGL file

Mainmenu	Sub menu **File** menu item
	
	    Save
	    Save as -> **HPGL files**

Keyboard	Press **Ctrl s**
	Press **Save** button

!!! First select the layer to be saved as a HPGL file.
In the next dialogbox, the penplot diameters, scale, offset, HPGL filename can be changed. The HPGL file can be saved using the methods **Direct** and **Optimized**. The **Direct** method means the saving order of the HPGL objects will be the same as at time of loading. The **Optimized** method means the program collect all concatenated HPGL objects, and save them like a daisy chain. For example a rectangle with four lines:

 - The second coordinate of a line is equal to the first coordinate of the next line.

After pressing the **OK** button the the program will check if all HPGL objects can be saved by using the current set of pens. Objects who are to small to fit by a pen will be selected, and saving will be aborted.

Save drill file

Mainmenu	Sub menu **File** menu item
	
	    Save
	    Save as -> **Drill files**

Keyboard	Press **Ctrl s**
	Press **Save** button

!!! First select the drill layer to be saved.
First the program will create new tools if necessary. The parameters at the time the drill file was loaded will be used for the drill output parameters. The drill output parameters can be modified if necessary.
After pressing the **OK** button the drill objects on the current layer will be saved.

See also Edit startup info

Print
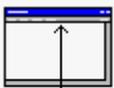
	Press **Print** button
Mainmenu	Sub menu **File** menu item **Print**

In the next dialogbox the layers and milling objects can be selected. Also the scale factor can be modified. After pressing the **OK** button the selected layers will be printed.

<u>Edit</u>

<u>*Edit apertures*</u>
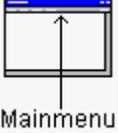
Mainmenu	Sub menu **Edit** menu item **Edit apertures** Sub menu **Edit** menu item **Edit global apertures**

In the next dialogbox the apertures can be edited.

Modify an aperture: Select the aperture to be modified.
                                      Change the D code, aperture type and size if necessary
                                      Press the **Change** button and the aperture will be changed

Add an aperture: Change the D code, aperture type and size if necessary
                                      Press the **Add** button and the aperture will be added
Delete an aperture: Select the aperture to be deleted.
                                      Press the **Delete aperture** button and the aperture will be deleted

By pressing the **Delete all** button all apertures will be deleted. Pressing the **Units** button will switch between **mils**/**mm**/**inch** units. By pressing the **Load apertures** button a new set of apertures can be loaded.
After pressing the **OK** button the **global apertures**/**apertures current layer** will be modified.

<u>*Edit global drill tools*</u>
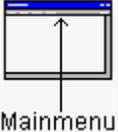
Mainmenu	Sub menu **Edit** menu item **Edit global drill tools**

In the next dialogbox the drill tools can be edited.

Modify a drill tool: Select the drill tool to be modified.

Change the tool code, diameter, plated/unplated if necessary
Press the **Change** button and the tool will be changed

Add a drill tool : Change the tool code, diameter, plated/unplated if necessary

Press the **Add** button and the tool will be added

Delete a drill tool: Select the drill tool to be deleted.
Press the **Delete tool** button and the tool will be deleted

By pressing the **Delete all** button all tools will be deleted. Pressing the **Units** button will switch between **mils**/**mm**/**inch** units.

After pressing the **OK** button the global drill tools will be modified.

Edit milling settings

Mainmenu	Sub menu **Edit** menu item **Edit milling settings**

This function will start with a dialogbox. In this dialogbox the milling parameters can be changed. The following parameters can be changed:
- Milling tool 1 (Usually a small one)
- Milling tool 2 (Usually a larger one)
- Milling around pads or complete milling
- Diameter milling tools
- The milling tolerance
- The milling resolution (Usually HPGL format or 0.025 mm)
- Milling tool used for editing
- Filling with milling lines horizontal/vertical
    (Used for "Filling with milling lines" mouse right button menu)

See also Create milling data

Edit penplot sizes

Mainmenu	Sub menu **Edit** menu item **Edit penplot parameters**

In the next dialogbox the penplot diameters can be edited.

Modify a pen: Select the pen to be modified.
                       Change the diameter
                       Press the **Change** button and the pen will be changed

Delete a pen: Select the pen to be deleted.
                       Change the diameter to zero
                       Press the **Change** button and the pen will be removed

Modify resolution: The HPGL resolution (0.025mm) can be modified by editing this
                       resolution field.

Pressing the **Units** button will switch between **mils**/**mm**/**inch** units.

After pressing the **OK** button the penplot diameters will be modified.

Edit startup info

Mainmenu	Sub menu **Edit** menu item **Edit gerber/drill startup info**

The startup info for gerber and drill parameters can be used as the default parameters.
When the gerber/drill files/apertures/drill tools used always have the same parameter
format, the values can be put in this dialogbox and those parameters will be the default
values.
In the next dialogbox the startup info for gerber and drill parameters can be edited.
These parameters will be used when loading a gerber file, loading apertures, loading a
drill file and loading the drill tools. At the time the program stops these parameters will
be saved into the **isocam.ini** file. When the program starts these parameters will be
loaded from this **isocam.ini** file. With the two buttons **Load current gerber values** and
Load current drill values the parameters used for the latest loading of gerber
files/apertures/drill files/drill tools will be put in this dialogbox.

See also Initialization file isocam.ini

Thickness line

Mainmenu	Sub menu **Edit** menu item **Select line width**
Menu Mouse	Select line width
Keyboard	Press **Ctrl l**

In the next dialogbox the line width can be changed. When the last item has been selected, the user can fill in a not available line width.
This line width will be used when lines are being added, and also for filling circles, rectangles, oblong pads and polygons.

Undo

	Press **Select layers** button
Keyboard	Press **u**
Menu Mouse	**Undo**

This function will undo almost all-previous actions.

Redo

	Press **Select layers** button
	Redo

This function will redo previous undo actions.

Selection objects
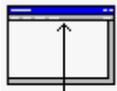
	Press **s** (one or two times)
	Sub menu **Selection mode** menu item **Plot objects**

Selection of normal objects can be activated by one of two above actions.
Activation of the normal object selection is made visible on the info bar at the bottom
right of the window. **Object selection layer x** is now visible.

See also Selection milling objects

Selection milling objects

	Press **s** (one or two times)

	Sub menu **Selection mode** menu item **Milling objects**

Selection of milling objects can be activated by one of two above actions.
Activation of the milling object selection is made visible on the info bar at the bottom right of the window. **Milling object selection layer x** is now visible.

Selection/deselection objects

To select an object, place the mouse cursor above the object, and press and hold the **left mouse button**. A rectangle will mark the selection window. There are two selection modes available. The first and default selection mode is the **Replacement mode**, and the second selection mode is the **Adding selection mode**.

The **Replacement selection mode** means, every time a new selection rectangle is drawn the previous objects selected will be deselected. When pressing down the **shift** key together with the **left mouse button** it is possible to use more than one selection at a time.

The other selection mode is the **Adding selection mode**. In this mode every object which is selected stays selected, until the deselect all function is executed. To deselect an object press the **left mouse button** and place the selection rectangle around this object again.

To change the selection mode use the **Replacement** or **Appending** in the **Selection mode** section of the menu.

Deselect all

	Deselect all button
	Press **F2**

Menu Mouse	**Deselect all**

Deselect all objects on the current layer.

Deselect all layers

Menu Mouse	**Deselect all layers**

Deselect all objects on all layers.

Select all

Menu Mouse	**Select all**

Select all objects on the current layer

Select all layers

Menu Mouse	**Select all layers**

Select all objects on all layers.

Deselect

Menu Mouse	**Deselect**

Object selection :

Depending on the layer type objects can be deselected.
Layer type :
- Gerber :   Object with an aperture
- HPGL :   Lines with a pen
- Drill :   Drills with a tool

Milling object selection :

Milling lines with a tool can be deselected.

Select only

Object selection :

Depending on the layer type objects can be selected only.
Layer type :
- Gerber :   Object with an aperture
- HPGL :   Lines with a pen
- Drill :   Drills with a tool

Milling object selection :

Milling lines with a tool can be selected only.

Menu Mouse	**Select only**

Info on selected objects

	Info selected objects button
	Press **i**
	Info

Displays some information about **selected** objects.

Select layer
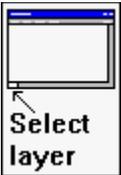
	Press **Ctrl 0 .. 9**
	Press **l**
	Select the layer from the listbox

Layer selection.

Change units

Keyboard	Press **Ctrl u**
Mainmenu	Sub menu **units** menu item **Mm** **Mils** **Inch** **HPGL**

Changing the units is possible in every drawing/moving function.

See also Initialization file isocam.ini

Change grid

Keyboard	Press **Ctrl g**
Mainmenu	Sub menu **View** menu item **Change grid**

Changing the grid is possible in every drawing/moving function.

The grid settings in the dialogbox can be modified by changing the **isocam.ini** settings.

See also Initialization file isocam.ini

Zero relative cursor

Keyboard	Press **Ctrl z**

The relative cursor will be set to zero. On the window a white cross will mark the zero point.

With the next menu item function the relative position will be on the grid or not.

View

Hide/view layers

	Select layers button
Keyboard	Press **Ctrl a**
Mainmenu	Sub menu **View** menu item **Layers**

Change visibility layers.

The **hide/view layers** function can be used in every possible drawing/moving function.
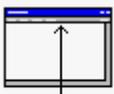
See also Change grid

Zoom in

Keyboard	Press **z**
Mainmenu	Sub menu **View** menu item **Zoom in**

The **zoom in** function can be used in every possible drawing/moving function.

See also Window based zooming

Zoom out

Keyboard	Press **Z**
Mainmenu	Sub menu **View** menu item **Zoom out**

The **zoom out** function can be used in every possible drawing/moving function.

See also Window based zooming

Window based Zooming

To zoom in on a window, place the mouse cursor to the left top place of the window. Hold down the **Ctrl** key, than press and hold down the **left mouse button**. Move the mouse cursor in the right bottom direction of your window. After releasing the **Ctrl** key and the **left mouse button** zooming in will take place.
To zoom out, use the previous function, but now move the mouse cursor in the left top direction. The non-changing rectangle visible is the border of your design. The changing rectangle is the zoom out window. After releasing the **Ctrl** key and the **left mouse button**, zooming out will take place.

The **window based zooming** function can be used in every possible drawing/moving function.

Pan window

Keyboard	Press ⇐,⇒,⇑,⇓
Keyboard	Press **x**
Window	Use the scrollbars

When pressing the **x** key, the window will be panned around the current mouse position.

The **pan window** function can be used in every possible drawing/moving function.

Window based panning

There is a function available to view a different part of your design (special window for panning). To enter this function, hold down the **Ctrl** key, than press and hold down the **right mouse button**. The non-moving rectangle visible is the border of your design. The moving rectangle is the viewable window. After releasing the **Ctrl** key and the **right mouse button** panning will take place.

The **Window based panning** function can be used in every possible drawing/moving function.

Return to previous view window

Keyboard	Press **v**
Menu **Mouse**	**Previous view**

Return to a previous view.

The **Previous view** function can be used in every possible drawing/moving function.

Repaint

	Press **F5**
	Repaint

The whole window will be repainted.

The **Repaint** function can be used in every possible drawing/moving function.

View whole design

	Press **F8**
	View whole design

The window view will be scaled that the whole design will fit.

The **View whole design** function can be used in every possible drawing/moving function.

Change colors

Mainmenu	Sub menu **View** menu item **Change colors**

The color settings can be modified in the next dialogbox. The color settings will be copied into the **isocam.ini** initialisation file.

See also Initialization file isocam.ini

Load default colors

Mainmenu	Sub menu **View** menu item **Load default colors**

The default color settings will be loaded.

View/hide grid

Keyboard	Press **g**

View/hide grid

Add objects

Add rectangle objects

	Press **Add rectangle pad** button
	Press **Add rectangle** button
Menu Mouse	**Add objects** -> **pad** -> **Rectangle** **Add objects** -> **rectangle** **Add milling objects** -> **Pad cut out** -> **Rectangle** **Add milling objects** -> **Rectangle**
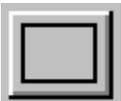
A rectangle object will be added. When the **spacebar** is pressed, a dialogbox will popup, and the rectangle parameters can be edited by hand. The first two parameters are the width, and height. The optional third and four parameter is the rectangle center. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position**. The coordinates typed in will be used with the current units (dimension).

See also Thickness line

Add circle objects

	Press **Add circle pad** button
	Press **Add circle** button
Menu Mouse	**Add objects** -> **Pad** -> **Circle** **Add objects** -> C**ircle** -> **Select circle type** **Add milling objects** -> **Pad cut cout** -> **Circle** **Add milling objects** -> **Circle** -> **Select circle type**

A circle object will be added. When the **spacebar** is pressed, a dialogbox will popup, and the circle parameters can be edited by hand. The first parameter is the diameter. The optional second and third parameter is the circle center. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position**. The coordinates typed in will be used with the current units (dimension).

See also <u>Thickness line</u>

Add oblong objects

	Press **Add oblong pad** button
	Add objects -> **Pad** -> **Oblong** **Add milling objects** -> **Pad cut out**-> **Oblong**

An oblong object will be added. When the **spacebar** is pressed, a dialogbox will popup, and the oblong parameters can be edited by hand. The first two parameters are the width, and height. The optional third and four parameter is the oblong center. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid) position**. The coordinates typed in will be used with the current units (dimension).

See also <u>Thickness line</u>

Add line objects

	Press **Add trace** button
	Add objects -> **line** **Add milling objects** -> **Line**

A line object will be added. The mouse cursor will snap to an object, when in range. By pressing the **Shift** key the mouse cursor will never snap to the nearest object. When the **spacebar** is pressed, a dialogbox will popup, and the line parameters can be edited by hand. As many as 16 points (15 lines) can be edited. In addition, one point can be edited for the starting point of the line. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position.** The coordinates typed in will be used with the current units (dimension).

See also Thickness line

Add arc objects

	Press **Add arc** button
Menu Mouse	**Add objects** -> **arc** **Add milling objects** -> **Arc**

An arc object will be added. When the **spacebar** is pressed, a dialogbox will popup, and the arc parameters can be edited by hand. The first parameters are the diameter. The optional second and third parameter is the arc center. The optional fourth and fifth parameter is the first radial ending point. The optional sixth and seventh parameter is the second radial ending point. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position.** The coordinates typed in will be used with the current units (dimension).
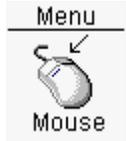
See also Thickness line

Add text objects

TEXT	Press **Add arc** button
Keyboard	Press **t**

Menu Mouse	**Add objects** -> **Text** **Add milling objects** -> **Text**

A text object will be added. In the next dialogbox the text can be entered. In addition the textheight can be edited. After pressing the **OK** button the text can be placed. When the **spacebar** is pressed, a dialogbox will popup, and the text placement point can be edited by hand. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position.** The coordinates typed in will be used with the current units (dimension).
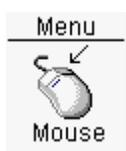
See also Thickness line

Add polygon object

	Press **Add polygon** button
Menu Mouse	**Add objects** -> **Polygon**

After activation of this function a polyline must be drawn. When drawing this polyline use the the **right mouse button** menu to change the drawing direction, goto the previous polyline point (Backwards) and to finish the polyline drawing. When the spacebar is pressed, a dialogbox will popup, and the polyline parameters can be edited by hand. As many as 64 points can be edited. The coordinates typed in will be used with the current units (dimension). After finishing the polyline drawing and the polyline does not contain any crossings of lines, the area enclosed by the polyline will be filled up with lines.

See also Thickness line
See also Add filled rectangle
See also Add filled circle
See also Create milling cut out polygon

Add drill

Menu / Mouse	**Add objects** -> **drill plated** **Add objects** -> **drill unplated**

A drill hole (plated/unplated) will be added. When the **spacebar** is pressed, a dialogbox will popup, and the drill hole parameters can be edited by hand. The first parameter is the diameter. The optional second and third parameter is the drill hole center. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid) position**. The coordinates typed in will be used with the current units (dimension).

Add fixing holes
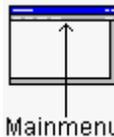
Mainmenu	Sub menu **Edit** menu item **Add fixing holes**

With this function fixing holes can be added on a new drill layer. On other layers pads will be added on gerber layers, and drill holes on drill layers. The pads/drills on these other layers can be used to synchronize mirrored layers. In the next dialogbox the fixing hole size can be changed, and the fixing holes can be placed horizontal and vertical. There are two ways of placing the fixing holes using a distance. In the top box the fixing holes will be placed at a distance from the PCB borders, and in the bottom box the fixing holes will be placed at the distance from each other.

See also Mirror objects
See also Synchronize layers

Fill with milling lines

Menu / Mouse	**Fill with milling lines**

With this function a closed series of objects can be filled with milling lines, avoiding other series of closed objects inside this main series of objects. After the mouse has been placed on the right spot and the **left mouse button** has been pressed, a dialogbox will popup where the milling pen and filling direction can be choosen. Filling can be aborted by pressing the **ESC** key.

Fill with lines

Menu Mouse	**Fill with lines**

With this function a closed series of objects can be filled with lines, avoiding other series of closed objects inside this main series of objects. If the current layer is a gerber file a line with the standard line width will be used, and if the current layer is a HPGL file the line with the current pen will be used. Filling can be aborted by pressing the **ESC** key. The filling direction can be changed with the function **Edit milling parameters**.

See also Create milling data

Create milling cut out polygon

Menu Mouse	**Add objects** -> **Polygon** -> **Polyline** **Rectangle** **Circle** **Oblong**

When the selection mode is milling lines, a dialobox will be visible, and the milling tool used for filling must be selected.

Polyline : When drawing this polyline use the the **right mouse button** menu to change the drawing direction, goto the previous polyline point (Backwards) and to finish the polyline drawing.

Rectangle : A rectangle will be visible. The rectangle can be changed by pressing the **shift** key. When the **spacebar** has been pressed a dialogbox will be visible. The

width,height parameters of the rectangle can be entered. To leave this function by the **ESC** key or use the **right mouse button** menu.

Circle : Same as the rectangle.
Oblong : Same as the rectangle cutout.

After finishing the polyline/rectangle/circle drawing and the polyline does not contain any crossings of lines, the area enclosed by the polyline will be filled up with milling lines. Those milling lines will not overlap copper objects.
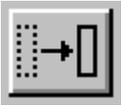
See also Thickness line
See also Add rectangle (Pad filled)
See also Add circle (Pad filled)

Change objects

Move objects

	Press **Move** button
	Press **m**
	Move

Move **selected** objects. By pressing and keep down the **shift** key and moving the mouse cursor, the moving center will change. When the **spacebar** is pressed, a dialogbox will popup, and the endpoint parameters can be edited by hand. The endpoint coordinates will be the center of the selected objects. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position**. The coordinates typed in will be used with the current units (dimension).

Move lines to milling

Menu Mouse	**Move lines to milling**

With this function selected traces/lines can be moved to the corresponding milling layer. The thickness of those selected traces/lines will be the milling of the current milling tool used for editing.

See also Edit milling settings

Drag objects
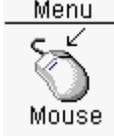
Keyboard	Press **d**
Menu Mouse	**Drag**

Drag **selected** objects. By pressing and keep down the **shift** key and moving the mouse cursor, the moving center will change. When the **spacebar** is pressed, a dialogbox will popup, and the endpoint parameters can be edited by hand. The endpoint coordinates will be the center of the selected objects. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position**. The coordinates typed in will be used with the current units (dimension).

Copy objects

[⫿→⫿]	Press **Copy** button

Keyboard	Press **c**
Menu Mouse	**Copy**

With this function **selected** objects can be copied to a new location. By pressing and keep down the **shift** key and moving the mouse cursor, the moving center will change. When the **spacebar** is pressed, a dialogbox will popup, and the endpoint parameters can be edited by hand. The endpoint coordinates will be the center of the selected objects. When the first character typed is a **@** the coordinates will be relative against the **Relative (grid)position**. The coordinates typed in will be used with the current units (dimension).

Delete objects

(trash icon)	Press **Delete** button
Keyboard	Press **Del**
Menu Mouse	**Delete**

Delete **selected** objects.

Rotate objects

Menu Mouse	**Rotate** **Rotate 180** **Rotate 270**

Rotate **selected** objects 90,180,270 degrees counter clock wise.

Mirror objects

Menu Mouse	**Mirror X** **Mirror Y**

Mirror **selected** objects in X or Y direction.

Mirror layer over fixing holes

Menu Mouse	**Mirror over fixing holes**

When fixing holes are added, the current layer can be mirrored with this function. If the fixing holes are placed on a horizontal line, the layer will be mirrored over this horizontal line. If the fixing holes are placed on a vertical line, the layer will be mirrored over this vertical line.

Edit object

Keyboard	Press **e**
Menu Mouse	**Edit object**

Edit an object (Circle pad/rectangle pad/drill/oblong pad/trace).

Change circle pads

Menu Mouse	**Change diameter circle pads**

The diameter of **selected** circle pads/drills can be changed into a new value typed in the following dialogbox.

Change diameter drills

Menu Mouse	**Change diameter drills**

The diameter of **selected** drills can be changed into a new value typed in the following dialogbox.

Change rectangle pads

Menu Mouse	**Change width/height rectangle pads**

The width/height of **selected** rectangle pads can be changed into a new value typed in the following dialogbox.

Change oblong pads

Menu Mouse	**Change width/height oblong pads**

The width/height of **selected** oblong pads can be changed into a new value typed in the following dialogbox.

Change lines/traces

Menu Mouse	**Change width lines/traces**

The width of **selected** lines/traces can be changed into a new value typed in the following dialogbox.

Change tool milling line

Menu Mouse	**Change milling tool**

The width of **selected** milling lines can be changed into a new tool in the following dialogbox.

Change tool drills

	Change tool drills
Menu / Mouse	

If the current layer is a drill layer, the tool of **selected** drills can be changed into a new tool in the following dialogbox. If necessary a new tool can be added.

Change pen

	Change pen
Menu / Mouse	

If the current layer is a HPGL layer, the pen of **selected** lines can be changed into a new pen in the following dialogbox.

Convert to board cut lines

	Convert to board cut lines
Menu / Mouse	

With this function selected traces/lines which form a polyline, can be converted and added to the corresponding milling layer. In the next dialogbox the cutting tool can be entered, increasing/decreasing the board outline. Decreasing board outline will be used to the remove a inner piece of the PCB. Also the gap and segmentation length can be entered. Segmentation will follow when the check box 'Segmentation board cut lines' has been marked. After pressing the **OK** button the board outline will created. The created milling lines can now be saved to a separate file.

See also Edit milling settings

Segmentation board cut lines

Menu Mouse	**Segmentation to board cut lines**

In the next doalogbox the gap and segmentation length can be entered. After pressing the **OK** button the selected milling line will be segmented.

See also Edit milling settings

Shorten board cut lines

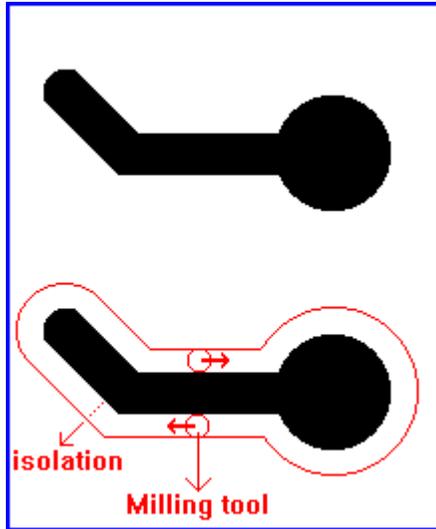|	
Menu Mouse	**Shorten board cut lines**

In the next doalogbox the gap length can be entered. After pressing the **OK** button the selected and concatenated two milling lines will be made shorter.

See also Edit milling settings

Milling

Create milling data

Mainmenu	Sub menu **File** menu item **Create milling data**

Instead of making a PCB by using etching, milling of copper is also a possibility. An example is shown in the above figure. The milling tool will follow a way around the copper objects. After milling the three connected copper objects are separated from the rest. After all copper is removed arround the different nets (connected copper objects), the electrical functionality will be the same as when the PCB was etched.

This function will start with a dialogbox. In this dialogbox the milling parameters can be changed. The following parameters can be changed:

- Milling tool 1 (Usually a small one)
- Milling tool 2 (Usually a larger one)
- Milling around pads or complete milling
- Diameter milling tools
- The milling tolerance
- The milling resolution (Usually HPGL format or 0.025 mm)
- Milling accuracy

For the last option there are three possibilities, High, normal and low accuracy. Low accuracy will reduce the number of milling vertors.

The creation of milling data will go through two steps.

1. Calculation of the milling lines
2. If needed a design rule check of the milling data against all copper objects.

After the milling data (polylines) has been calculated, it will be made visible. If necessary the user can modify the milling data, or add additional milling objects. Before milling objects can be added the selection mode should be millings objects.

When using two milling tools milling starts with the thick tool. The thick tool will mill around pads or completely. After milling with the thick tool, milling continues with the

smaller milling tool. The milling created by the second (smaller) milling tool will be deleted, when the thick milling tool has already been there.

See also Edit milling settings
See also Selection milling objects

Save milling data
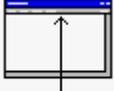
Mainmenu	Sub menu **File** menu item **Save milling data**

After selecting a filename In the next filename dialogbox, the milling data of the current layer will be saved. The milling data will be saved in the HPGL format and with the milling resolution.

See also Edit milling settings

Design rules
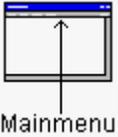
Check design rules

Mainmenu	Sub menu **Check** menu item **Design rules**

In the next dialogbox the clearance can be entered. After pressing **OK** the design rules of the plot objects on the current layer with the clearance will be checked. The objects with an error will be painted in the error color.

See also View design rule errors

Synchronize layers

	Sub menu **Edit** menu item **Synchronize layers**
Mainmenu	

With this function layers with different offsets can be synchronized. Synchronization can be done automatically or by hand. In the next dialogbox layers to be synchronized should be selected, and the layer to synchronize to. If the check box **Move selected layers to zero** is marked layers will be synchronized and moved towards the zero point. After pressing the **OK** button synchronization will start with the auto option. When synchronization should be done by hand, an object (Not a line) should be selected for each layer. After synchronizing the layers will have the same offset as the layer to synchronize to (if necessary).

Initialization file isocam.ini

The initialization file **isocam.ini** is used to save some designs parameters. The file will be in the same directory as the executable.

[Settings]

WindowWidth	The width of the windows
WindowHeight	The height of the windows
WindowStartX	Origin X of the windows (0,0 = left top)
WindowStartY	Origin Y of the windows
Units	(0 = mils,1 = mm,2 = inch,3 = HPGL)
GridSize	The gridsize (10nm units)
DrawGrid	0 = FALSE,1 = TRUE
DrawPads	0 = FALSE,1 = TRUE
DrawTraces	0 = FALSE,1 = TRUE
DrawMilling	0 = FALSE,1 = TRUE
DrawDrills	0 = FALSE,1 = TRUE
SelectionMode	0 = replacement, 1= appending
MouseCursorOnGrid	0 = FALSE,1 = TRUE
Layer0	Draw layer 0 (0 = FALSE,1 = TRUE)
Layer1	Draw layer 1 (0 = FALSE,1 = TRUE)
Layer2	Draw layer 2 (0 = FALSE,1 = TRUE)
…	…
Layer31	Draw layer 31 (0 = FALSE,1 = TRUE)
PenPlotSize1	Penplot size 1 (10nm units)
…	…

PenPlotSize15	Penplot size 15 (10nm units)
PenPlotResolution	The resolution of HPGL files (10 nm units) Default to 2500 (0.025 mm)
MillingResolution	Resolution milling (10nm units) Default to 2500 (0.025 mm)
MillingTool	Diameter milling tool (10nm units) Default to 30000 (0.3 mm)
Grid0	Gridsize definition 0 (10nm units)
Grid1	Gridsize definition 1 (10nm units)
…	…
Grid29	Gridsize definition 29 (10nm units)
ViewLayerColor0	24 bit RGB color (Stored as 32 bit)
…	…
ViewLayerColor31	24 bit RGB color (Stored as 32 bit)
ErrorColor	24 bit RGB color (Stored as 32 bit)
DrillColor	24 bit RGB color (Stored as 32 bit)
DrillUnplatedColor	24 bit RGB color (Stored as 32 bit)
MllingColor	24 bit RGB color (Stored as 32 bit)
ButtonInfoColor	24 bit RGB color (Stored as 32 bit)
GridColor	24 bit RGB color (Stored as 32 bit)
BackGroundColor	24 bit RGB color (Stored as 32 bit)
StartGerberDigits1	2,3,4 (When used for gerber type objects)
StartGerberDigits2	2,3,4,5 (When used for gerber type objects)
StartGerberUnits	0 = mils,1 = mm,2 = inch,3=0.01 mm

StartGerberZeroMode	0=Leading zero suppression 1=Trailing zero suppression
StartGerberNumberFormat	0=integer,1=floating point
StartAperTureListUnits	0 = mils,1 = mm,2 = inch
StartAperTureListSkipLines	Nr lines of the aperture file that should be skipped
StartAperTureListDCodeColumn	Column nr DCode
StartAperTureListObjectTypeColumn	Column nr aperture object type
StartAperTureListXColumn	Column nr X size or diameter aperture
StartAperTureListYColumn	Column nr Y size aperture
StartDrillDigits1	2,3,4 (When used for gerber type drills)
StartDrillDigits2	3,4,5 (When used for gerber type drills)
StartDrillUnits	0 = mils,1 = mm,2 = inch,3=0.01 mm
StartDrillZeroMode	0=Leading zero suppression 1=Trailing zero suppression
StartDrillNumberFormat	0=integer,1=floating point
StartDrillToolListUnits	0 = mils,1 = mm,2 = inch
StartDrillToolListSkipLines	Nr lines of the drill tool file that should be skipped
StartDrillToolListMaxLineNr	Max nr lines of the drill tool file that should be used
StartDrillToolListToolColumn	Column nr drill tool
StartDrillToolListDiameterColumn	Column nr diameter drill tool

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