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Application Note
IMECICLINK/ASICS

Guidelines to create a bonding diagram

Author(s):	Adel Ammar
Date:	12-10-2016
Keywords:	Packaging, Bonding diagram
Distribution list:	Europractice customers

Scope

This application note explains how to create a bonding diagram in Cadence Virtuoso IC6 and submit a wirebonding request.

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Importing the design

- Import your design to Cadence Virtuoso:

Please use a GDS that contains a complete IO ring and all the pads in your design. If you have used .lef files and cannot see the pads or the IO ring, we can send you a GDS that contains backend information (metals, passivation openings, ...) of your design, which can be used to make a bonding diagram.

Importing the GDS file with all the packaging options

- Import the Europractice packages GDS file to Cadence Virtuoso. This GDS file can be found on Europractice's website.
- When you import this GDS, add layers y0-y5 to the layer table as shown in Figure 1.

  If you are using Cadence Virtuoso IC6, follow the following steps:

  - Show 'StreamIn Options' -> 'Layers' -> 'Add Row'.
  - Use the layer names and GDS numbers as shown below:

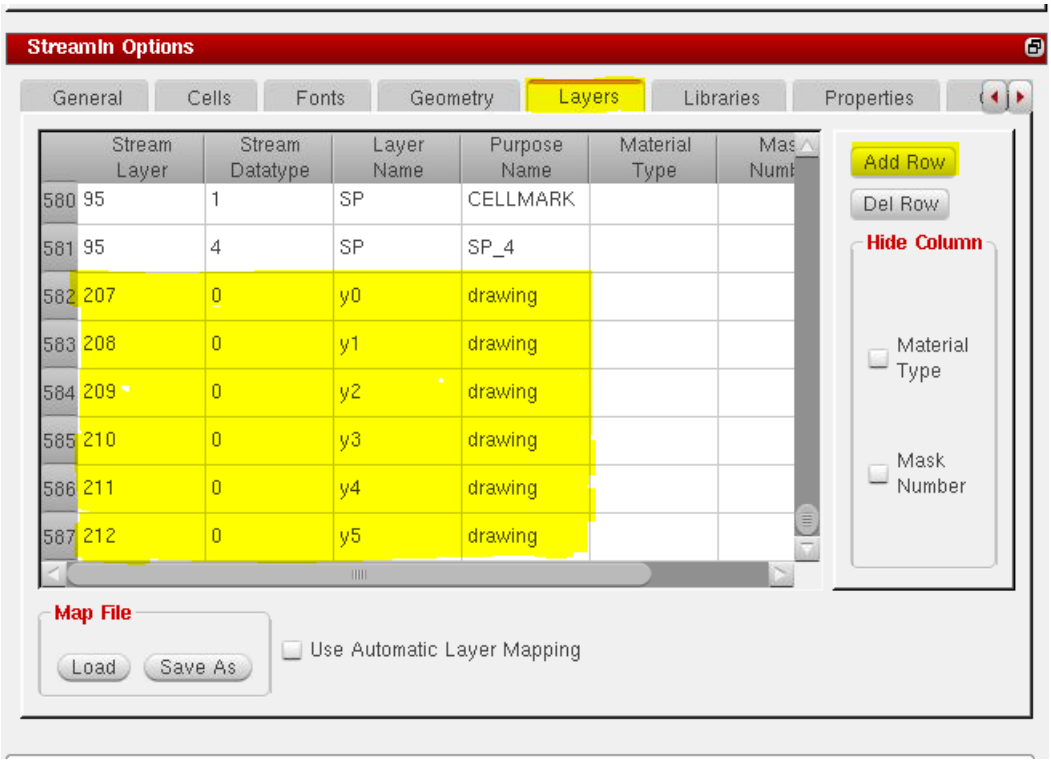

Figure 1: Adding layers to the layer table.

Creating a Bonding diagram layout cell view

- Create a new layout cell. In this cell, add an instance of the imported backend design and an instance of the "_A4" cell version of the desired package.

- We recommend you give a name that ends in _pack to this cell. For example: “Top_pack”, or “Sensor_pack”.

- You need to enable the new layers y0-y5 in the “valid layers” category in order to be able to use them in the bonding diagram, as shown in Figure 2.

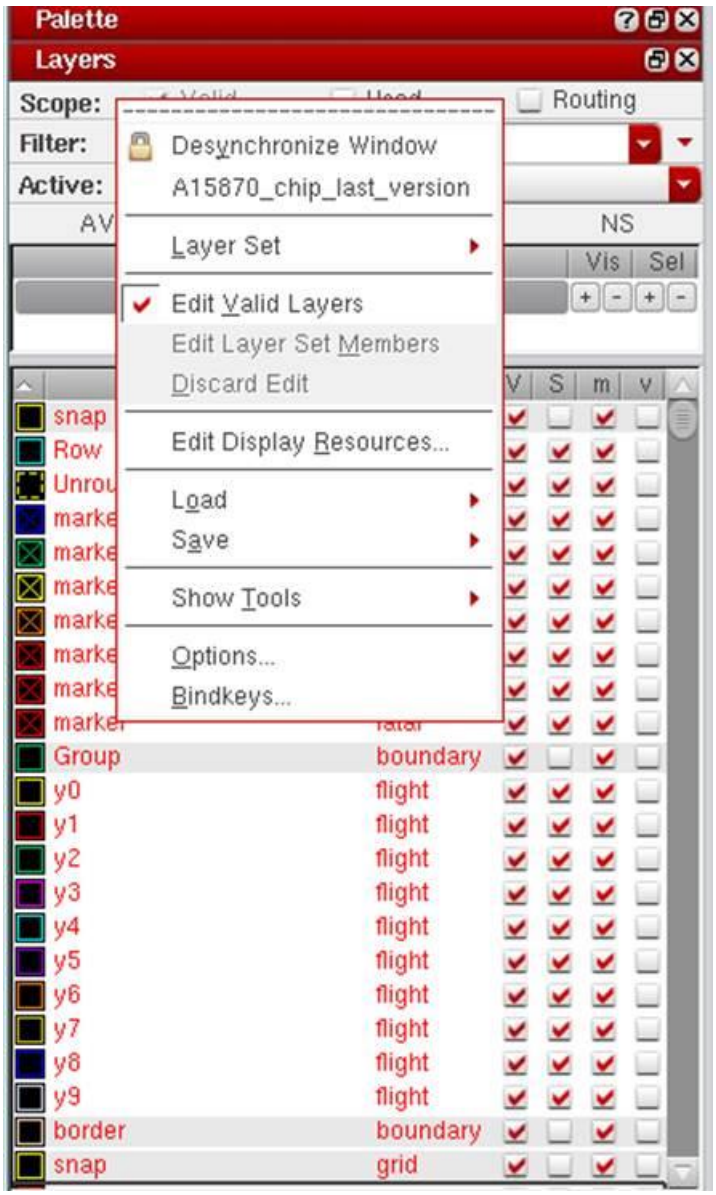

Figure 2: Edit valid layers.

Creating the bonding diagram

If you are using Cadence Virtuoso IC6, follow the following steps:

Create a ‘path’ (see Figure 3) which represents the bond wire by choosing:

- Create -> shape -> path

- Choose the layer “y4” to be used in the path

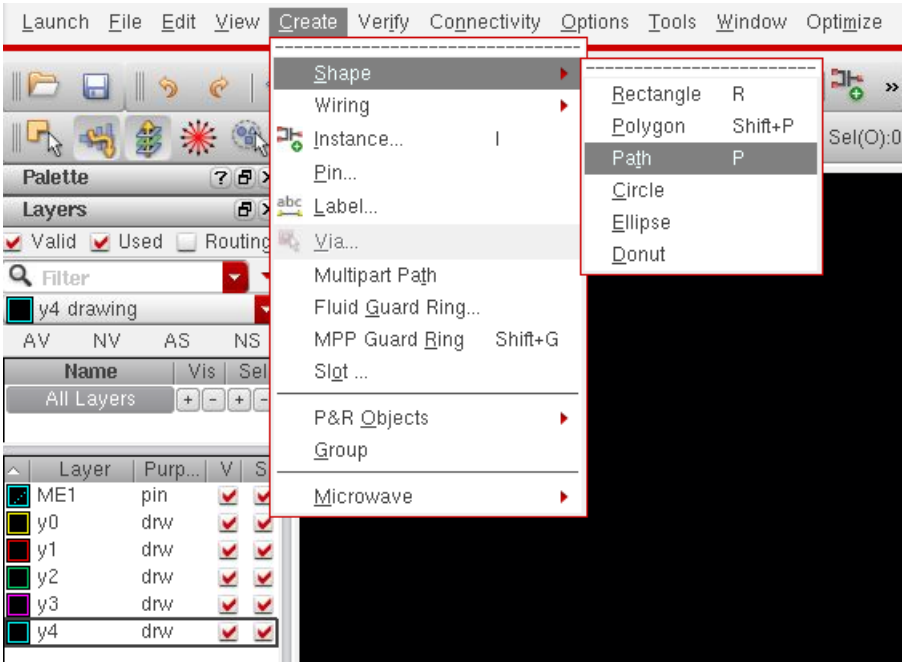

Figure 3: Create a path.

- Press F3 to edit the path options and change the path width to 30 as shown in Figure 4.

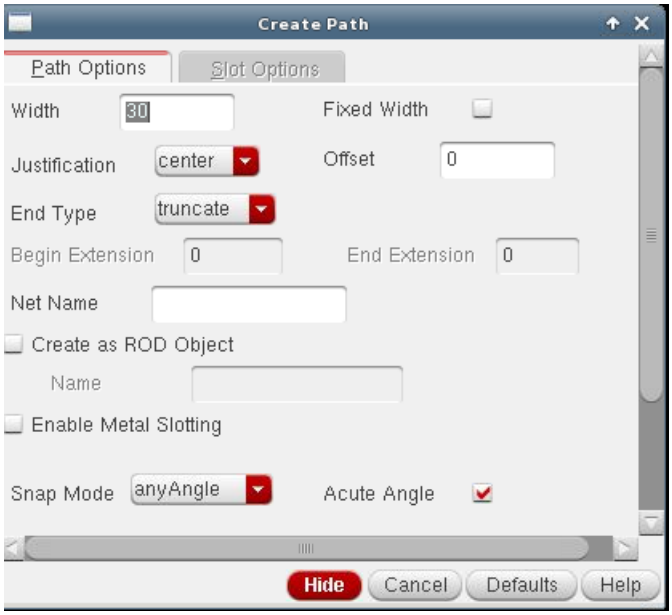

Figure 4: Changing the path width.

- Connect the pins of the package to the bond pads of your design using the path as a wire.

Please note that your design should be placed with the right orientation. Make sure that the bond pads on your design match the corresponding pins of the package. The position of the logo in your design can help you place your design correctly.

Adding the packaging information

Fill in the empty text fields in the bonding diagram by editing the label properties. You can then fill in the missing information in the text field as indicated in Figure 5 and Figure 6.

Please delete any comments in the template that are irrelevant to your design. For example, if you do not use any double wires to connect a pin in your packaging request, please delete the comment “double wires connected to same pin” in the template.

Please find below some additional information concerning each field that appears in the packaging template.

1- Design name: Please insert the name of your design.

2- General comments: Please fill these fields by measuring the relevant parameters in your design’s back-end GDS. Please delete any lines that don’t apply to your design.

3- MPW: Please specify the Europractice run number.

4- Die: Top cell (= project name) of the final version of your GDS file.

5- Qty packaged: The number of dies that need to be packaged.

6- Qty Naked: The number of dies that will not be packaged based on this bonding diagram. This number therefore either corresponds to the number of unpackaged dies, or to the number of dies packaged using a different bonding diagram.

7- Die Attach: The material to be used to attach a die to a package. By default, the die attach is EPO-TEK H20E conductive epoxy (please fill in “Default” for this field if you have no specific requirement). For specific requirements, please ask your technical imec contact for advice.

8- Wire: Type of wire to be used (Default is 1.2mil gold wire). Please fill in “Default” for this field if you have no specific requirement; otherwise, please ask your technical imec contact for advice.

9- Size incl scribe: Size of the dies. Please indicate the approximate size rounded to the nearest tenth of a millimetre.

10- Lid: Type of Lid requested. Please put a cross in the right square.

There are 4 possible options:

Taped = the lid is attached using a sticky tape.

Sealed = the lid is completely sealed.

Glued = The alloy lid is attached with glue.

Glass = The lid is transparent.

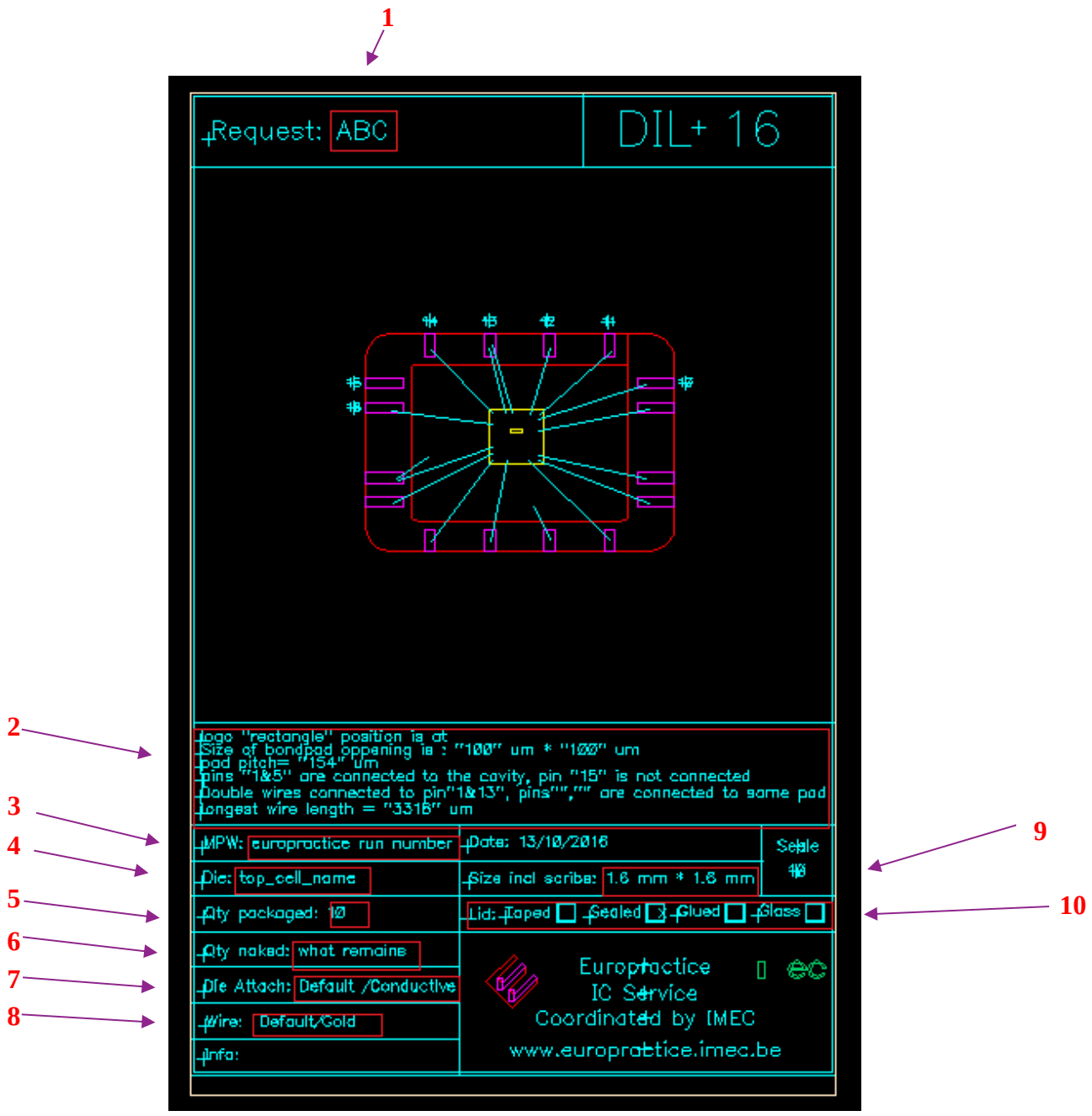

Figure 5: Bonding diagram example.

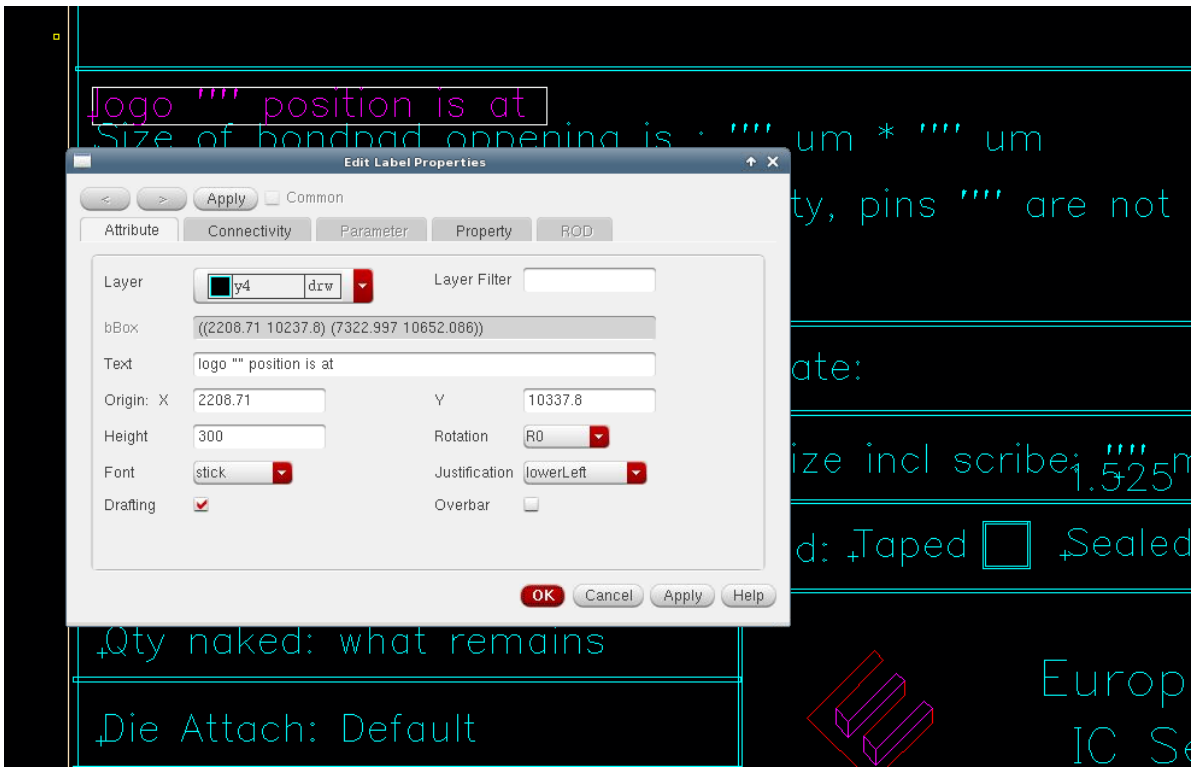

Figure 6: Editing text.

Creating a GDS file with the bonding diagram

- To export the bonding diagram, make sure that the extra layers (used for the bonding diagram) in addition to the technology layers are all exported.
- Please do not load the layer table which contains the layers (y0-y4) during export as this will result in the loss of the technology layers from the exported GDS and your design will appear as an empty spot in the place of the die. Please add these extra layers (y0-y4) to the existing technology layer table as shown in Figure 7.
- Make sure you choose the right top cell which contains the bonding diagram during export.
- Please double check that the exported GDS is as it should be before sending it to us. For this you can use any layout viewer such as Calibre RVE or free tools such as K-Layout for example.

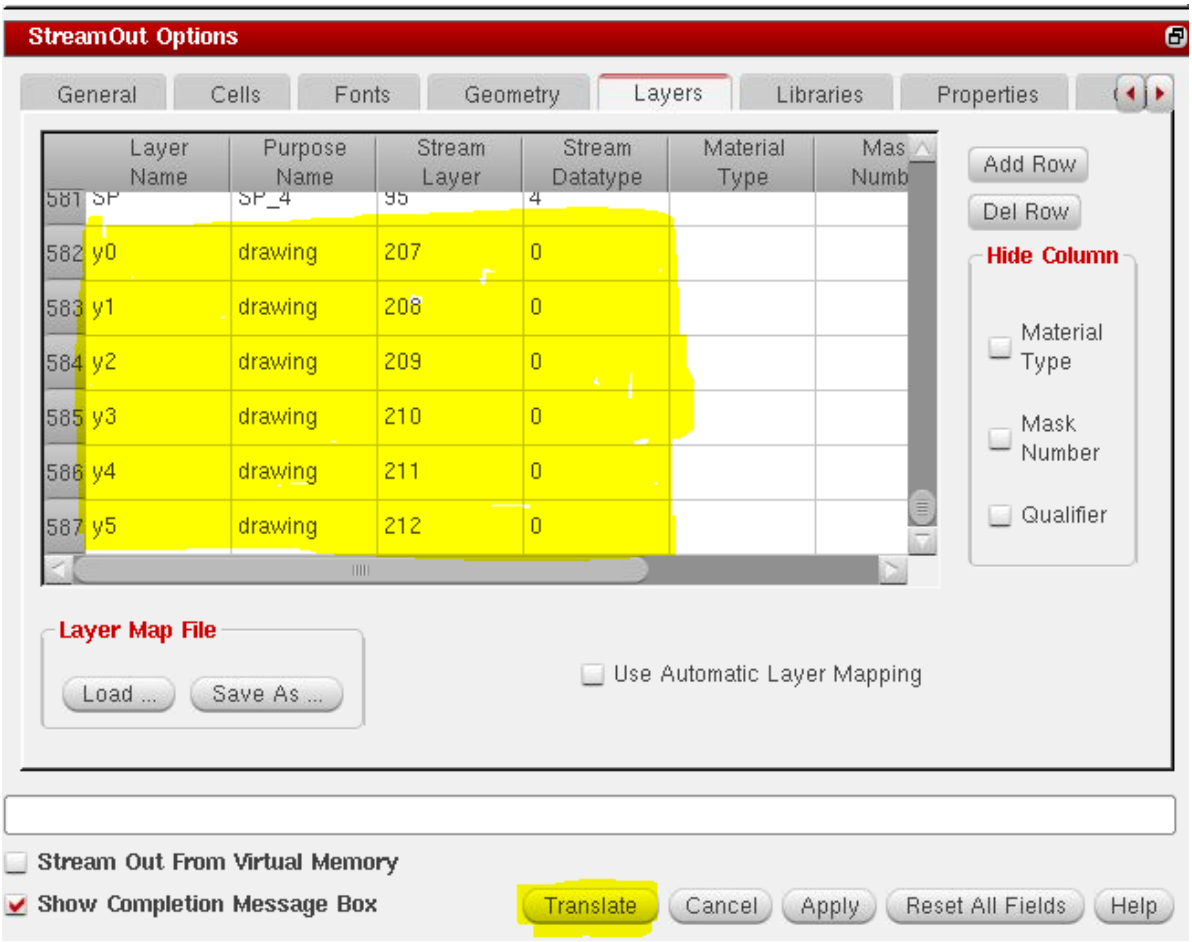

Figure 7: Adding layers during stream out.

Preparing a bonding request

Please send us your wirebonding request by e-mail. This e-mail should mention the reference number of your design, and contain 3 attachments:

- A screenshot of your wirebonding diagram, which includes information on the package used. A screenshot example is shown in Figure 8.
- A detailed screenshot of the package and the connections to your chip. The pins on the package, the pads on the chip, and every connection between each pin on the package and each pad on the chip should be clearly visible. Packaging requests with unclear connections will not be processed. A screenshot example is shown in Figure 9.
- The GDS of your packaging request.

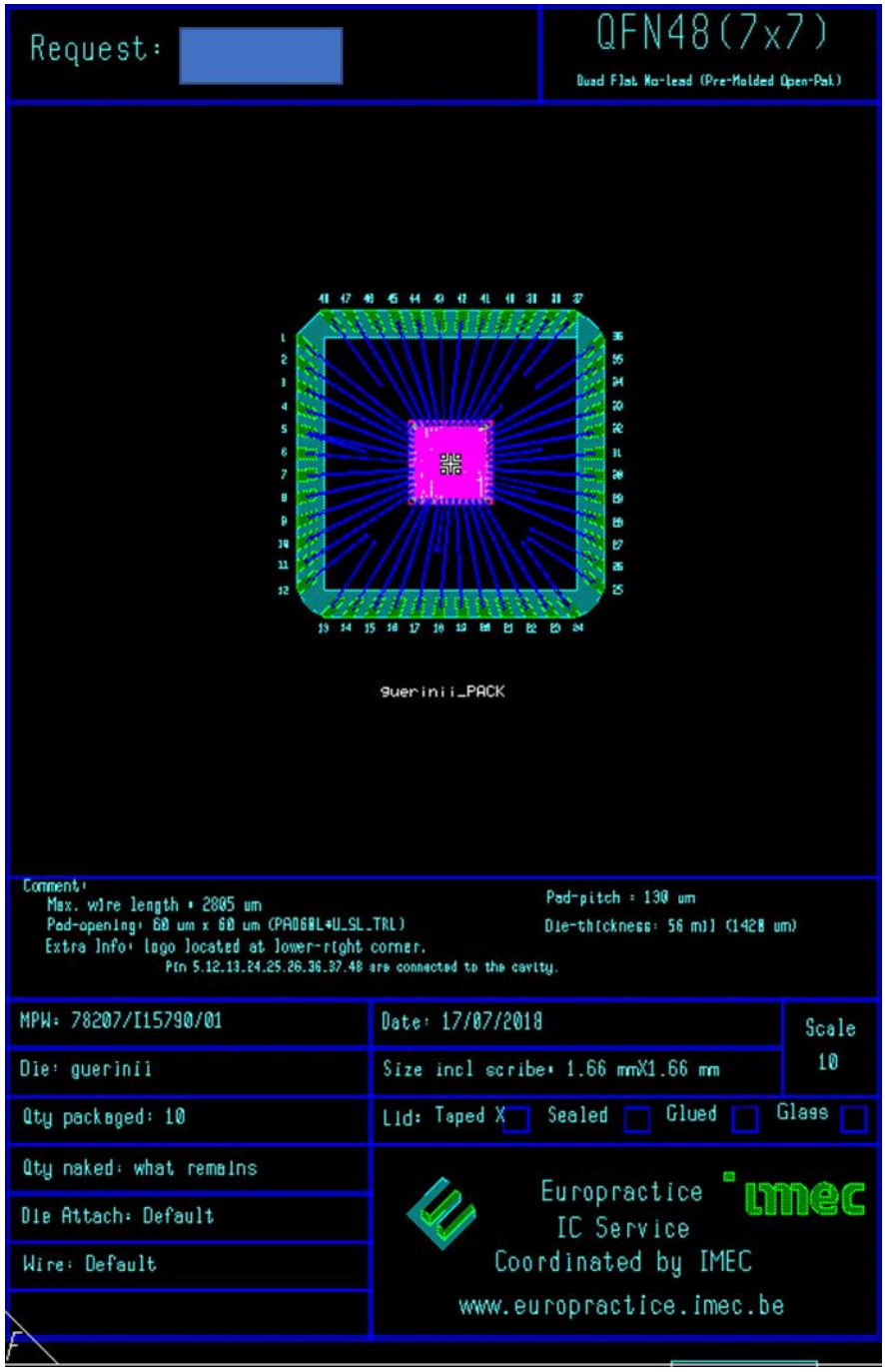

Figure 8: Wirebonding diagram screenshot. The screenshot should be such that the name of the package, the package itself, the chip and all relevant information are clearly visible.

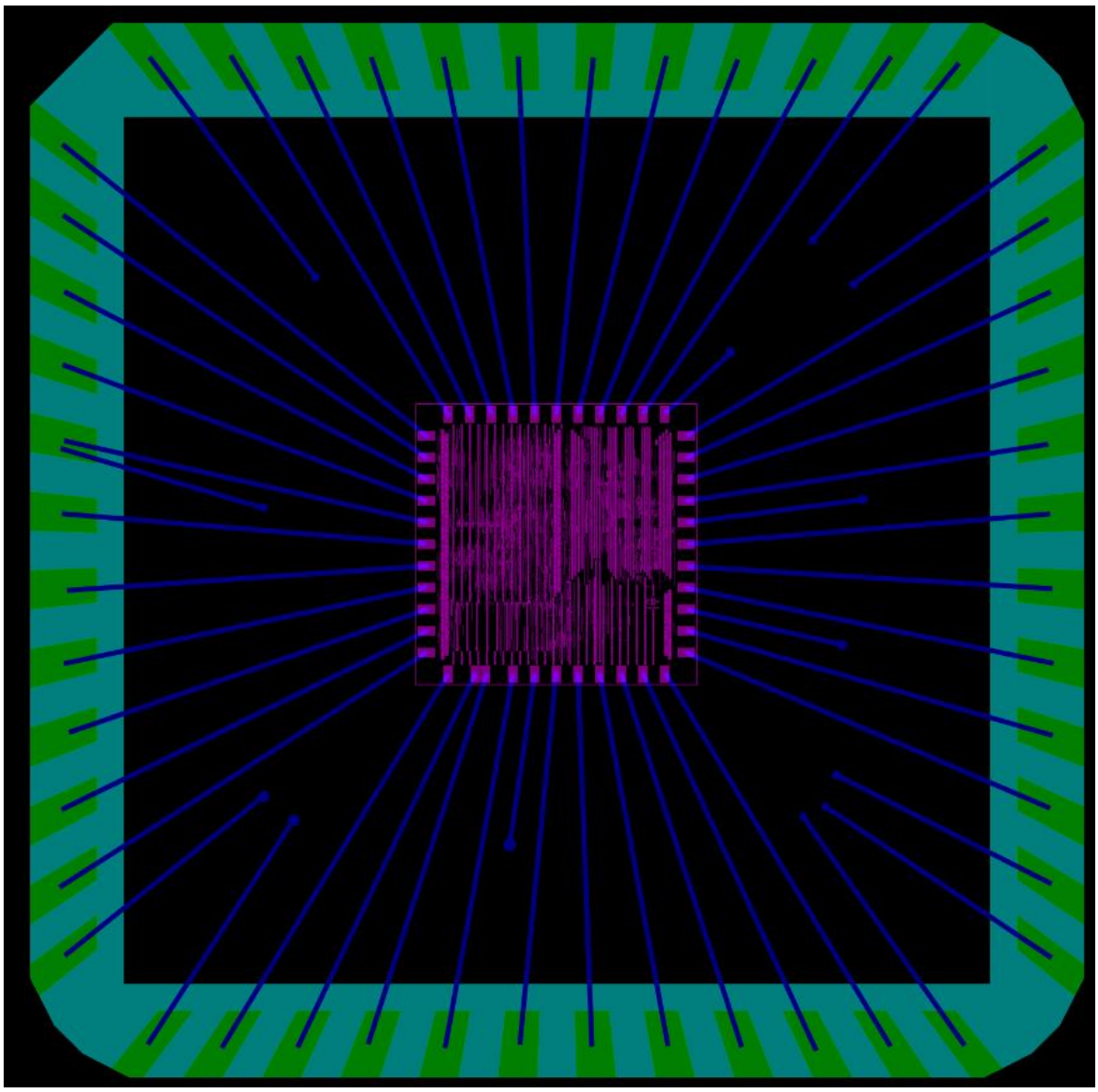

Figure 9: Screenshot of the package and its connections. The pins of the package, the pads of the chip and all the connections between the package's pins and the circuit's pads should all be clearly visible.

Aside from the 3 attachments described above, the e-mail you send us should also contain the following table, completed:

- Package
- Technology
- CUP (Circuit Under Pad)
- Min bond pad pitch
- Polyimide (yes/no)
- Die size
- Passivation opening
- Die material
- Total number of dies
- Number of dies to package
- Wafer thickness
- Lid attach method
- Glue type

Below is some information on how to complete the different fields.

- Package: The package you require. The name inserted here should correspond to the package name indicated on the wirebonding diagram. For example, in the case of the submission example shown in Figure 8, the package is QFN48 (7x7).

- Technology: Foundry and technology node your design was made in. For example, TSMC 180nm.

- CUP (Circuit Under Pad): If your design contains metal paths or TSMC IO cells beneath the pads, other than the metal of the pad itself, then it's a CUP and you should answer "Yes". Otherwise, answer "No".

- Min bond pad pitch: Find the pads in your circuit that are closest to each other and measure the pitch between these 2 pads.

- Polyimide (yes/no): If your design contains a polyimide layer, answer "Yes". Otherwise, answer "No".

- Passivation opening: Measure the dimensions in micro-meters of the passivation openings in your design. The passivation opening layer is called CB and corresponds to CAD layer 19.

- Die material: Please put "Silicon" here since this is the standard die material.

- Total number of dies. Please specify the total number of dies you have for this design. Usually this is 40 dies (for 8 inch technologies) or 100 dies (for 12 inch technologies) unless you order additional dies.

- Number of dies to package: Please specify the number of dies to be packaged using the wirebonding diagram you are submitting a wirebonding request for.

- Wafer thickness: Please specify the wafer thickness in mils and in micrometers (1 mil = 25.4um).

- Lid attach method: Specify one of the 4 possible options: sealed / taped / glass / glue.

- Glue: Please specify if you want conductive epoxy (default), or non-conductive epoxy.

Two lines of marking will be added to your package. You may choose what text appears on these 2 lines, but please note there is a maximum of **10 characters** allowed per line.

Please specify in your e-mail what text you would like to see on:

- Line 1
- Line 2

Important remarks:

1) There is a minimum order of 10 piece per packaging request.
   1 packaging request =
   - > = 10 dies to be packaged
   - The dies should come from the same tray (waffle pack)
     - If dies from separate trays need to be packaged, there will be additional costs
   - The same wirebonding diagram must apply for all dies to be packaged
   - The screenshot of the wirebonding diagram must correspond to the dies to be packaged.

2) From the day the bare dies are shipped to the assembly house, it takes on average 1 month before the packaged dies return to imec.

3) The bare dies and packaged dies will be shipped to you at the same time in one single shipment.
   If the bare dies need to be shipped separately, additional shipment costs will apply.

4) If your packaging request is for a chip designed in a shrinkage node (**28nm/40nm/55nm**), you should complete the table below (and not the "standard" one mentioned above) :

   - Package
   - Technology
   - CUP (Circuit Under Pad)
   - Min bond pad pitch (drawn in layout, **before** shrinkage)
   - Min bond pad pitch (on silicon, **after** shrinkage)
   - Polyimide (yes/no)
   - Die size (drawn in layout, **before** shrinkage)
   - Die size (on silicon, **after** shrinkage)
   - Passivation opening (drawn in layout, **before** shrinkage)
   - Passivation opening (on silicon, **after** shrinkage)
   - Die material
   - Total number of dies
   - Number of dies to package
   - Wafer thickness
   - Lid attach method
   - Glue type

Sending your request

When you have gathered all the necessary information for your request, please send your bonding request by e-mail to the following accounts/people:

- The packaging team:
  - Hennan Oflu: Hennan.Oflu@imec.be
  - Sven Decock: Sven.Decock@imec.be
  - Maryse Wauters: Maryse.Wouters@imec.be
  - ASIC Assembly: asicp.assembly@imec.be

- Your imec technical contact from eptsmc (Ahmed/Jan/Jonas/Mohamad/Pieter/Sebastien/Steve/Theodosis)

- Eptsmc: eptsmc@imec.be

Make sure this e-mail contains:

- 3 attachments as described above (screenshot + detailed screenshot + GDS)
- The completed table with information on your design
- The text you would like to see on your package.
- The reference number of your submission
  - Your TSMC "TM" number (example: TMKW01_C05)
  - If this is a Europractice reservation or not (yes/no)
  - If Yes:
    - Your Europractice reference number (example: 78614/A12345/01)
    - If it is an MPW run or a mini@sic run
    - The run number (example: 6375)
- The name of your institution

Packaging can not proceed if some of the above information is missing.

Please make sure to send your packaging request at the latest 3 weeks after your tape-out is submitted and the final tape-out forms have been sent to you.

Please note that all pricing information can be found on Europractice's website.