

LIQ File Format

The LIQ file contains all the information to create a database in AsPacker as well as all the geometries needed when importing into a PCB layout package. There are 8 sections to the LIQ file plus and [End LIQ] statement. Each one must be present and in the proper order to be considered a valid LIQ file. Any deviation from this format will make the LIQ file invalid as far as reading it back into AsPacker. Lines that start with an “*” are considered comments. All unites are in microns

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The Header

This section contains all the information concerning the Die and File properties.

AsPacker IQ File Version 4.0 Generated with AsPacker Version 1.0.1.0

*

Output LIQ file = C:\....\Demo.liq 10/26/2014 1:13:44 PM

*

Input Pin file = Demo.pinlist 6/22/2014 7:01:35 AM

Input Die file =

Input Net file =

*

* Origin (0,0) at Center of the Die

* Back Bias ??

*

LIQ_PART_NAME ABC

LIQ_COMPONENT U1

UNITS Microns

TECHNOLOGY Wire_Bond

[Component Size]

CompL 2140.000

CompW 1420.000

CompZ 525.000

Rotation 0.000

OffsetX 0.000

OffsetY 0.000

OffsetZ 0.000

*

- The first line identifies the version of the LIQ file format and the version on the AsPacker tool.
- The next line identifies the LIQ file name and path where it resides as well as the date and time of creation.
- The **Input Pin File** is the original source of the Die properties and pad sizes and locations on the die
- The **Input Die File** is reserved for future use when a bitmap of a die can be imported as an underlay to the die.
- The **Input Net File** is an optional Netlist file which can be used to assign Net names to the pads on the die. For not it is not used and reserved for future versions.
- The **Origin** is either the Center or the Lower Left Corner.of the die and the (0:0) point of the coordinates.
- The **Back Bias** is for documentation only but defines the electrical potential of the back of the die. Normally this would be Ground or VSS.
- The **LIQ_PART_NAME** Defines the Name of the die. 68HC11
- The **LIQ_COMPONENT** Defines the part as found in the netlist U1, U2,....
- **CompL** is the Length of the Die. (Y direction)
- **CompW** is the Width of the Die. (X direction)
- **CompZ** is the height or thickness of the Die. (Z direction)

- **Rotation** is the rotation applied to a die and used for Stacked Devices which will be implemented in future releases.
- **OffsetX** is any X offset added to a Stacked Device.
- **OffsetY** is any Y offset applied to a Stacked Device.
- **OffsetZ** is the level at which a Stacked Device resides. A total of all the devices below it.

For each die in the design there is a matching Input File section and Component/Die definition section. The Origin and Back Bias only apply to the Base or Bottom Die which also has a Rotation, OffsetX, OffsetY and OffsetZ equal to 0.

[Component Bond Pads]

This section defines all the pads on the die. All lines begin with “CBP”.

CBP#	Part	Xcoord	Ycoord	Layer	Height	Width	Edge	Shape	Type	NetName	APRef#
CBP 2	U1	-680.000	870.000	CBP-NS	40.000	40.000	L	Rectangle	Signal	NET2	1

- **CBP#** is the pad number on the Die.
- **Part** is the Component name of the Die. (U1, U2, ...)
- **Xcoord** is the X location of the center of the pad.
- **Ycoord** is the Y location of the center of the pad.
- **Layer** is the Placement layer in the CAD tool by default and legacy it is CBP-NS.
- **Height** is the Y dimension of the pad.
- **Width** is the X dimension of the pad.
- **Edge** is the assigned edge of the pad.
- **Shape** by default is Rectangle but if future releases Round will also be available
- **Type** defines what the pad is used for. Signal (Blue), Power (Red), or Ground (Green).
- **SignalName** is the assigned name for the pad. This can be imported using the netlist when that feature is added to the tool.
- **APRef#** is a unique AsPacker Reference number for each SBP. Used to identify Package pins in some layout packages.

Note: The Height and Width of a pad are relative to the edge. The X and Y dimensions are as then appear if the pad is at the top edge of the pad. For Example. If a pad is on the left edge of the die the X and Y coordinates are swapped because the pad has been rotated by 90 degrees.

[Substrate Bond Pads]

This section defines all the Substrate Bond Pads used in the design. All lines begin with “SBP”.

* CBP#	SBP#	Part	Xcoord	Ycoord	Layer	Length	Width	Rot	Shape	Row	Edge	Group	NetName	APRef#
SBP 2	2	U1	-1972.230	1395.930	SBP-NS	200.000	100.000	19.827	Oval	3	L	0	NET2	1

- **CBP#** is the Component Bond Pad that is associated with the substrate Bond Pad.

- **SBP#** is the Substrate Bond Pad number and is normally the same as the CBP#. This is also known as the Package Pin.
- **Part** is the Component name of the Die (U1, U2 ...)
- **Xcoord** is the X location of the center of the pad.
- **Ycoord** is the Y location of the center of the pad.
- **Layer** is the Placement layer in the CAD tool by default and legacy it is SBP-NS.
- **Length** is the Y dimension of the pad. This is also the width of the Ring that the SBP sits on.
- **Width** is the X dimension of the pad.
- **Rot** is the rotation that is applied to the pad.
- **Shape** is either Rectangle or oval depending on how it is drawn in the CAD tool and FAB house
- **Row** defines which tier or level the pad is placed on.
- **Edge** defines the edge that the SBP is associated with.
- **Group** is the Fanout Group number assigned to the bad during the Fanout process.
- **NetName** is the net associated with the SBP and is the same as the CBP net name.
- **APRef#** is a unique AsPacker Reference number for each SBP. Used to identify Package pins in some layout packages.

Note: The Height and Width of a pad are relative to the edge. The X and Y dimensions are as then appear if the pad is at the top edge of the pad. For Example. If a pad is on the left edge of the die the X and Y coordinates are swapped because the pad has been rotated by 90 degrees. The rotation is also relative to the edge of the die ranging +180 to -180 degrees with 0 being perpendicular to the edge. If viewed at the top edge – is to the left and + is to the right.

[Wirebonds]

This section defines the wire connections between the die and the PCB or Package. Both the CBP and SBP attach points can have an X or Y applied to them as applied with 0 rotation and as viewed on the top edge of the die. All lines begin with “WB”.

```
* CBP# Part Xcoord Ycoord Xoffset Yoffset SBP# Xcoord Ycoord Xoffset Yoffset CBPZ SBPZ APRef#
WB 2 U1 -680.000 930.000 0.000 0.000 2 -1972.230 1395.930 0.000 0.000 525.000 0.000 1
```

- **CBP#** is the Component Bond Pad on the die and sometimes referred as the From Point.
- **Part** is the Component name of the Die (U1, U2 ...)
- **Xcoord** is the X location of the center of the pad.
- **Ycoord** is the Y location of the center of the pad.
- **Xoffset** is the X offset applied to the CBP attach point.
- **Yoffset** is the Y offset applied to the CBP attach point.
- **SBP#** is the Substrate Bond Pad on the die and sometimes referred as the To Point.
- **Part** is the Component name of the Die (U1, U2 ...)
- **Xcoord** is the X location of the center of the pad.
- **Ycoord** is the Y location of the center of the pad.
- **Xoffset** is the X offset applied to the SBP attach point.

- **Yoffset** is the Y offset applied to the SBP attach point.
- **CBPZ** is the Attach point elevation. On the base die it is the thickness of the Die.
- **SBPZ** is the Attach Point elevation. Normally this is 0 but may vary depending on the mounting technology used.
- **APRef#** is a unique AsPacker Reference number for each SBP. Used to identify Package pins in some layout packages.

Note: The reason for having Attach Point offsets is to accommodate possible rework and bonding to a new site as well as the ability to have multiple attach points on a given pad for multiple wirebonds.

[Stitches]

This section defines wires that do not go to the PCB or Package and used when stacked devices are used and you want to connect CBPs on one die to the CBPs on another Die. These are manually placed wires. This feature will be implemented in future releases of the tool. All lines begin with “**STITCH**”.

```
* Pad1# Part Xcoord Ycoord Xoffset Yoffset Pad2# Part Xcoord Ycoord Xoffset Yoffset Pad1Z Pad2Z
Stitch 2 U1 -680.000 930.000 0 0 2 U2 -580.000 830.000 0 0 525.000 1050.000
```

- **Pad1#** is the CBP on the Upper Die.
- **Part** is the Component name of the Upper Die (U1, U2 ...)
- **Xcoord** is the X location of the center of the pad on the Upper Die.
- **Ycoord** is the Y location of the center of the pad on the Upper Die.
- **Xoffset** is the X offset applied to the CBP attach point on the Upper Die.
- **Yoffset** is the Y offset applied to the CBP attach point on the Upper Die.
- **Pad2#** is the CBP on the Lower Die.
- **Part** is the Component name of the upper Die (U1, U2 ...)
- **Xcoord** is the X location of the center of the pad on the Lower Die.
- **Ycoord** is the Y location of the center of the pad on the Lower Die.
- **Xoffset** is the X offset applied to the CBP attach point on the Lower Die.
- **Yoffset** is the Y offset applied to the CBP attach point on the Lower Die.
- **Pad1Z** is the Attach Point elevation on the Upper Die.
- **Pad2Z** is the Attach Point elevation on the Lower Die.

[Rings]

This section describes the geometries of the rings used in the fanout process. All Lines begin with “**RING**”.

```
* No. Shape UpperLeftX UpperLeftY LowerRightX LowerRightY Width Bulg Type
RING 1 Flat -1260.000 1620.000 1260.000 -1620.000 100.000 0.000 Ground
```

- **No.** is the ring number starting from the die edge and going outward. A maximum of 4 rings can be defined.
- **Shape** defines the shape if the ring either Flat or Arc.
- **UpperLeftX** is the X coordinate of the Upper Left corner of the Ring.
- **UpperLeftY** is the Y coordinate of the Upper Left corner of the Ring.
- **LowerRightX** is the X coordinate of the Lower Right corner of the Ring.
- **LowerRightY** is the Y coordinate of the Lower Right corner of the Ring.
- **Width** defines the width of a ring if the style is Ring. It also defines the height of the SBPs placed on the Ring.
- **Bulge** defines Arc height if the ring has a shape of an Arc.
- **Type** defines what the ring is used for. Power, Ground or Signal.

[Die Attach Pad]

This section defines the geometries on the Die Attach pad and associated attachment to the inner ring if specified in the Die Attach tool. This section is also broken down into several sub categories. 1. Attach Pad Margin. 2. Attach Pad Hatch if the Hatch option is selected. 3. Attach Corners if the corner option is selected. 4. Attach Side if the Side option is selected. All these geometries are defined as single line with a start and end point along with the line width. All lines begin with “DAP.”

```
*   Shape  StartX  StartY  EndX    EndY    Width
DAP Line   49.998 -49.998 49.998 -49.998 100.000
```

- **Line** is the Shape of the geometry. In this case all are type Line.
- **StartX** is the X coordinate of the line Start Point.
- **StartY** is the Y coordinate of the line Start Point.
- **EndX** is the X coordinate of the line End Point.
- **EndY** is the Y coordinate of the line End Point.
- **Width** is the width of the line.

[Tool Setup]

This section defines all the project settings. It does not contain any geometry information. This section is needed to reproduce a complete project from scratch using the LIQ file as the input source. It contains several sub sections. 1. **TIER** defines all the tiers properties. 2. **DRC** defines the DRC rules for each Tier. 3. Die **ATTACH** defines the die attach properties. 4. **DEF** defines all the other project default values.

Tiers:

*Tiers

```
*   # Distance  Style Shape  Bulge Type  SBPOrientation SBPShape  SBPWidth  SBPHeight
TIER 1  500.000  Ring Flat   100.000 Ground Angle      Rectangle  100.000  100.000
```

- # is the Tier number starting at the ring closest to the die and moving outward.
- **Distance** is the distance from the Die Edge to the inner edge of the ring.
- **Style** is the shape of the Ring either flat or Arc.
- **Bulge** defines the height of the arc if the Style is Arc.
- **Type** defines how the ring is used Power, Ground or Signal.
- **SBPOrientation** defines the orientation of the SBPs on a given Tier. Either Orthogonal (perpendicular to the die edge) or Angled.(aligned along the wire going to the CBPs).
- **SBPShape** defines the shape of the SBPs on a given Tier. Either Rectangle or Oval. (end caps of the pad)
- **SBPWidth** defines the width of the SBPs on a given Tier.
- **SBPHeight** defines the height of a Tier if it is Type Ring. It also defines the height of the SBPs on a given Tier.

DRC:

*DRC

* #	WireWidth	WireToWire	WireToPad	PadToPad	MaxLength	MaxAngle
DRC 0	25.400	50.000	50.000	100.000	6350.000	45.000

- # is the Tier number.
- **WireWidth** is the Width of the wire associated with a given SBP tier assignment. Normally all Wire Widths for all Tiers will be the same.
- **WireToWire** defines the Wire to Wire distance for a given Tier used during the Fanout Process and DRC checks. Currently not implemented and reserved for future versions of the tool.
- **WireToPad** defines the Wire to Pad distance for a given Tier used during the Fanout Process and DRC checks.
- **PadToPad** defines the Pad to Pad distance for a given Tier used during the Fanout Process and DRC checks.
- **MaxLength** is the Maximum Length of a wire and used for post process DRC checks and statistics.
- **MaxAngle** is the Maximum Angle of a wire relative to its edge and used for post process DRC checks and statistics.

Die Attach Pad:

*Die Attach

* Style	Rows	Columns	Width	Margin	Points	Width	Count	Angle
ATTACH Hatch	3	3	100.000	0.000	Both	100.000	3	Radial

- **Style** defines what the pad looks like. Either Solid or Hatch.
- **Rows** defines the number of Rows in the hatch pattern if the Style is Hatch.
- **Columns** defines the number of Columns in the hatch pattern if the Style is Hatch.
- **Width** defines the width of the hatch lines if the Style is Hatch.
- **Margin** defines the distance from the die edge of the Solid or Hatch pad. Can be either positive or negative.

- **Points** defines how the Attach pad is connected to the inner ring. None if no attachment. Corner if attached at the corners. Side if attached to the sides. Both if attached to both the sides and the corners.
- **Width** defines the line width used when attaching a Die Attach Pad to the inner ring.
- **Count** is the number of attach points per side if side Points is either Side or Both.
- **Angle** defines how the Side attach points are created. Either orthogonal (perpendicular to the Die Attach Pad) or radial (angled radiating from the Die Attach Pad to the inner ring).

Default Options:

*Defaults

*	Fill	Text	Wires	Attach	DieOnly	Origin	Tips	Mouse
DEF	True	True	True	True	False	True	True	False

- **Fill** defines if the CBPs are drawn as filled polygons (True/False).
- **Text** defines if the pad text is drawn (True/False).
- **Wires** defines if the wires are drawn (True/False).
- **Attach** defines if the Die Attach Pad is drawn (True/False).
- **DieOnly** defines if the only theh Die is drawn (True/False).
- **Origin** defines if the Origin of the coordinate system is at the center of the die (True) or at the Lower Left corner (False).
- **Tips** defines if the Tooltips are displayed when the mouse hovers over a control. (True/False).
- **Mouse** reverses the direction of zoom with the mouse wheel.

Fanout Options:

*Fanout

*	Clear	Center	KGroups	P/P	UTangle	Left	Bottom	Right	Top	All	KOrder	KEdge	Effort	OverRun	Prec.	CkDRC
FAN	True	True	True	True	True	True	True	True	True	True	True	True	10	15	3	True

*End Fanout

- **Clear** defines if the Fanout will be cleared before a fanout is initiated (True/False)
- **Center** defines if group centering is used during the fanout process(True/False)
- **KGroups** defines if previous group assignments should be kept (True/False)
- **P/P** defines if Push/Pull is used during the fanout process (True/False)
- **UTangle** defines how crossed wires are to be handled with stacked die (True/False)
- **Left** defines whether or not the side should be used during the fanout (True/False)
- **Bottom** defines whether or not the side should be used during the fanout (True/False)
- **Right** defines whether or not the side should be used during the fanout (True/False)
- **Top** defines whether or not the side should be used during the fanout (True/False)
- **All** defines if all the pads are to be fanned out or just selected pads (True/False)
- **KOrder** defines if previous pin order assignment should be kept (True/False)
- **Kedge** defines if previous edge assignment should be kept (True/False)
- **Effort** defines the number of iterations to be executed during fanout (1:10)
- **OverRun** defines how far past the tier bounds a SBP can be placed (%Tier Bounds)
- **Prec.** precision used during the group centering process.

- **CkDrc** Defines if post fanout wire Length and Angle are done (True/False)

[END LIQ]

This is the end of file indicator and the last statement in the LIQ File.