

# Wire Bond Profiles

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### Purpose

Bond wires are 3D entities that connect a die pin to a package substrate finger or another die pin.

This application note describes the process of defining Wire bond profiles and how they are applied to specific bond wires in the design.

### Audience

This document is intended for package designers who want to understand what Wire bond profiles are and how they are used.

### What are Wire bond profiles and how are they used?

Wire-bonding is the method of making electrical interconnections between an integrated circuit (IC) or other semiconductor device and its package, during semiconductor device fabrication.

Wire-bonding is a solid-state welding process where the two metallic materials (wire and pad surface) are brought into an intimate contact. Once the surfaces are in intimate contact, electron sharing or interdiffusion of atoms takes place, resulting in the formation of wire bond.

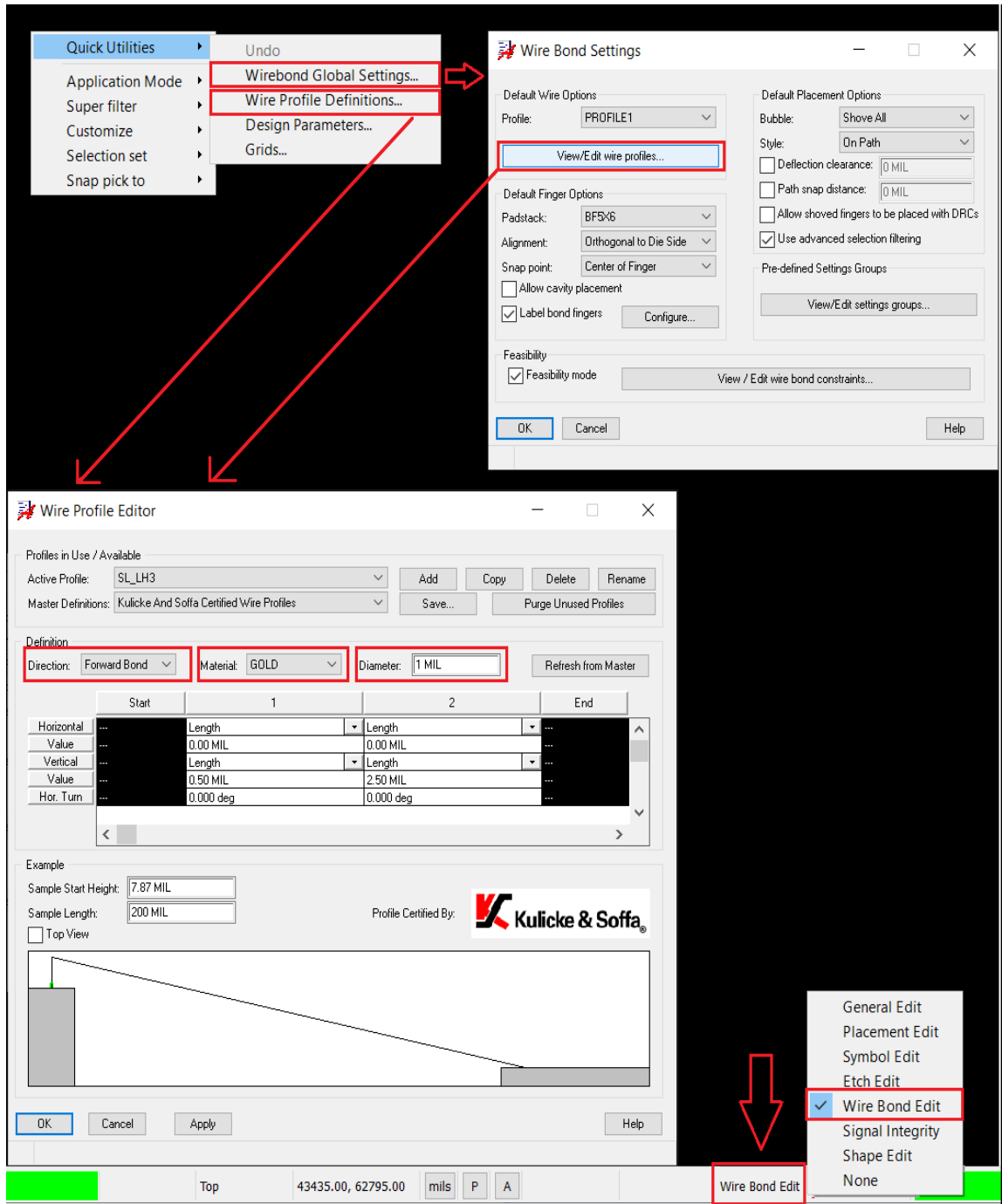
Wire bond profiles define the 3D curvature of bond wire objects as they connect from their starting object to their ending object. Bond wires are a unique type of object in a SiP or APD design in that they connect two other objects (typically, a wire bond die pad to a bond finger or power/ground ring, though there are many other possible combinations), which are most commonly at different vertical heights.

### What is a Wire bond profile?

A wire bond profile definition, as mentioned earlier, defines the 3D curvature or shape of a bond wire. Profile definitions are frequently obtained from the company that manufactures the wire-bonding machine and come certified as correct. However, it is possible to create and define your own custom profiles to meet the specific needs of your package substrate design – so long as that profile definition can be created by the bonding machine of the manufacturer.

- The *Wire Profile Editor* is accessible in the *Wire Bond Edit Application Mode*. The following image shows the definition of the SL\_LH3 profile in the *Wire Profile Editor*. This profile is just one of the wire bond profile definitions certified by Kulicke and Soffa, which ship as part of Cadence IC Packaging tools.

## Wire Bond Profiles

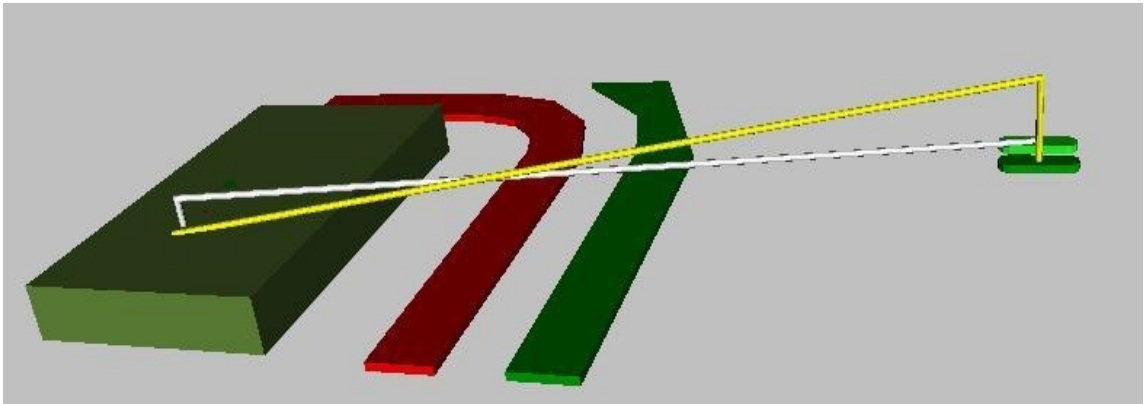


- The initial setup for a wire bond profile definition is 'Material' and 'Diameter' of bond wires referencing this profile. Typically, the Material is GOLD or COPPER and the Diameter is 1 MIL. The Material and Diameter are key attributes of the wire profile definition in terms of electrical characteristics of the bond wires using the profile.

## Wire Bond Profiles

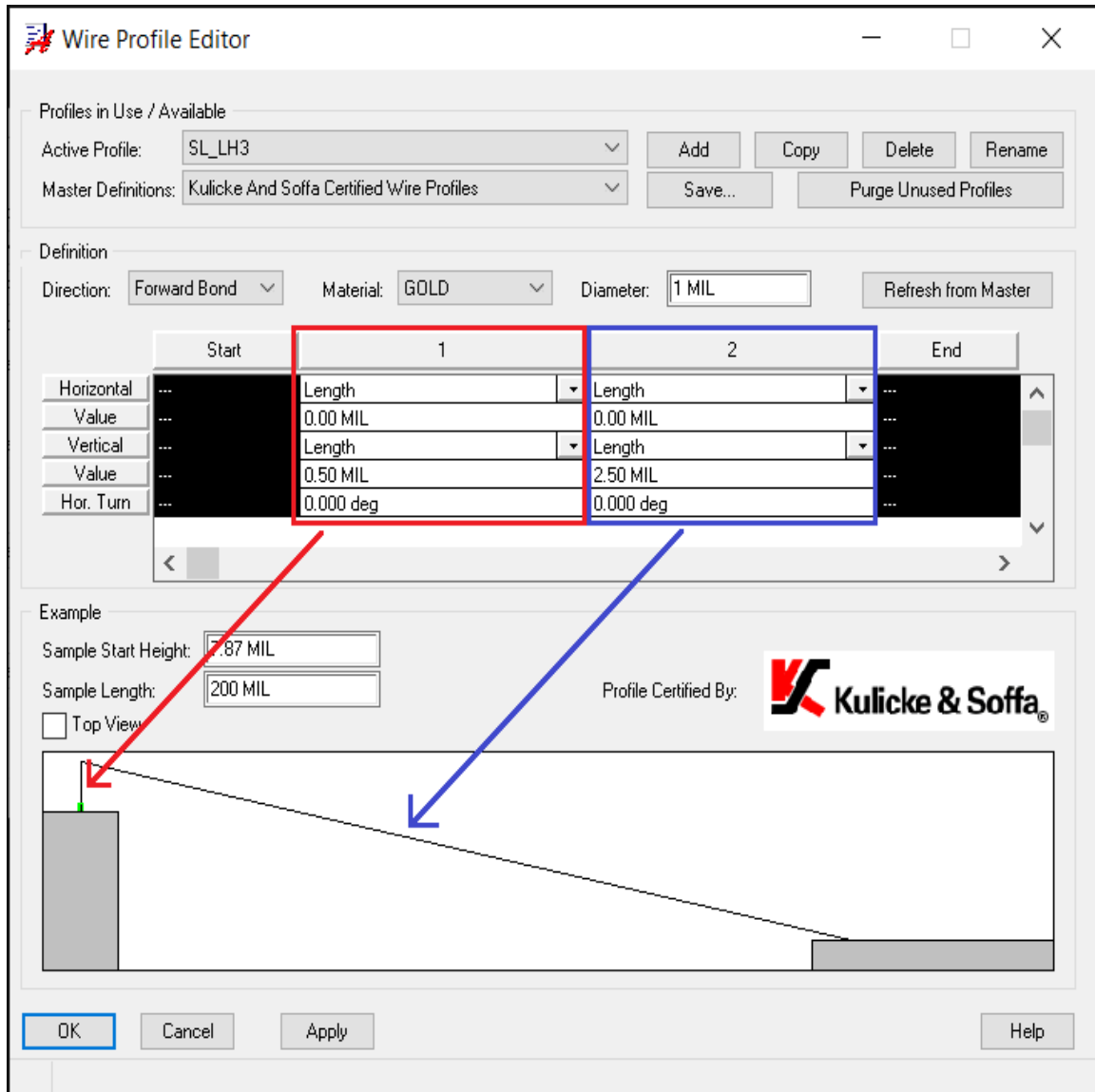
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- The profile also has a 'Direction'. The Direction governs how each bond wire is created by the bonding machine.
  - In a Forward Bond, the wire runs from the die pad to the bond finger.
  - In a Reverse Bond, the wire runs from the bond finger to the die pad.
- A Forward Bond will rise higher into the air at the die pad, while a Reverse Bond will be nearly horizontal by the time it reaches the die pad. In the following image, the white wire is a Forward Bond, while the yellow is a Reverse Bond:



- The wire profile definition has a list of steps to describe the curvature of the bond wire through the vertical space. Since each bond wire can have a unique 2D length (the distance between the start and end locations), the last segment of the 3D wire profile is calculated for each individual bond wire as the straight line between the two ends of the bond wire as defined by the list of movements.
- In the forward/reverse example image above, the yellow profile defines a single step, which is straight up in the vertical direction from the bond finger. The second segment of the wire, which connects the top of that first vertical segment to the die pad on the die, is calculated for each individual wire. This allows the same profile definition to be reused for wires of all lengths, and mimics how the bonding machine applies the profile definition when it is creating the physical wires in a design.
- A step in the profile is composed of a vertical and a horizontal segment. Each segment can be defined with an exact length (for example, 100UM), a percentage (for example, 10% of the wire's horizontal length), or an angle (for example 22.5 degrees from the horizontal plane).

## Wire Bond Profiles



### How is a Wire bond profile applied to specific bond wires in the design?

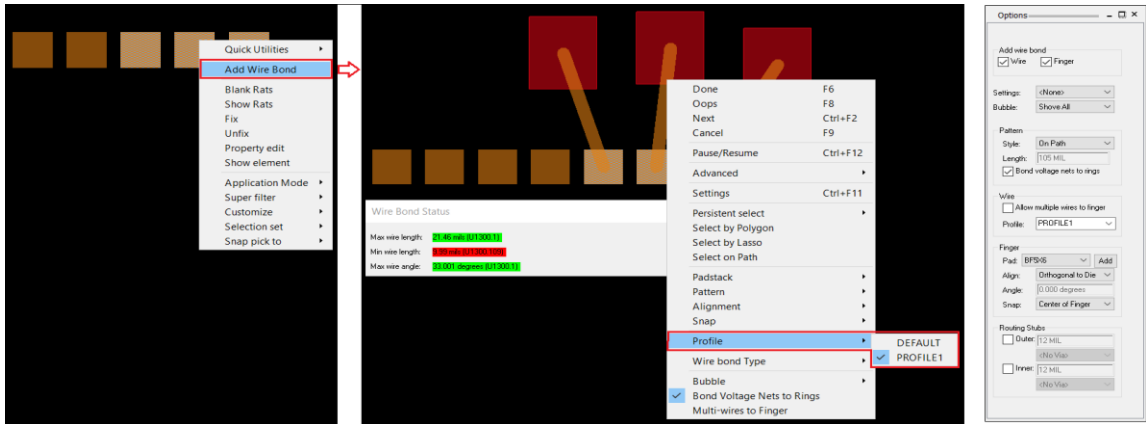
Once the process of defining the wire profile is done, it has to be applied to each individual bond wire in the design. As each bond wire may have a different start and end heights as well as different lengths, the exact path of each bond wire through the 3D space will be unique.

- In the *Wire Bond Edit Application Mode*, select the die pad that needs to be wire bonded and right-click on the canvas to see the **Add Wire Bond** option. Click on this and the wire bond comes attached with the cursor.

## Wire Bond Profiles

- Right-click gives a pop-down menu, which has the option to change the profile.
- The **Options** pane on the right-hand side also has options to change the Bond Finger pad, Wire Bond profile, and so on.

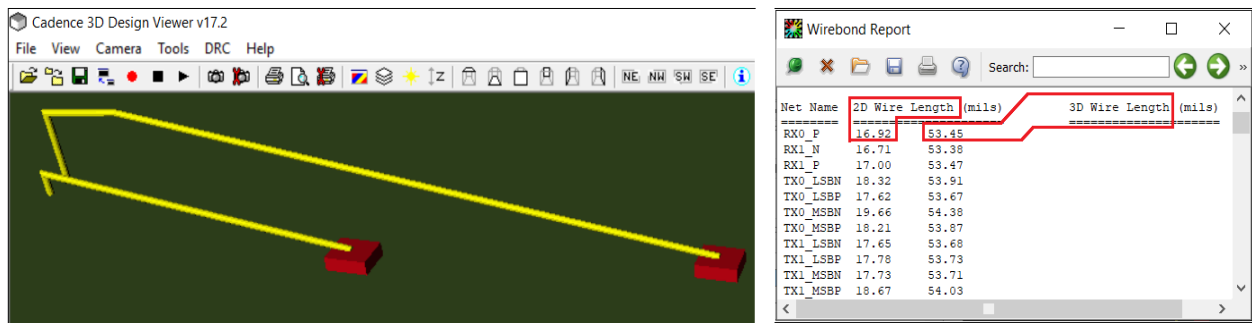
Refer to the following image:



## What commands make use of Wire bond profiles and 3D details of bond wires?

In many cases, the 3D details of a bond wire provide no additional accuracy for a command's processing. One example of this is any optical bond wire checks; the 2D, top-down view of the wires, as normally shown in the tool, provides all the information needed for optical verification. However, there are other commands where this information is crucial. The following tools take advantage of the 3D wire profile information:

- Cadence 3D Design Viewer (**View > 3D Model**)
- Wire Bond and Conductor Length Reports (**Reports > Wire Bond Report/Conductor Length Report**)



**Note:** Refer to [Creating a Wire Bond Profile \(Video\)](#). It shows the procedure in detail.



### Support

Cadence Support Portal provides access to support resources, including an extensive knowledge base, access to software updates for Cadence products, and the ability to interact with Cadence Customer Support. Visit <https://support.cadence.com>.

### Feedback

Email comments, questions, and suggestions to [content\\_feedback@cadence.com](mailto:content_feedback@cadence.com).