Packaging Evolution: From Basics to 3D Integration

Module 5: Package Design and Modelling – Building a Semiconductor Package from Scratch

Objective: To model a complete **wire bond semiconductor package cross-section** using **Ansys Electronics Desktop (AEDT)**, including all major components such as die, substrate, die attach, bond pads, wires, and Mold compound.

5.1 – Introduction to Cross-Section Modelling in AEDT

This hands-on lab is not focused on simulation but on **physical geometry creation** of a package in **Q3D Extractor**. The package stack includes:

- Die
- Die attach layer
- Substrate
- Bond pads
- Bond wires
- Mold compound

Package Specifications

Component	Material	Dimensions	Thickness/Height
Die	Silicon	3 mm x 3 mm	0.2 mm
Substrate	FR4	5 mm x 5 mm	0.5 mm
Die Attach Layer	Modified Epoxy	3 mm x 3 mm	0.1 mm
Die Bond Pads	Copper	0.2 mm x 0.2 mm	0.005 mm
Substrate Bond Pads	Copper	0.2 mm x 0.2 mm	0.01 mm
Bond Wire	Gold	JEDEC 4-point	-
Mold Compound	Epoxy	5 mm x 5 mm	1.2 mm

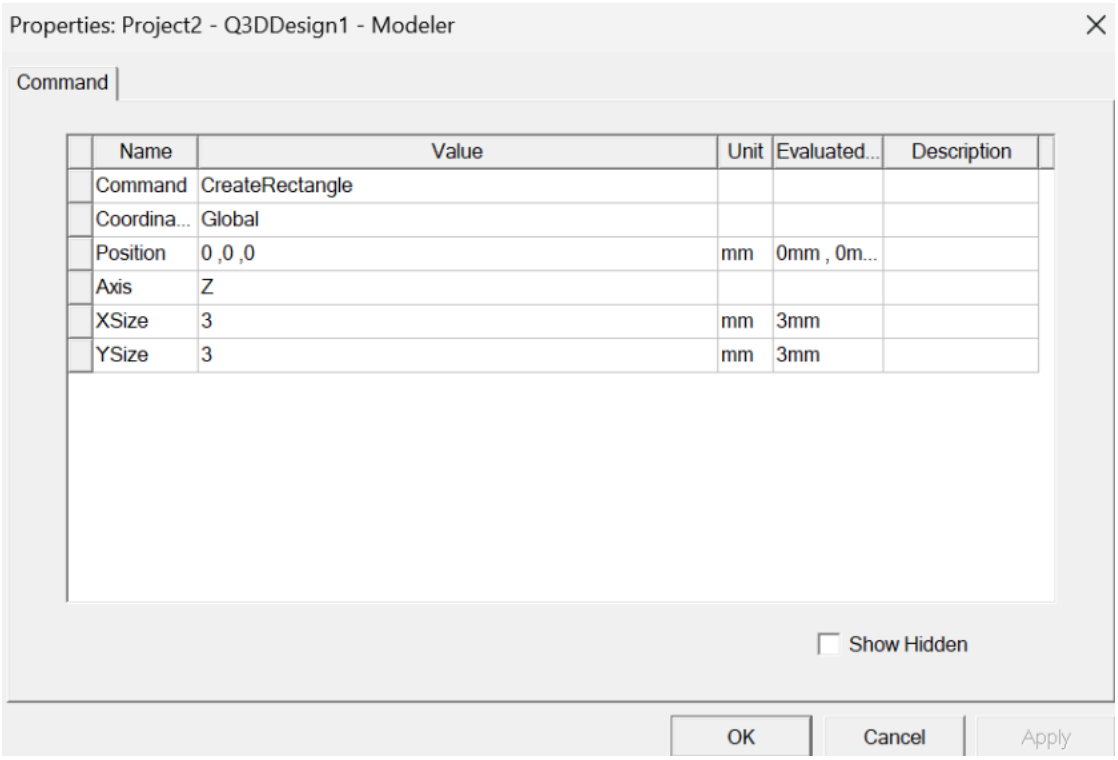
5.2 – Creating the Die and Substrate in AEDT

Step 1: Launch AEDT

- Select **Q3D Layout Design**.

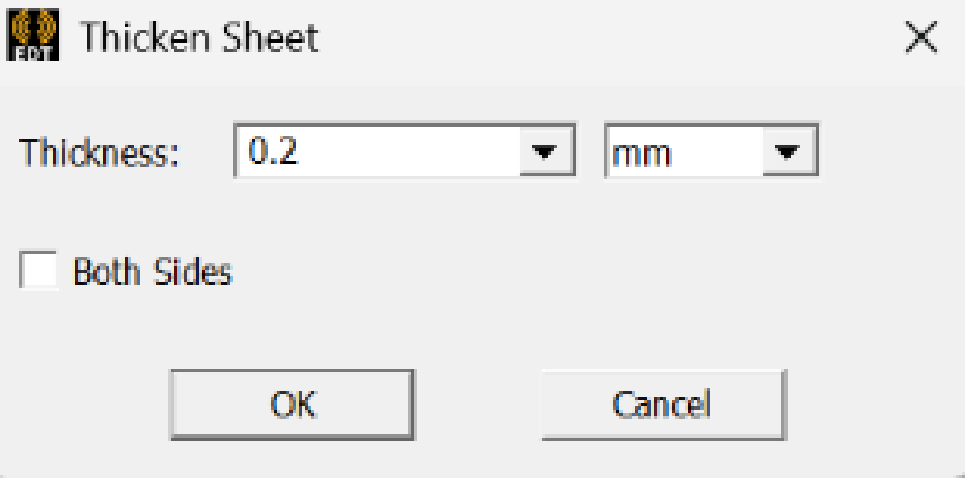
Step 2: Set Units

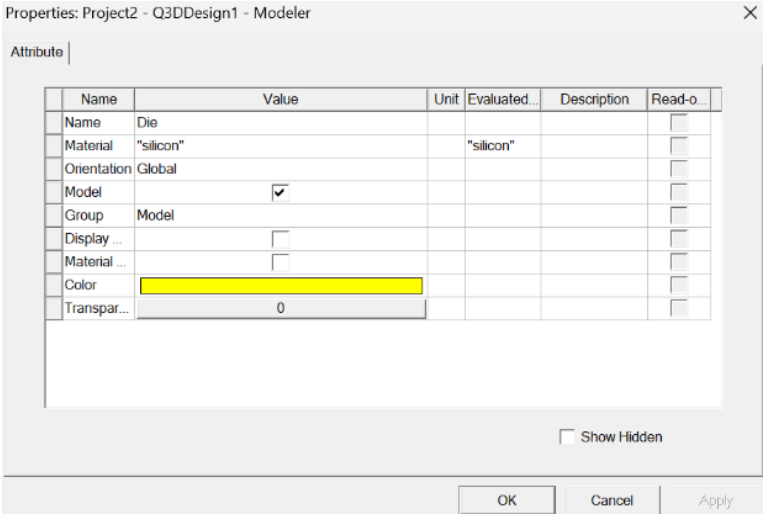
- Modeler → Units → mm (or µm for finer control)



Step 3: Create Die

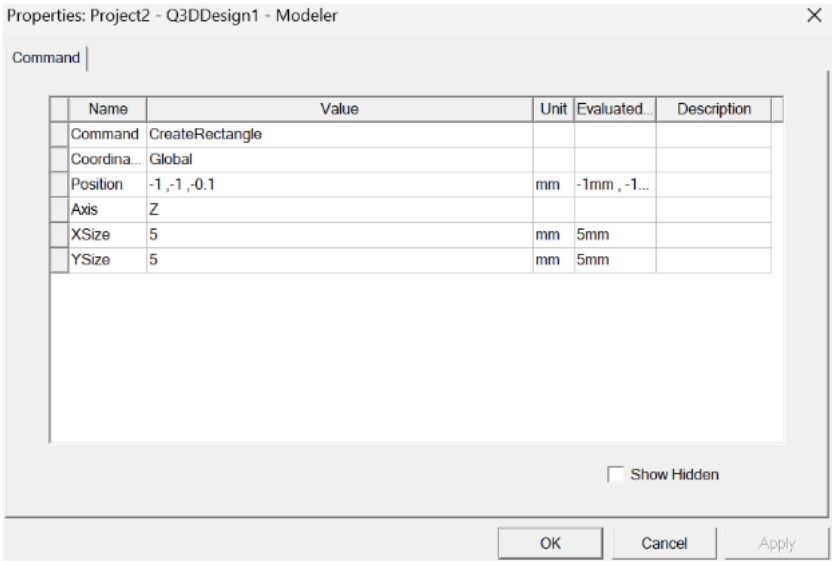
- Draw → Rectangle → 3 mm × 3 mm at (0, 0, 0)
- Modeler → Surface → Thicken Sheet → 0.2 mm
- Rename as **Die**, set **Material** = Silicon

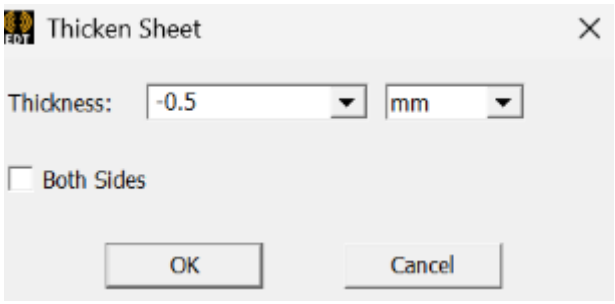


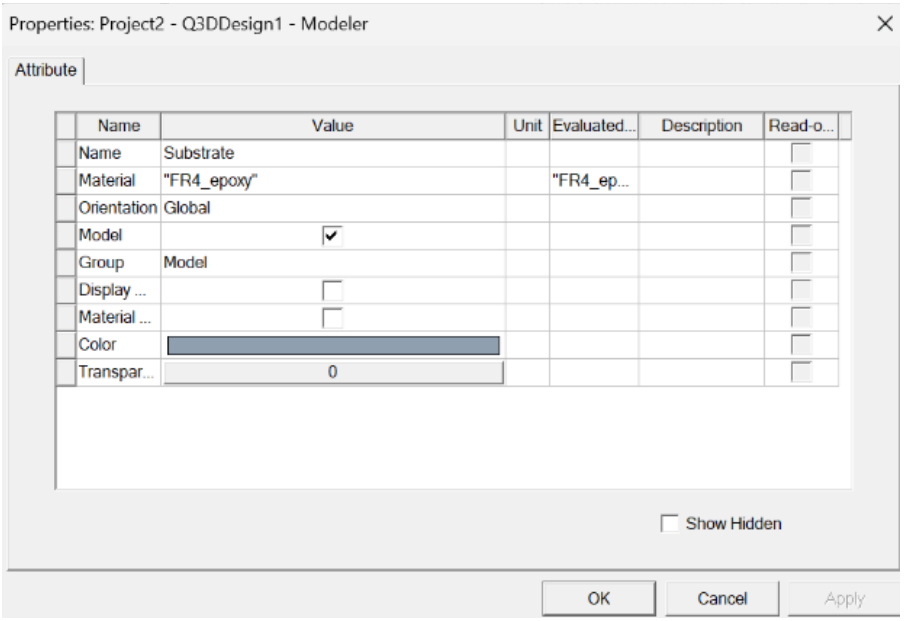


Step 4: Create Substrate

- Draw rectangle → 5 mm × 5 mm
- Position at (−1, −1, −0.1)
- Thicken Sheet → −0.5 mm
- Rename as **Substrate**; set **Material** = FR4


Properties: Project2 - Q3DDesign1 - Modeler
Command
Name
Value
Unit
Evaluated...
Description
Command
CreateRectangle
Coordina...
Global
Position
-1 ,-1 ,-0.1
mm
-1mm , -1...
Axis
Z
XSize
5
mm
5mm
YSize
5
mm
5mm
Show Hidden
OK
Cancel
Apply

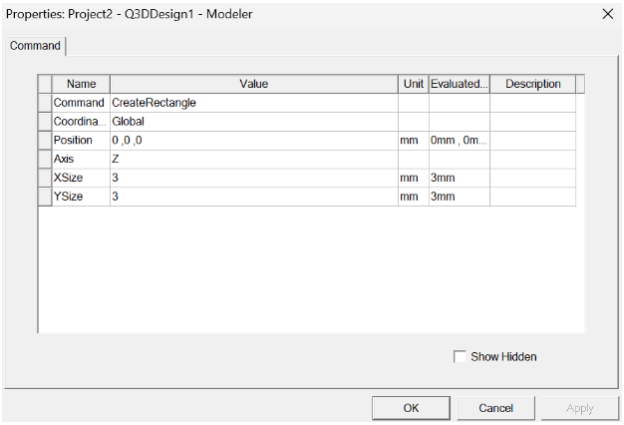

Thicken Sheet
Thickness:
-0.5
mm
Both Sides
OK
Cancel

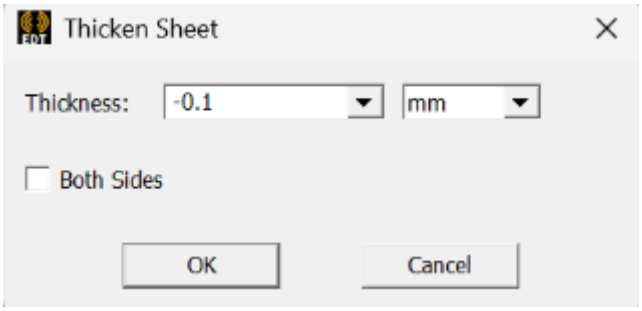

Properties: Project2 - Q3DDesign1 - Modeler
Attribute
Name
Value
Unit
Evaluated...
Description
Read-o...
Name
Substrate
Material
"FR4_epoxy"
"FR4_ep...
Orientation
Global
Model
Group
Model
Display ...
Material ...
Color
Transpar...
0
Show Hidden
OK
Cancel
Apply

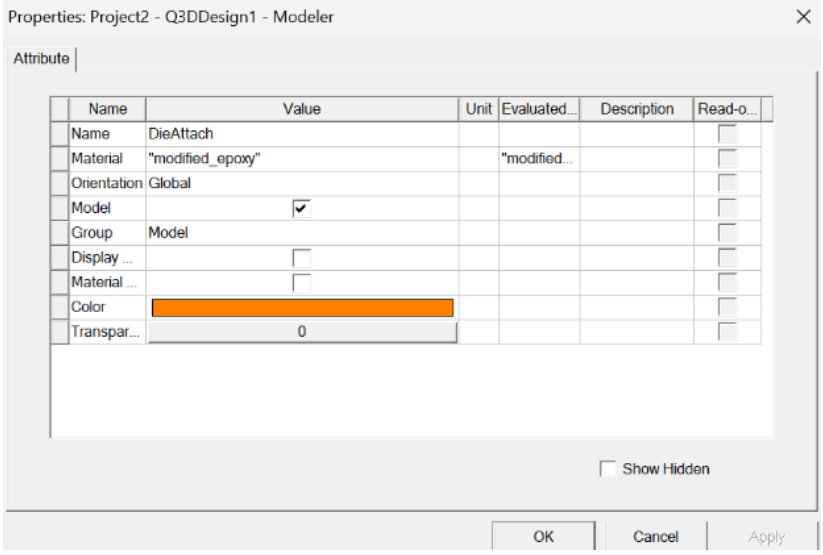
5.3 – Add Die Attach and Bond Pads

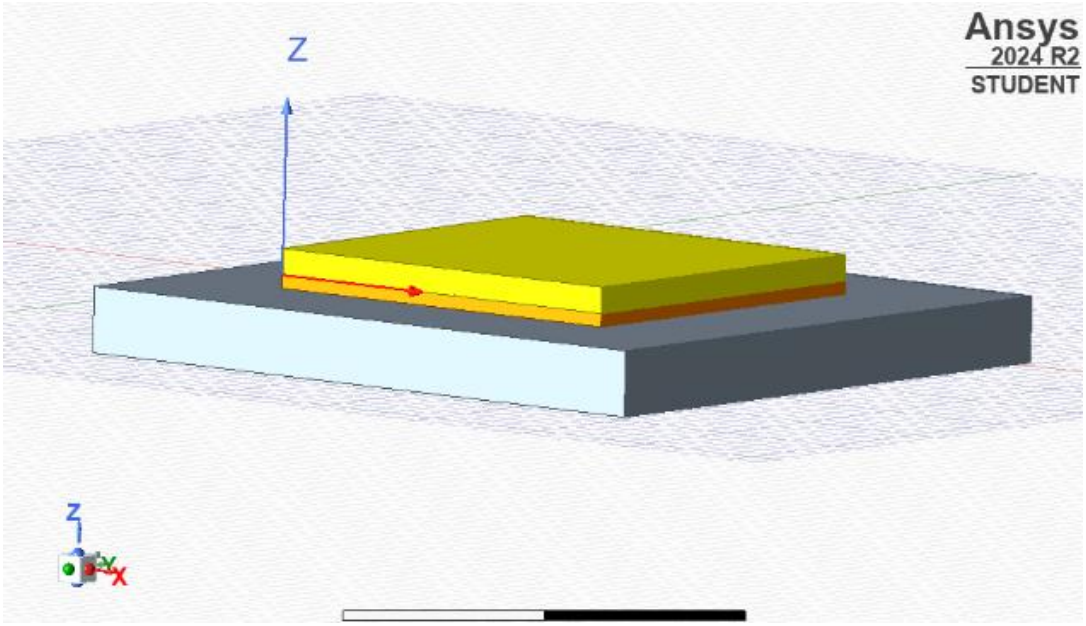
Step 5: Die Attach Layer

- Rectangle: 3 mm × 3 mm at (0, 0, 0)
- Thickness: −0.1 mm
- Set material: **Modified Epoxy**
- Colour it for easier distinction



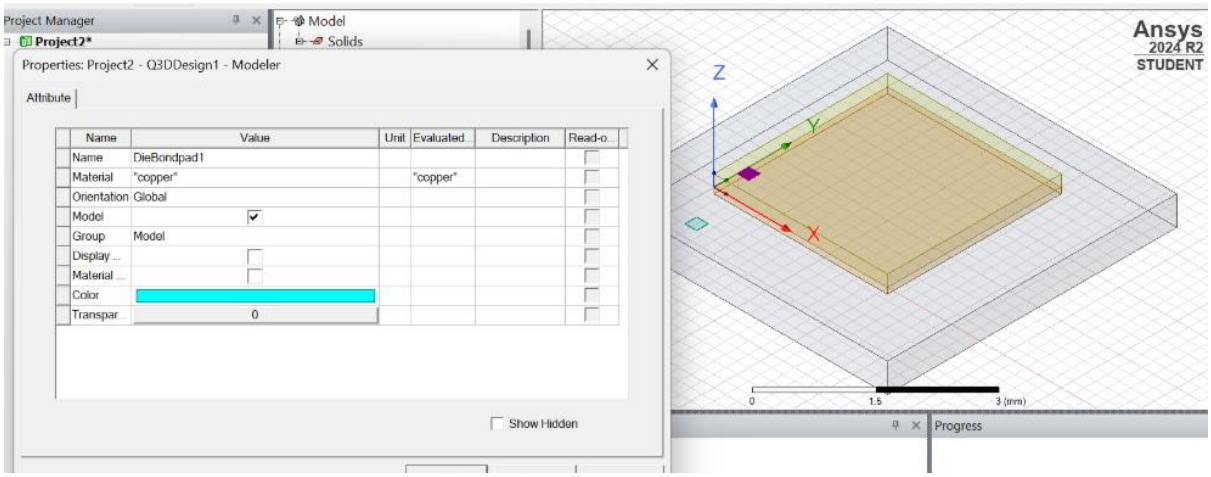




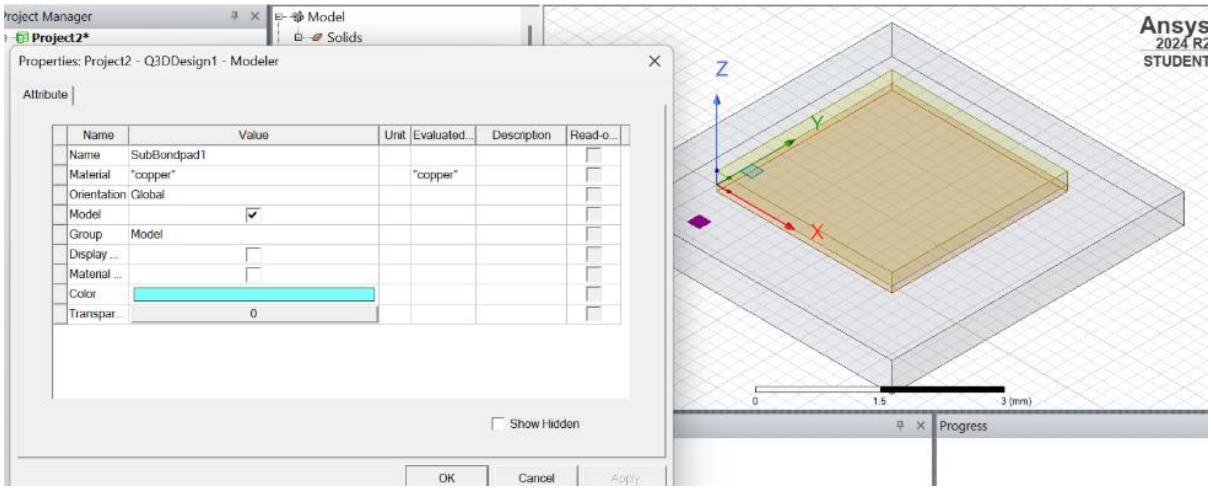


Step 6: Bond Pads

- **Die Pad**: 0.2 mm × 0.2 mm × 0.005 mm
    - Position: (0.2, 0.2, 0.2)
    - Material: Copper



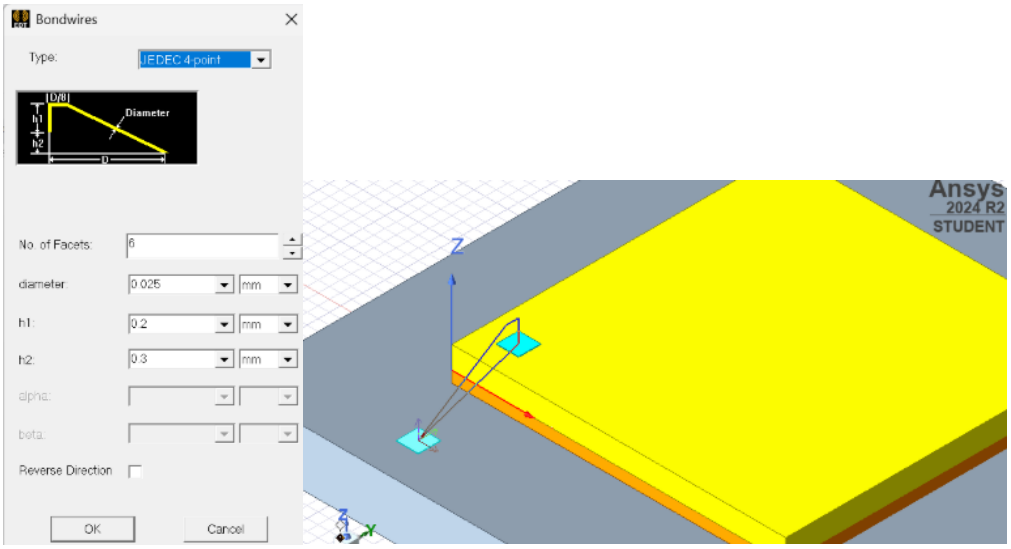
- **Substrate Pad**: 0.2 mm × 0.2 mm × 0.01 mm
    - Position: (0.2, −0.7, −0.1)
    - Material: Copper

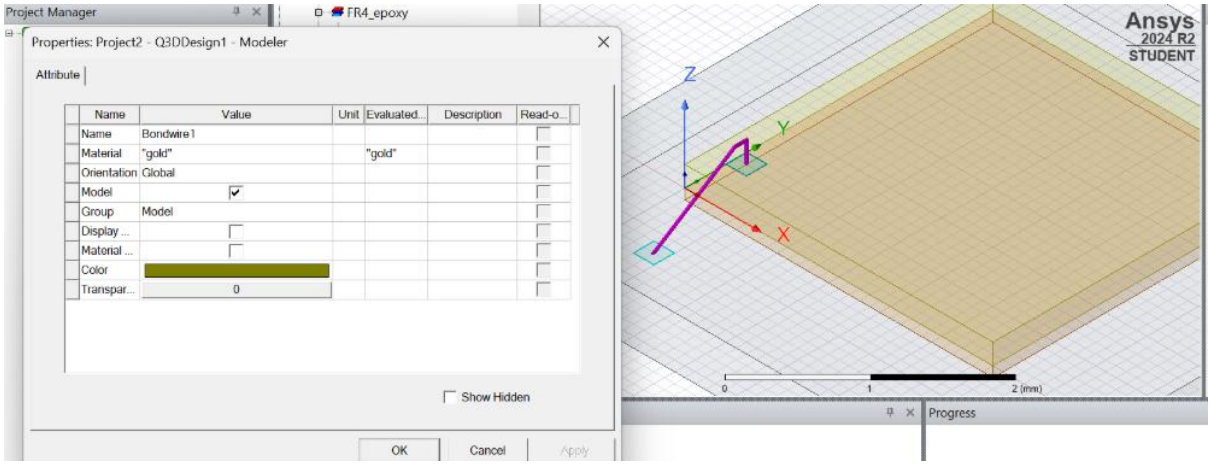


5.4 – Wire Bond Creation

Step 7: Draw Bond Wires

- Draw → Bondwire Tool
- Connect center of die pad to substrate pad
- Select **JEDEC 4-point** wire shape
- Assign **Material**: Gold
- Repeat for all required pad connections

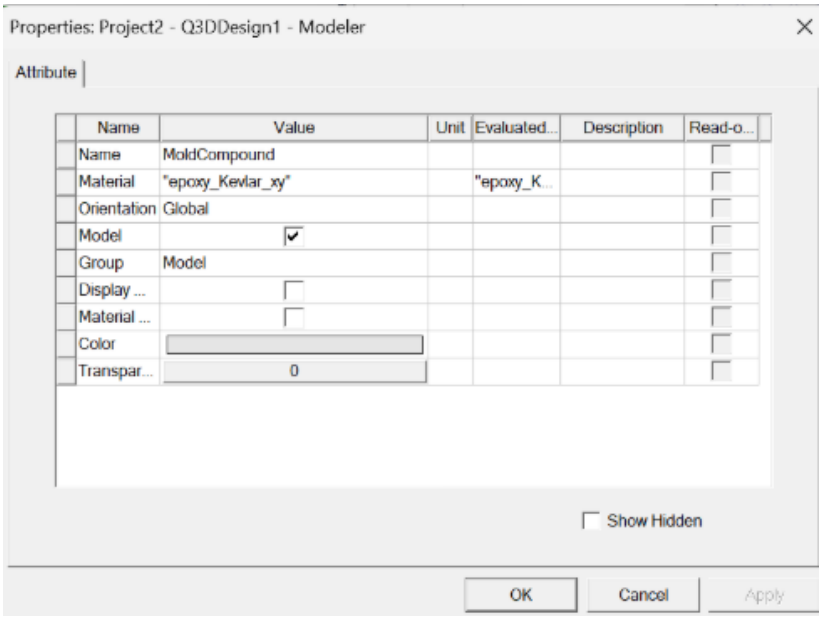




5.5 – Mold Compound Enclosure

Step 8: Add Mold

- Draw rectangle: 5 mm × 5 mm
- Position: (−1, −1, −0.1)
- Thickness: 1.2 mm (covers die and wires)
- Material: Epoxy Moulding Compound
- Leave margin for **laser marking** or surface engraving



Visual Guide

- Use **color-coded materials** to distinguish components

- Frequently **rotate the 3D view** to verify placement
- Use **snap and grid tools** for precise alignment
- Save project iterations at every major step