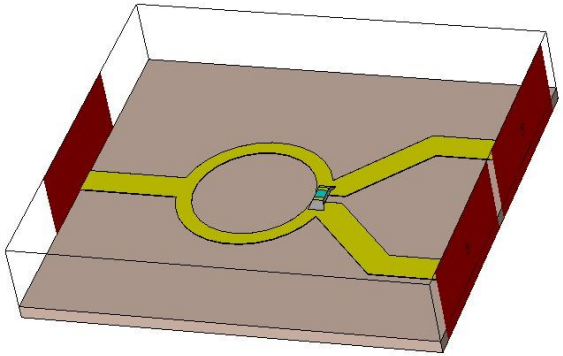
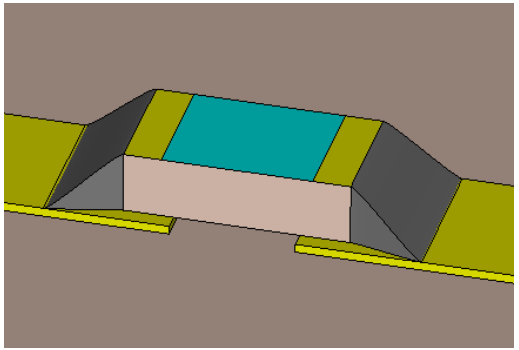
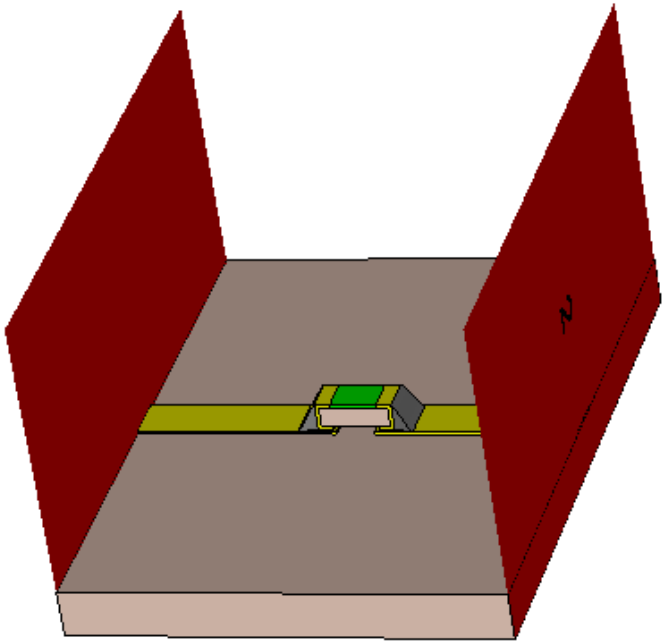
SMD Resistor Simulation

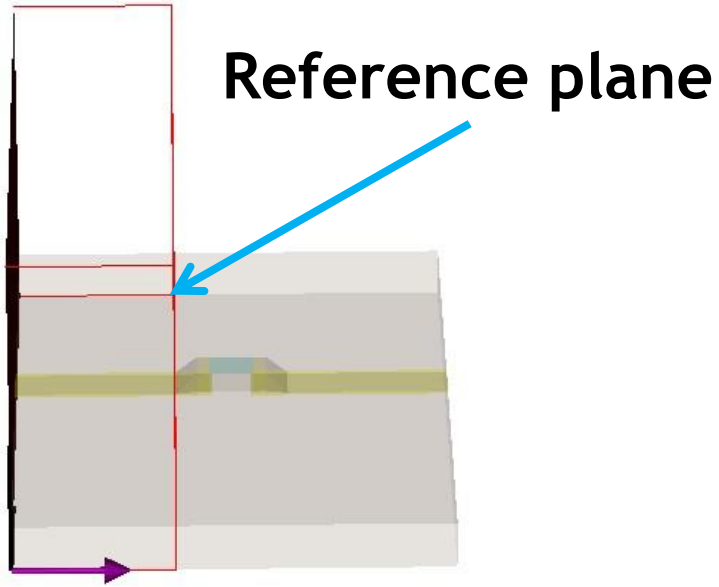
Modeling, Material Setting, Mesh





How to Simulate an SMD Resistor?

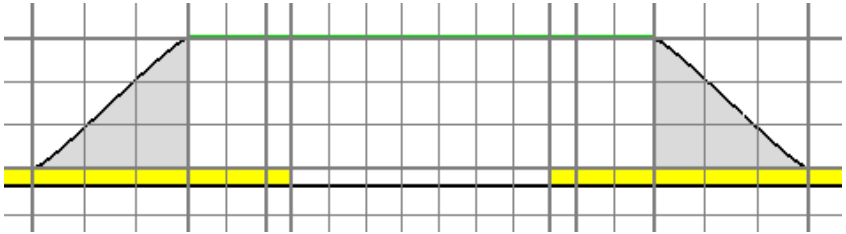




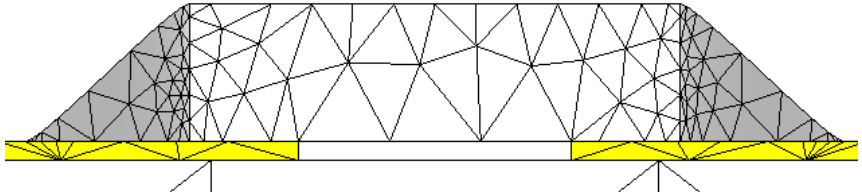
Ports constructed by macro:
“Macros/Solver/Ports/Calculate port extension coefficient”

Recommended Approach

Thin resistive layer



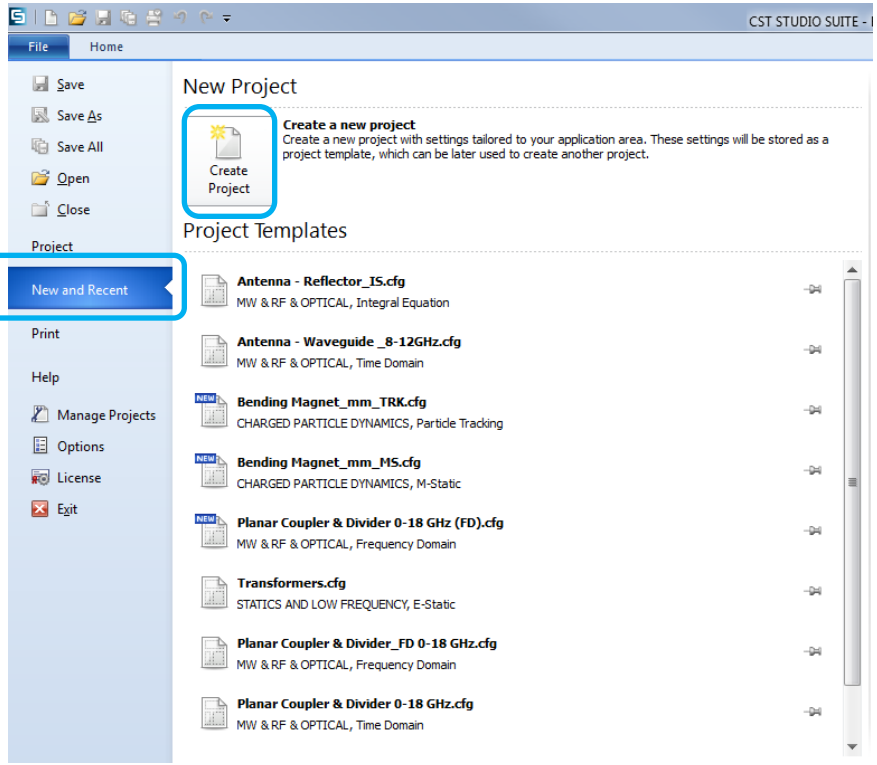
+ Hexahedral mesh

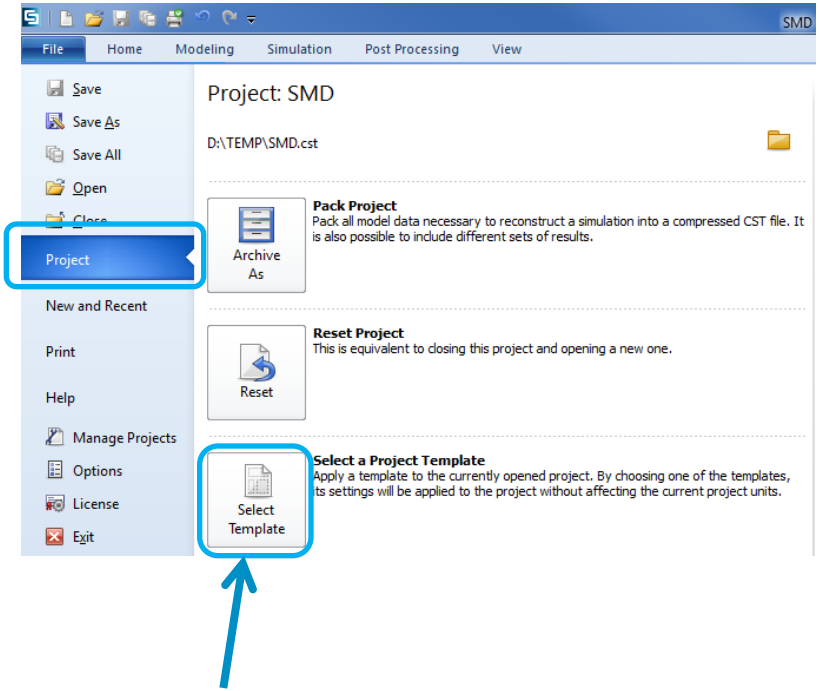


+ Tetrahedral mesh

Projects including SMD + microstrip line are included in a zip archive.

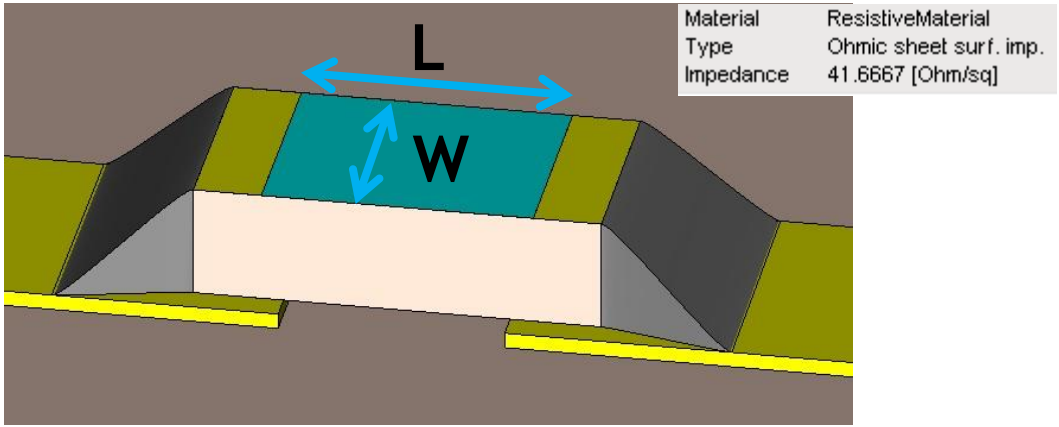
Select Appropriate Template





Apply template to existing projects

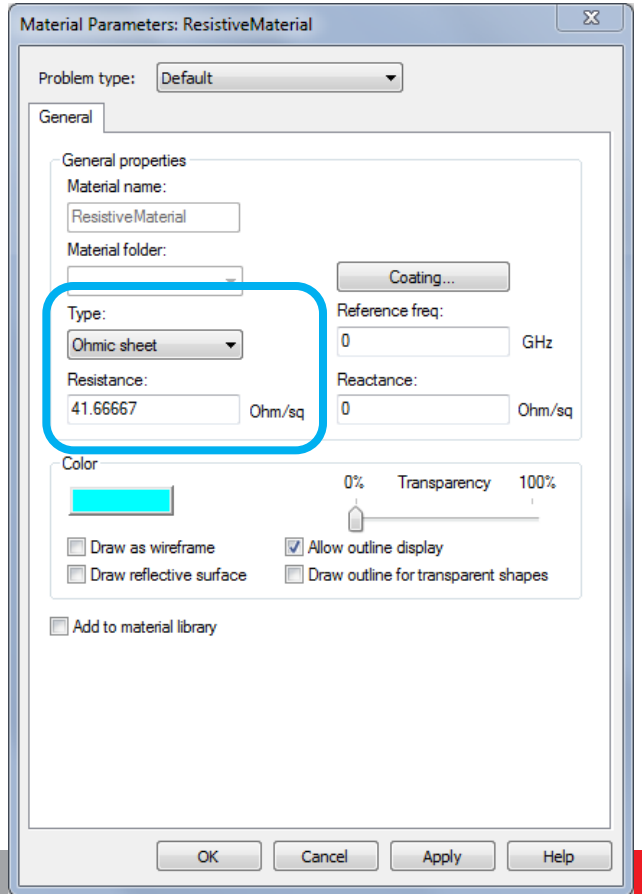
Material Setting - Thin Resistive Layer



Resistance [Ohm]

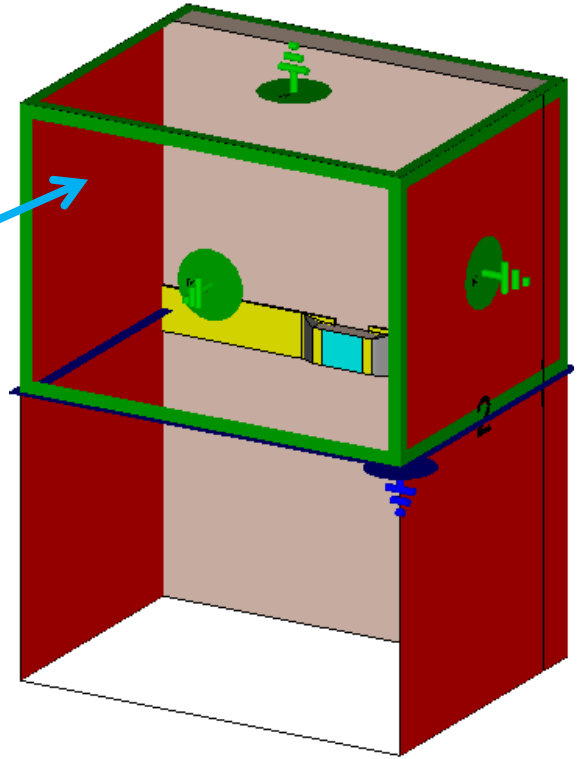
$$R_{\square} = \frac{RW}{L}$$

Surface Resistance [Ohm/sq]



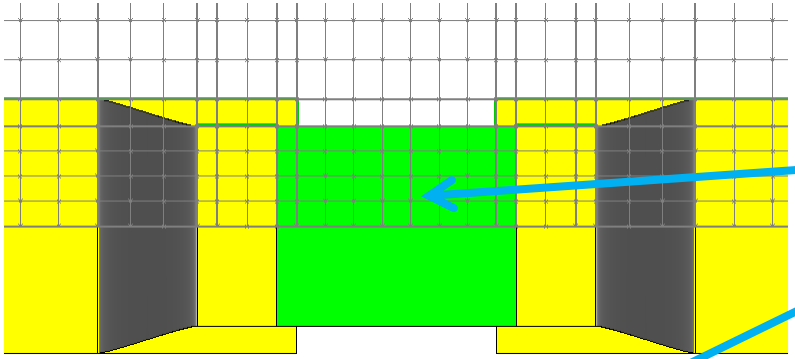
Boundary Conditions

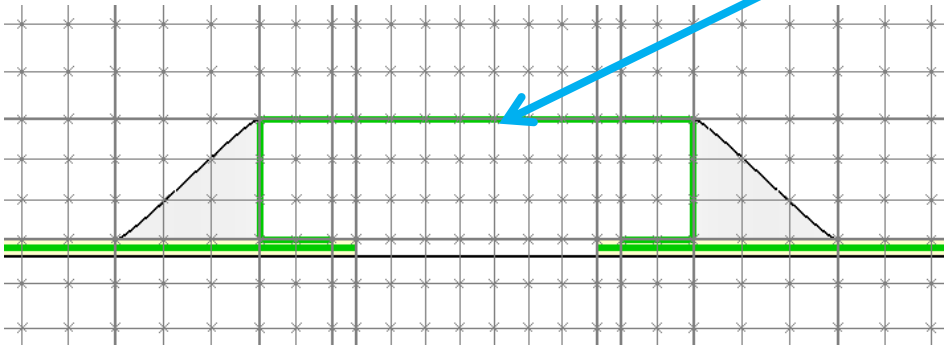
If the port covers the **whole plane**, it is recommended to use **electric boundaries**.

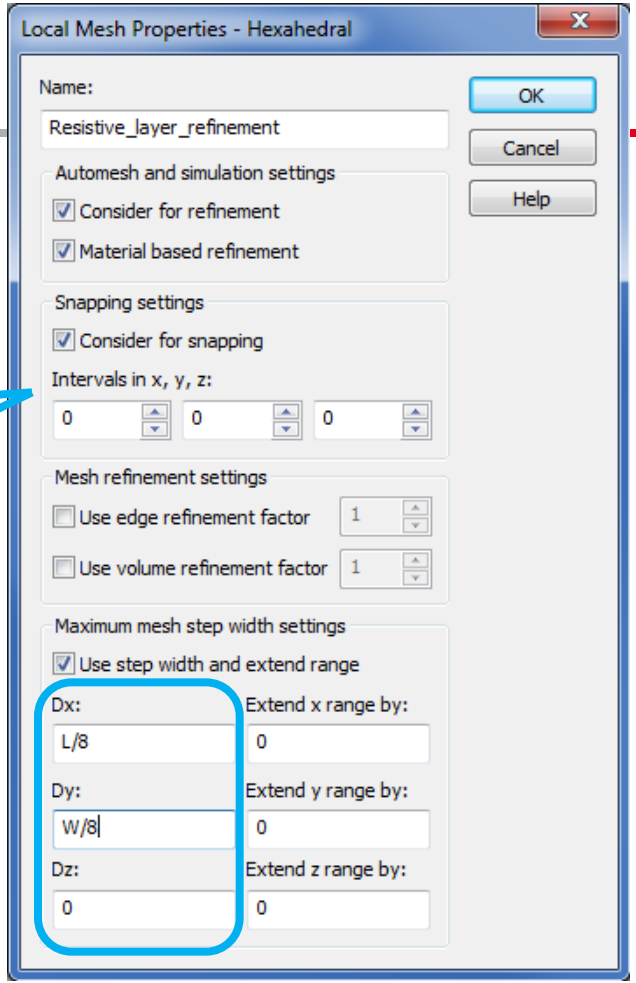


Hexahedral Mesh

Local Mesh Properties for Resistive Layer

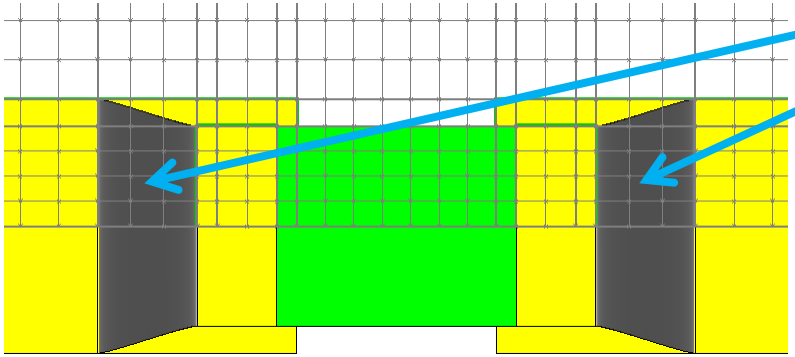


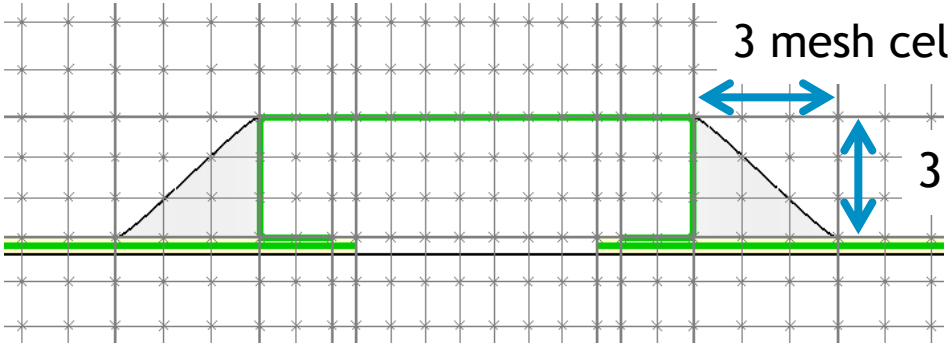


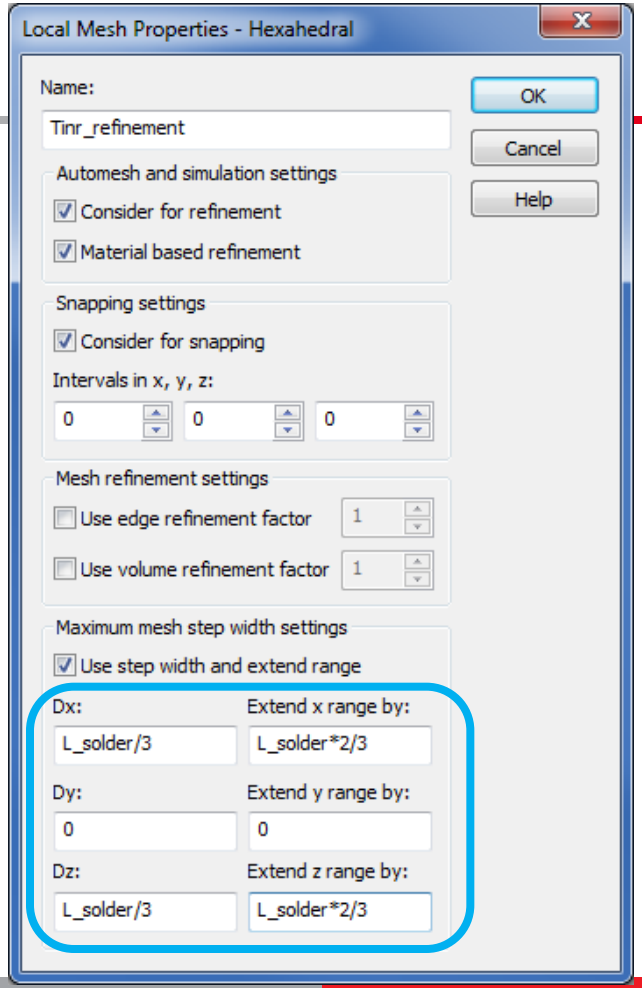


Hexahedral Mesh

Local Mesh Properties for Solder

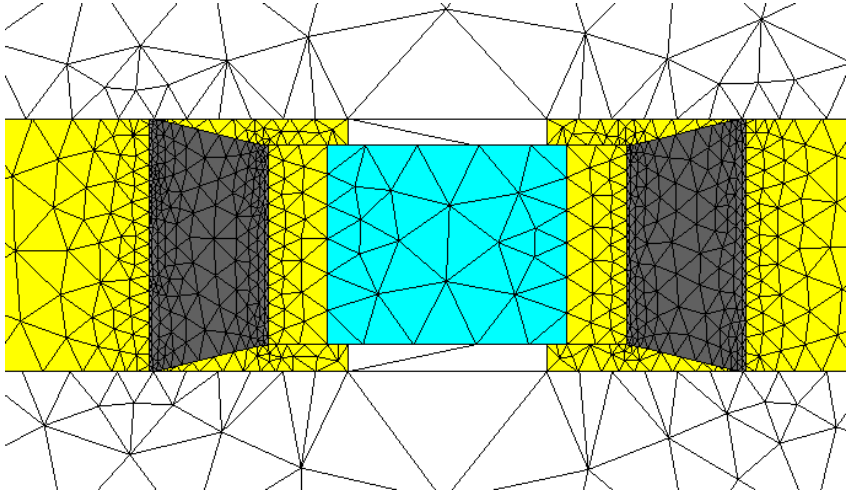




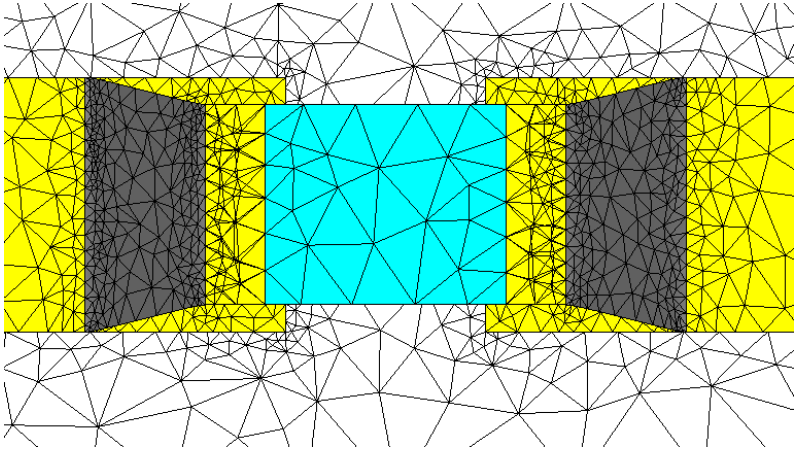


Tetrahedral Mesh

Initial mesh

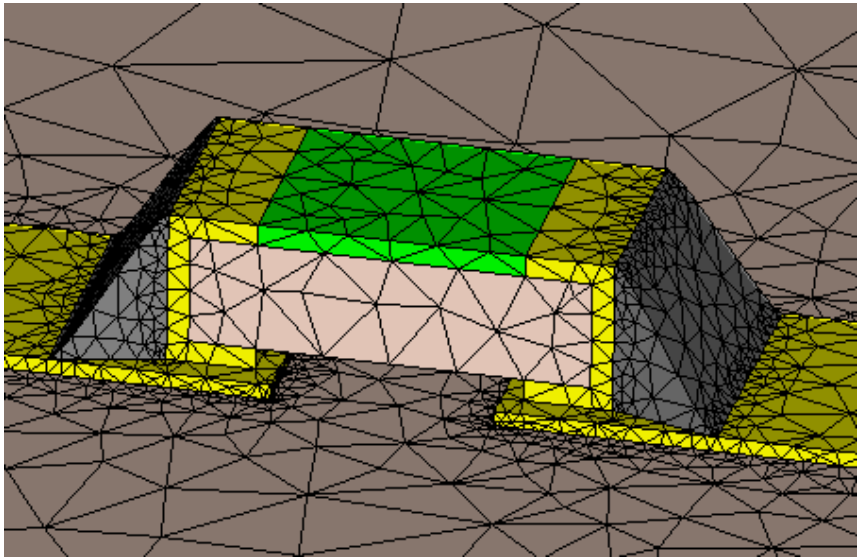


After Adaptive mesh refinement

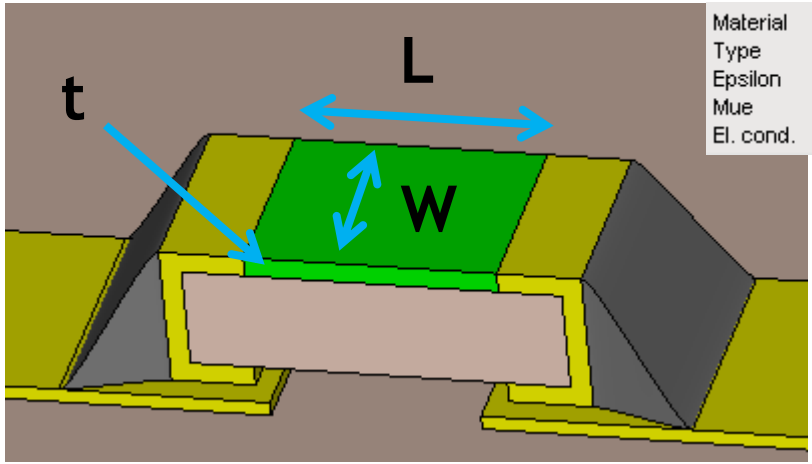


It is recommended to use Adaptive mesh refinement,
manual refinement is not necessary

Comparison to Thick Resistive Layer

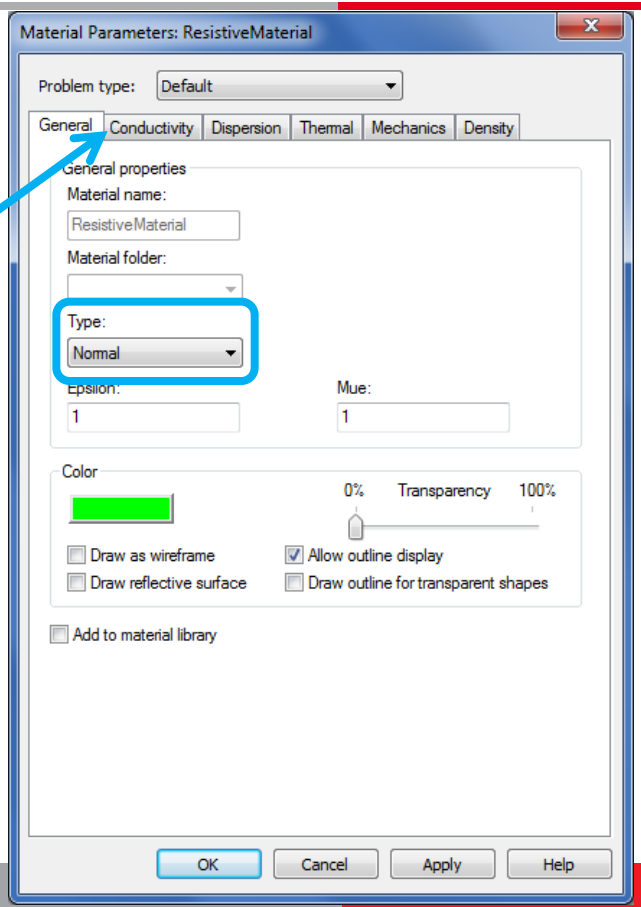


Material Setting - Thick Resistive Layer



Material	ResistiveMaterial
Type	Normal
Epsilon	1
Mue	1
El. cond.	480 [S/m]

Conductivity settings

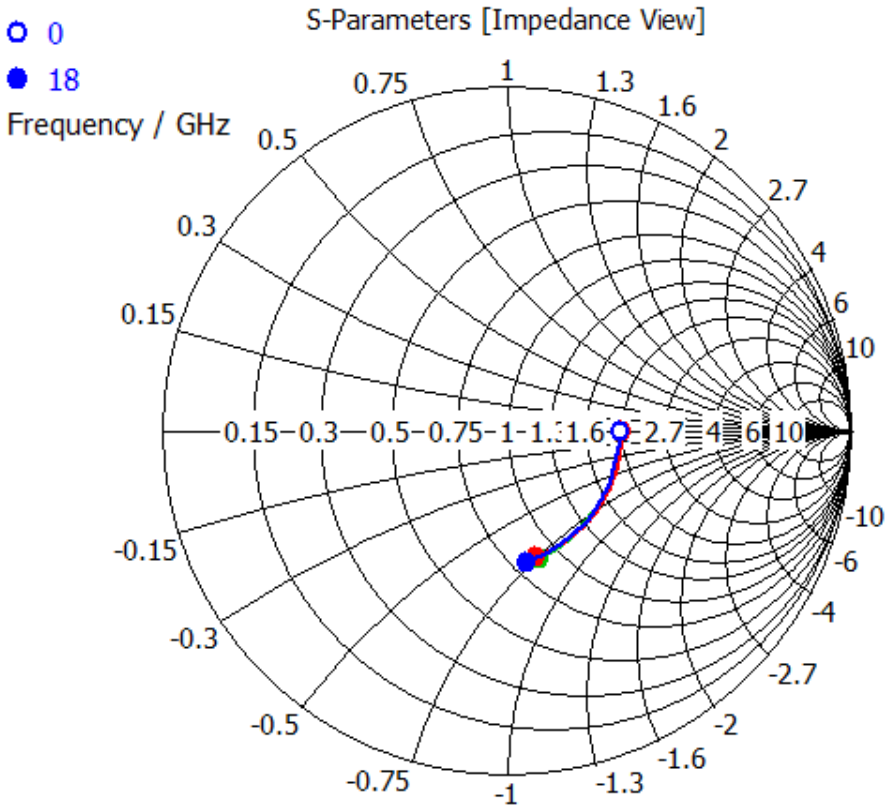


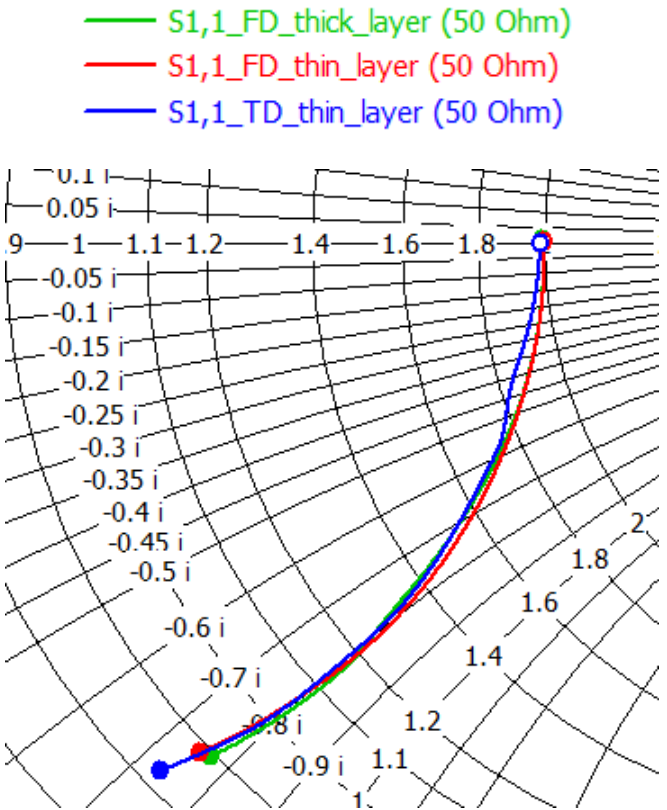
Conductivity [S/m]

$$\sigma = \frac{L}{RWt}$$

Resistance [Ohm]

Results


0
18
Frequency / GHz
S-Parameters [Impedance View]
0.75
1
1.3
1.6
2
2.7
4
6
10
0.5
0.3
0.15
-0.15
-0.3
-0.5
-0.75
-1
-1.3
-1.6
-2
-2.7
-4
-6
-10
0.15 0.3 0.5 0.75 1 1.3 1.6 2 2.7 4 6 10

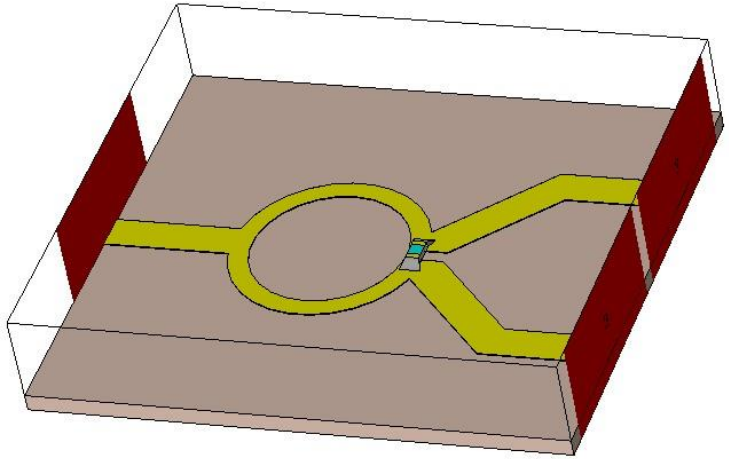

S1,1_FD_thick_layer (50 Ohm)
S1,1_FD_thin_layer (50 Ohm)
S1,1_TD_thin_layer (50 Ohm)
0.05 i
-0.05 i
-0.1 i
-0.15 i
-0.2 i
-0.25 i
-0.3 i
-0.35 i
-0.4 i
-0.45 i
-0.5 i
-0.6 i
-0.7 i
-0.9 i
1
1.1
1.2
1.4
1.6
1.8
2

Conclusion

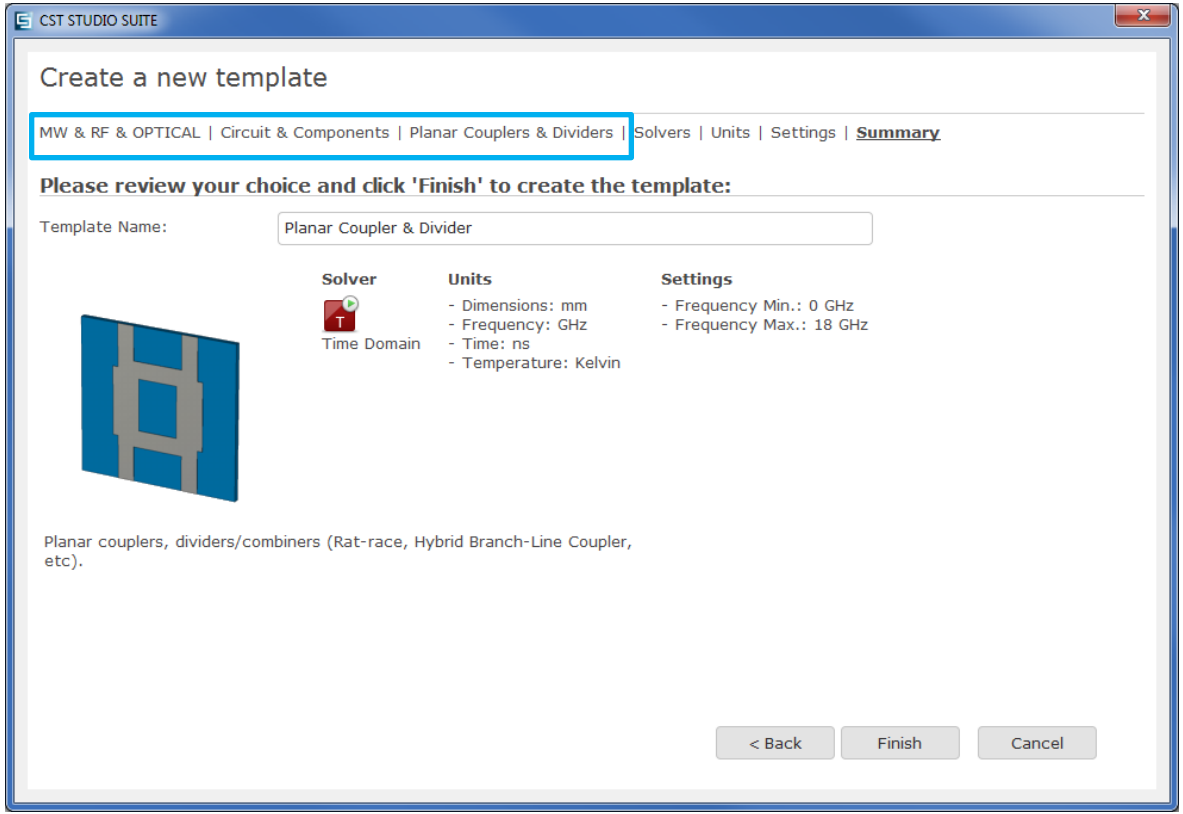
- To obtain accurate results adjust local mesh properties of the resistive layer.
- A thin layer modeling is preferred both in the time domain and frequency domain.
- For extraction of SMD equivalent circuit PEC boundary conditions are recommended.

All projects can be found in zip archive.

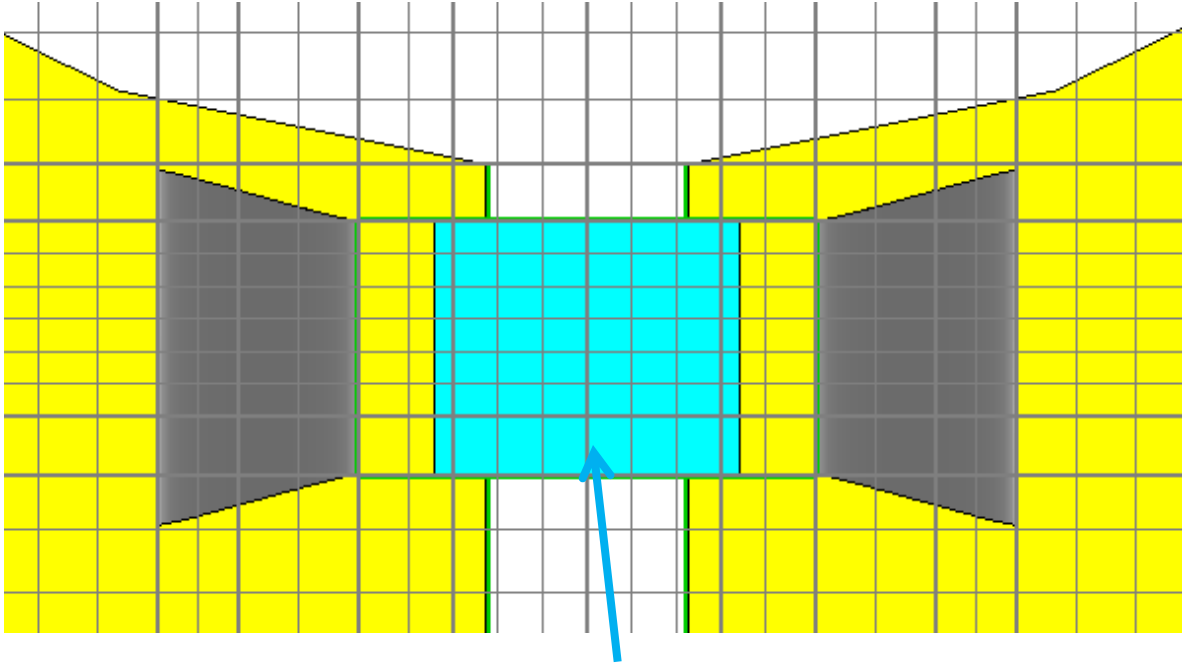
Wilkinson Power Divider with SMD Resistor



Selected Template

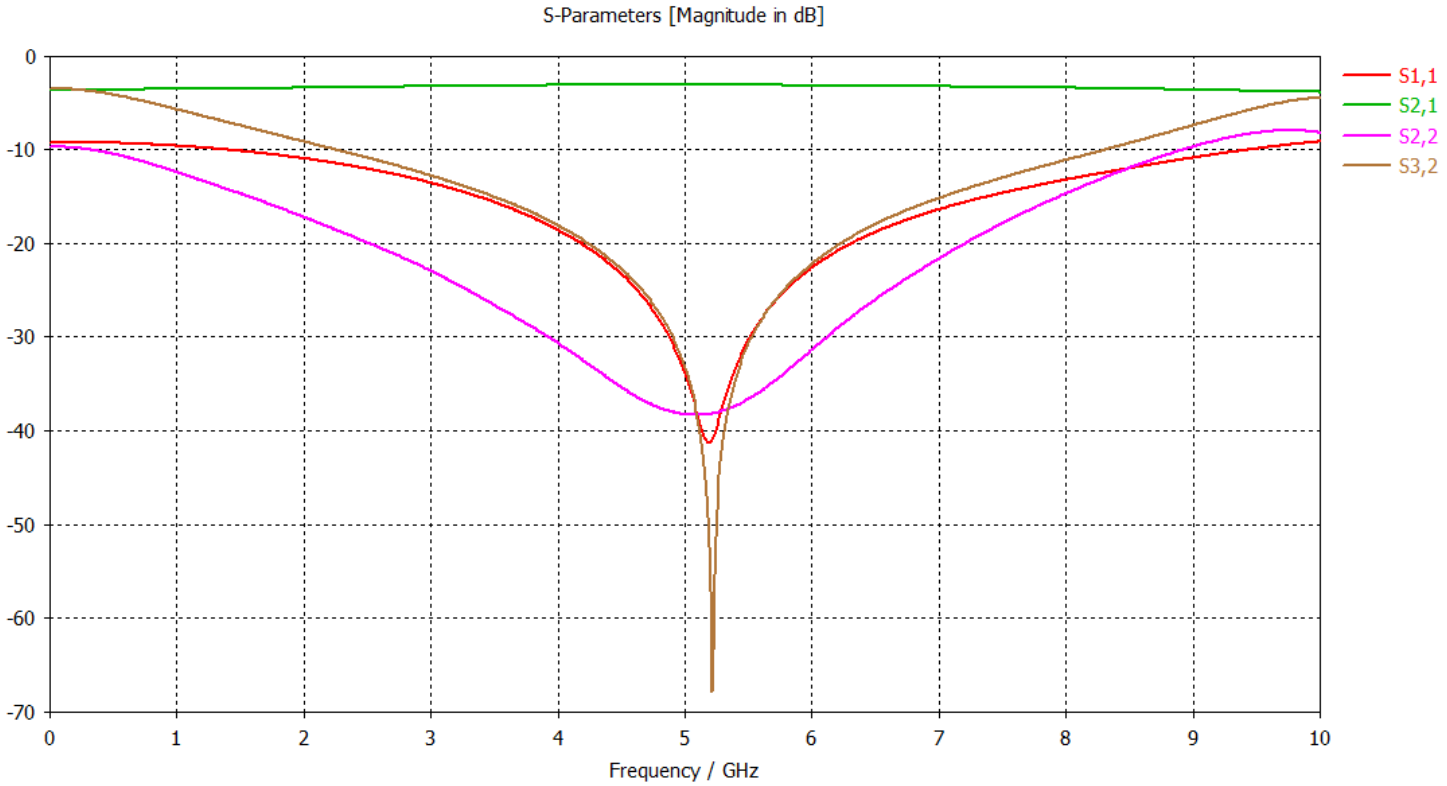


Hexahedral Mesh



Use the local mesh properties to refine the mesh.
(See previous section of this document)

Results


S-Parameters [Magnitude in dB]
0
-10
-20
-30
-40
-50
-60
-70
0
1
2
3
4
5
6
7
8
9
10
Frequency / GHz
S1,1
S2,1
S2,2
S3,2