

# MWI-2017 Software Instruction Manual



Advanced Connectivity Solutions

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# MWI-2017 Software Instruction Manual

- Installing software
- Starting software and basic operations
- Detailed software capabilities

# MWI-2017 Software Instruction Manual

## Installing:

- After downloading the mwi2017.exe file, save it on the hard drive of the computer that will be using the software
  - Do not install on a network system
  - If not able to download the \*.exe file, there is an option to download the same file that is in a zip format
- Double click on the "mwi2017.exe"
- The computer that runs the software must have an operating system with the dot-net framework, from 2004 or more recent

# MWI-2017 Software Instruction Manual

## Software Operations, material list

Dielectric Constant  
"Design Dk"

Dissipation Factor

Thermal Coefficient of Dk

Thermal conductivity of the substrate

When floating the mouse over the material name, additional information will be shown.

RT/duroid 5870   2.33   0.0012   -115   0.22

RT/duroid 5880   2.2   0.0009   -125   0.2

RT/duroid 5880LZ   1.96   0.0019   22   0.2

RT/duroid 6002   2.94   0.0012   12   0.6

RT/duroid 6010LM   10.7   0.0023   -425   0.78

RT/duroid 6035HTC   3.6   0.0013   -66   1.44

RT/duroid 6202   2.94   0.0015   13   0.68

RT/duroid 6035HTC is PTFE material with ceramic and has high thermal conductivity  
Moisture absorption = 0.06 %  
Coefficient of Thermal Expansion = 39 ppm/C in Z-axis  
UL Flame rating = 94V-0

Material Name: RT/duroid 6035HTC

Material Properties:

- Material: RO4350B
- Thickness (H): 0.020 in.
- Dk: 3.66
- Df: 0.0037
- Thermal Cond.: 0.62 W/K\*m
- use z-axis Bulk Dk values (selected)
- Dk values for a specific frequency
- Dk values for characteristic Impedance

Conductor Parameters:

- Thickness (T): 0.0006 in.
- 1/2oz ED
- Conductivity:  $5.813 \times 10^7$  S/m
- Surface Area Index: 3.8
- Roughness loss model: Hall-Huray
- Avg Nodule Size (microns): 0.28
- Surface Roughness (RMS): 2.8 microns
- Copper roughness values:
  - Optimum for accuracy (selected)
  - Actual measurement

Transmission Line Information:

- Length: 0.009 in. (1 in.)

Material Properties (bottom):

- Material: RO4350B
- Thickness (H): 0.020 in.
- Dk: 3.66
- Df: 0.0037
- Thermal Cond.: 0.62 W/K\*m
- use z-axis Bulk Dk values (selected)
- Synthesis Width: Impedance 50 Ohms
- Calculate
- Frequency: 1 GHz
- Generate Tables and Files: None
- Freq. Range: 1 to 30 GHz

Display results of only one calculation:

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## Software Operations, material thickness

Only standard thicknesses of the selected material are shown. This can be overridden.

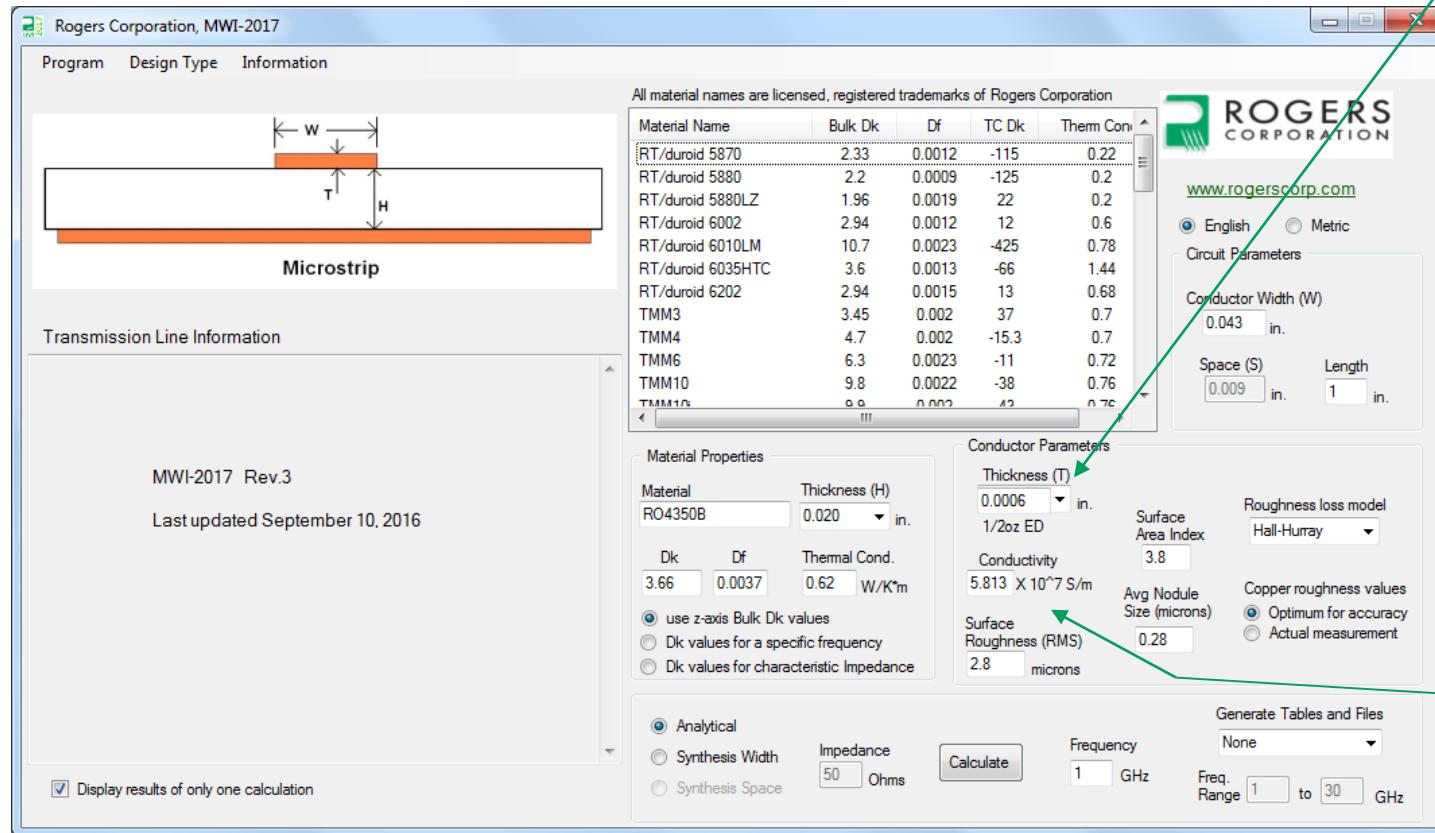
The screenshot shows the MWI-2017 software interface. At the top, there is a menu bar with 'Program', 'Design Type', and 'Information'. Below the menu is a diagram of a microstrip line with labels for Conductor Width (W), Dielectric Thickness (T), and Substrate Thickness (H). A table lists various Rogers materials with their Bulk Dk, Df, TC Dk, and Thermal Conductivity values. The 'ROGERS CORPORATION' logo and website 'www.rogerscorp.com' are in the top right. The 'Circuit Parameters' section includes fields for Conductor Width (W: 0.043 in.), Space (S: 0.009 in.), and Length (1 in.). The 'Material Properties' section shows RO4350B selected with a thickness of 0.020 in. The 'Conductor Parameters' section includes fields for Thickness (T: 0.0006 in.), Surface Area Index (3.8), and Roughness loss model (Hall-Hurray). The 'Material Name' table is as follows:

Material Name	Bulk Dk	Df	TC Dk	Thermal Cond.
RT/duriod 5870	2.33	0.0012	-115	0.22
RT/duriod 5880	2.2	0.0009	-125	0.2
RT/duriod 5880LZ	1.96	0.0019	22	0.2
RT/duriod 6002	2.94	0.0012	12	0.6
RT/duriod 6010LM	10.7	0.0023	-425	0.78
RT/duriod 6035HTC	3.6	0.0013	-66	1.44
RT/duriod 6202	2.94	0.0016	13	0.68
TMM3	3.45	0.002	37	0.7
TMM4	4.7	0.002	-15.3	0.7
TMM6	6.3	0.0023	-11	0.72
TMM10	9.8	0.0022	-38	0.76
TMM10n	0.0002	0.0002	42	0.76

At the bottom left, there is a note: 'Display results of only one calculation' with a checked checkbox. The bottom right corner features the Rogers logo and the text 'Advanced Connectivity Solutions'.

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## Software Operations, copper definition



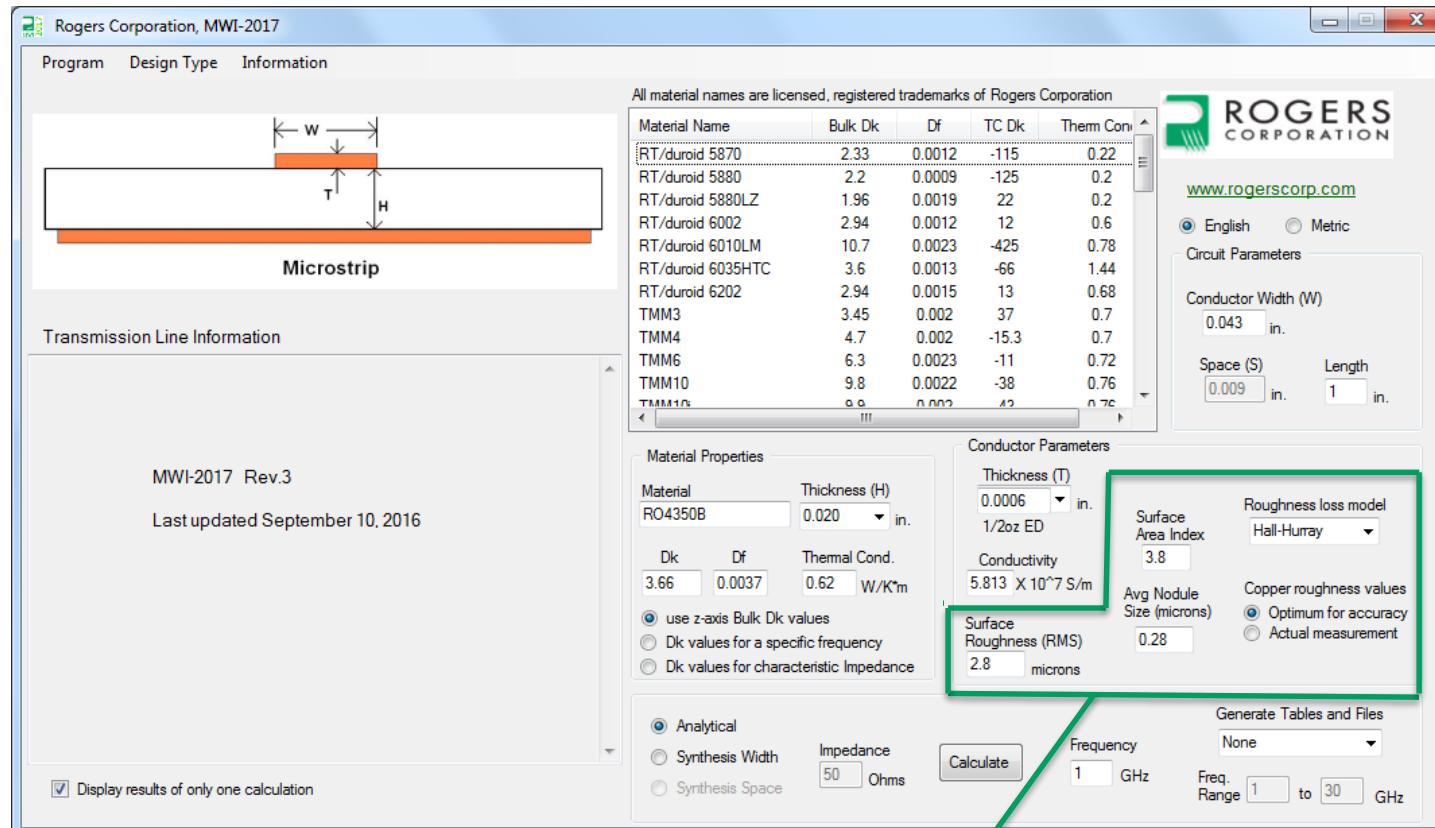
When copper is selected only standard thicknesses and copper types of the selected material are shown. This can be overridden.

Conductor conductivity can be entered; however it will affect all conductor layers of the circuit

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## Software Operations, copper definition

There are two copper roughness models available, which will supplement the insertion loss calculations with increased conductor loss due to copper surface roughness.



The Morgan rule is most accurate when used below about 12 GHz

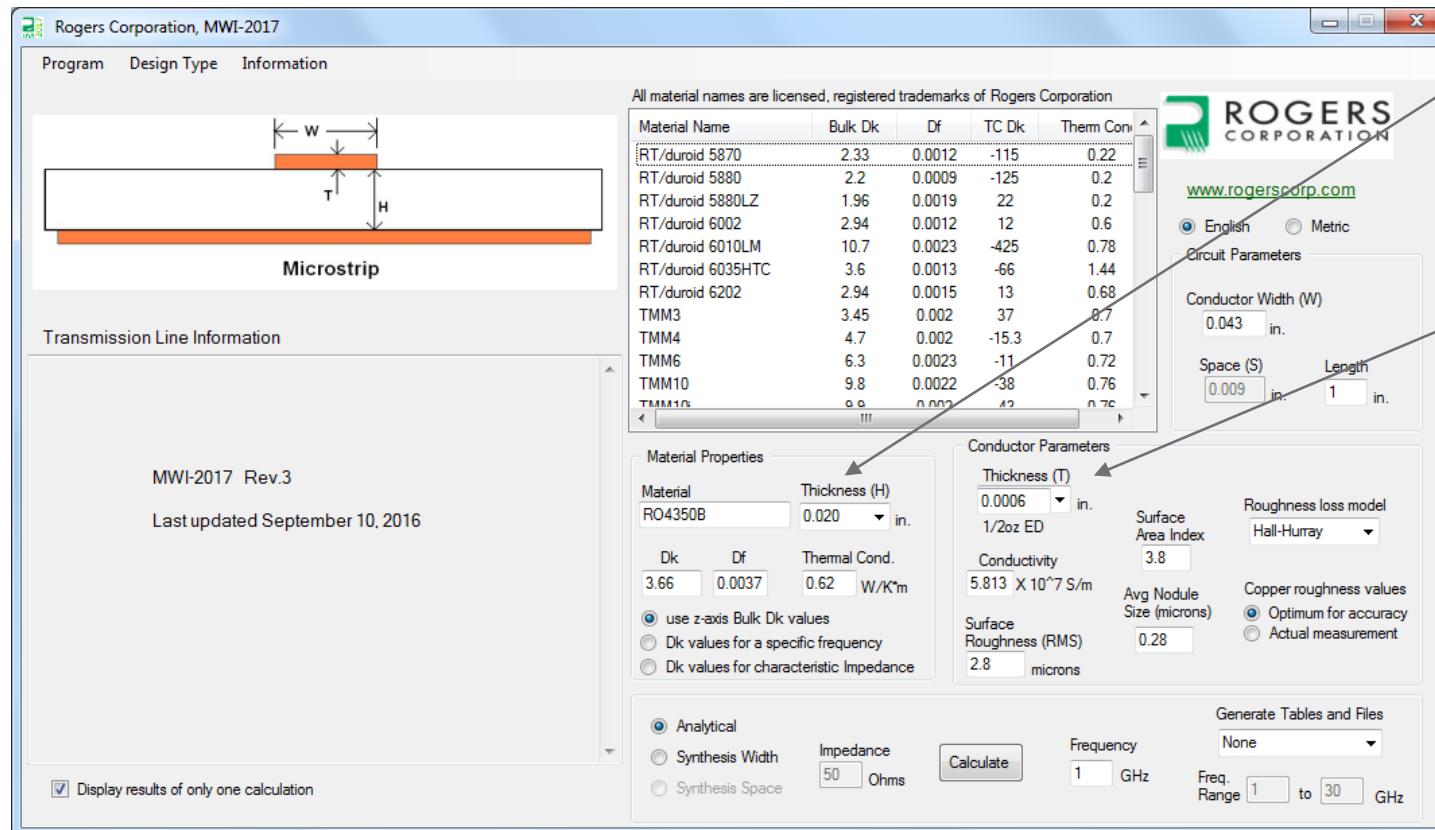
The Hall-Huray model is most accurate at higher frequencies

The surface roughness (RMS) is used for Morgan rule only

Copper roughness information

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## Software Operations, changing materials



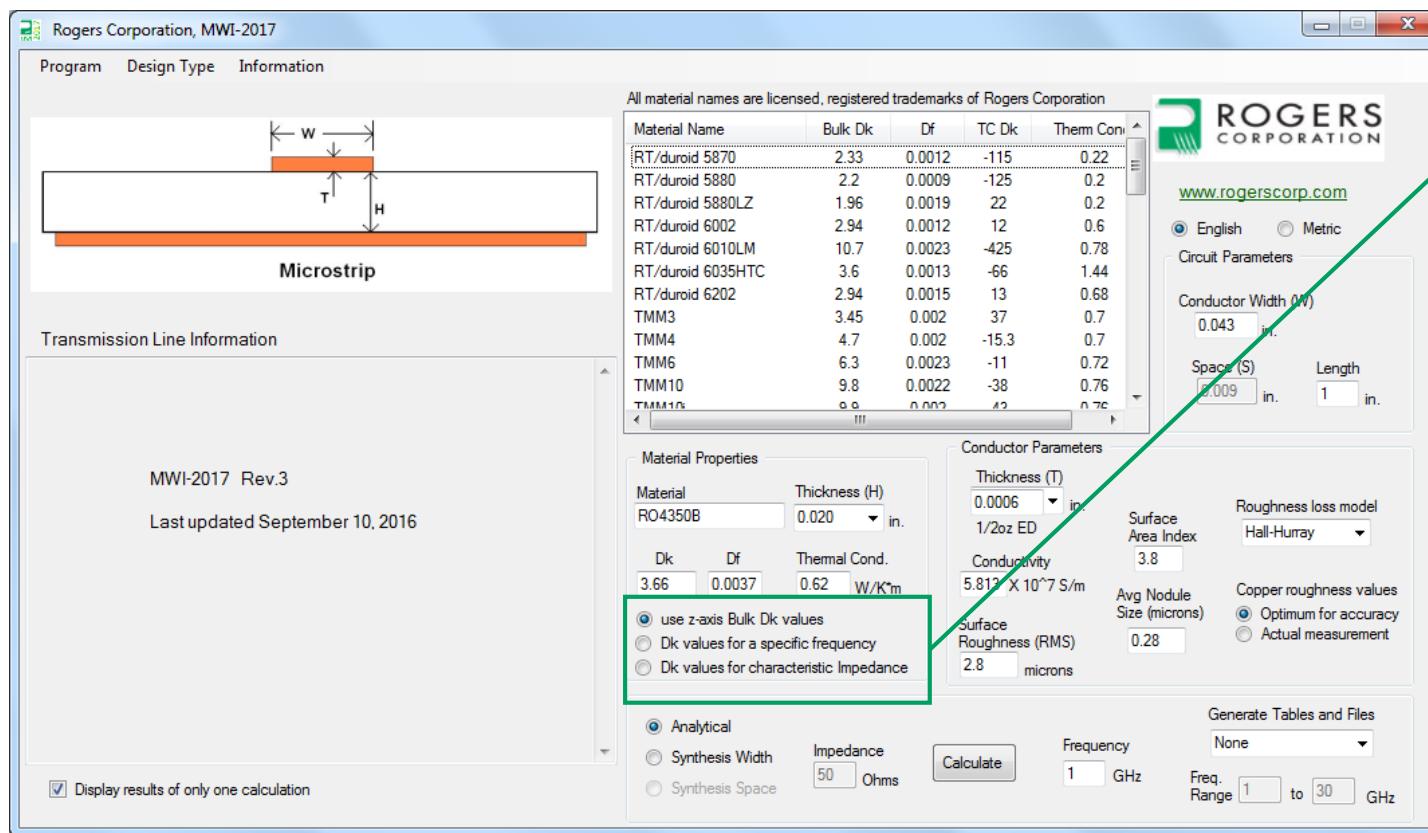
When changing from one material to another, the nearest standard thickness of new material selected will be chosen.

The optimum copper type will be automatically selected, for the newly selected material.

Both of these can be overridden.

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## Software Operations, Design Dk values



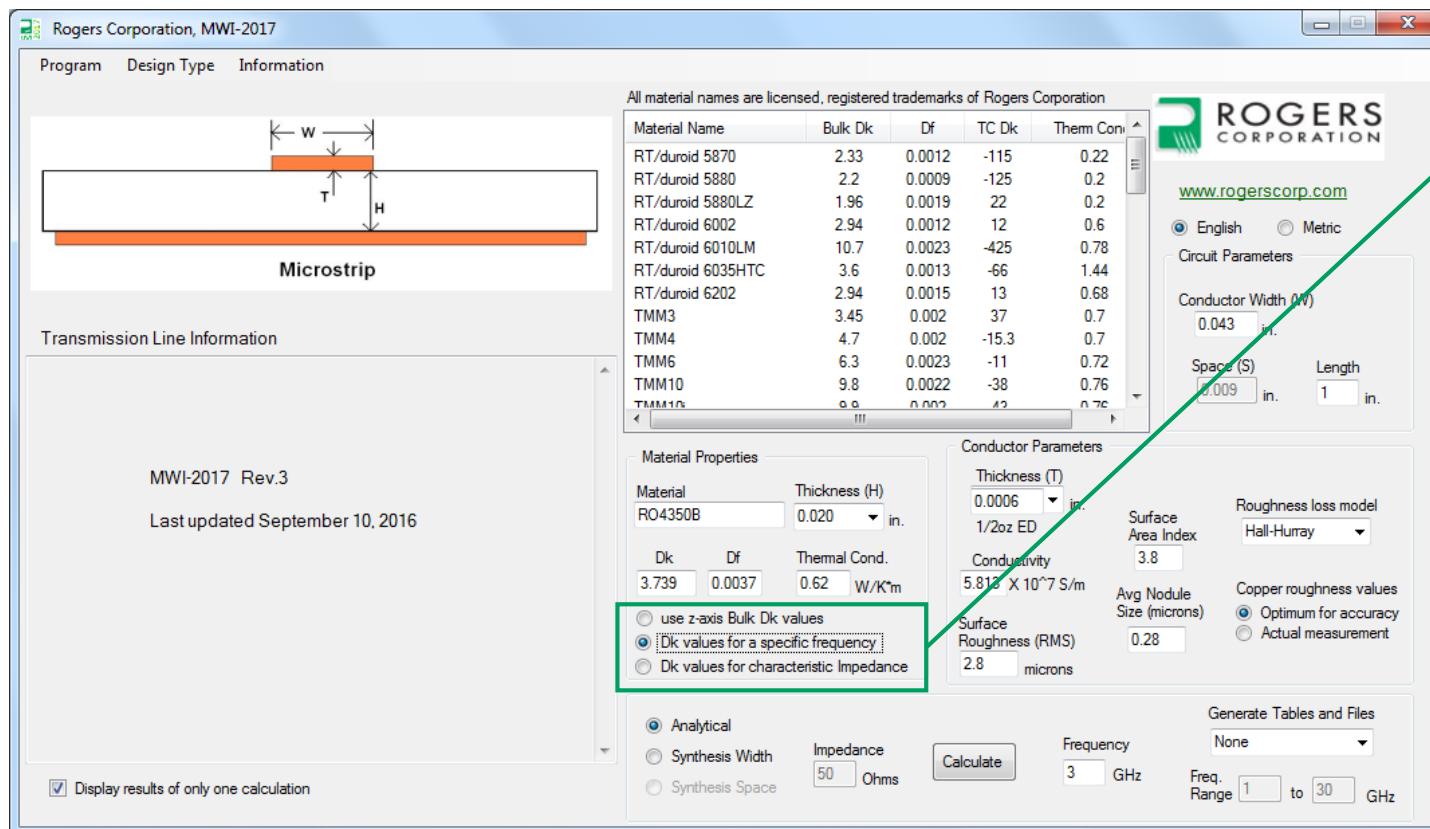
Design Dk is built into this software

For simple calculations the default z-axis Bulk Dk can be used

More accurate results can be achieved by using the RF Design Dk or Digital Dk Values

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## Software Operations, Design Dk values



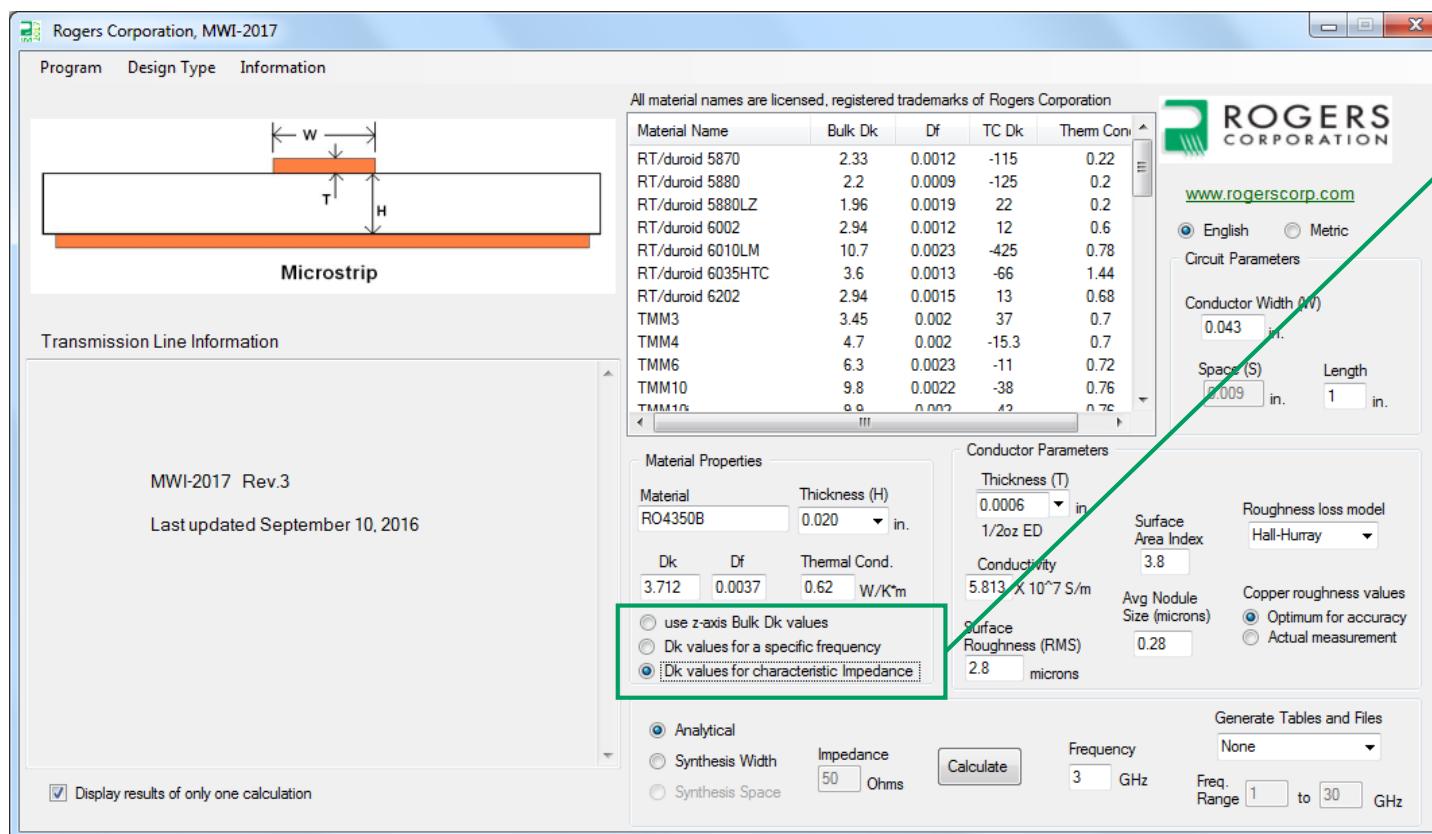
Design Dk is built into this software

For RF applications at a specific frequency or narrow frequency range, then the RF Design Dk values can be used.

Example: When designing a filter at 3 GHz the Design Dk “Dk values for a specific frequency” should be used and the Frequency input set to 3

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## Software Operations, Design Dk values



Design Dk is built into this software

Typically the user will use Digital Design Dk values for characteristic impedance, such as PCB fabricators trying to achieve a controlled impedance for a circuit.

Also this option is good for high speed digital applications or very wideband RF applications

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## Software Operations, Analytical and Synthesis

Units can be changed between English and Metric

User can select to generate a table or file of information for a range of frequencies.

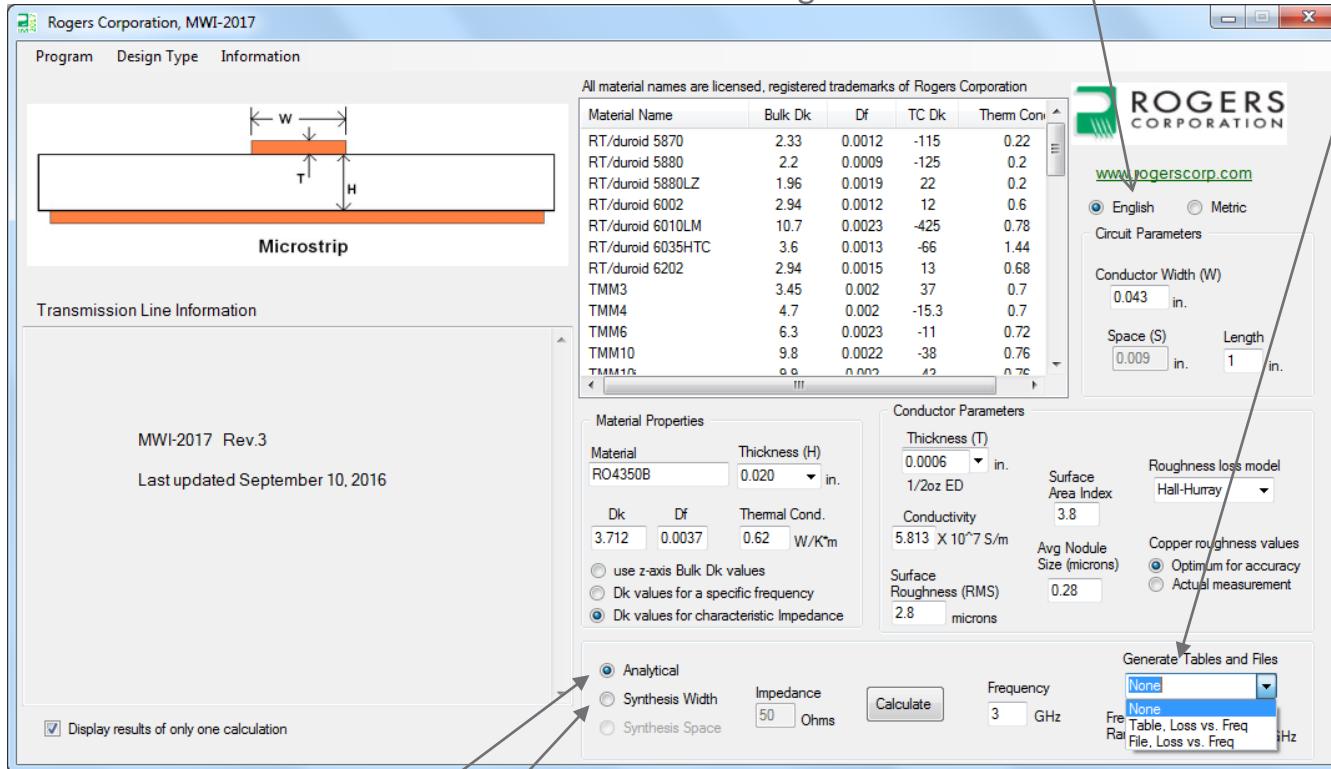
For some circuit geometries and/or designs, the synthesis may be unstable.

Using the Analytical option is safer and gives much more information.

User can do a simple Synthesis, then click to Analytical and it will hold the same data and give much more information when the calculate button is pressed.

Synthesis will generate the conductor width or spacing, given an impedance target.

Analytical will solve for impedance and other electrical properties given circuit geometry.



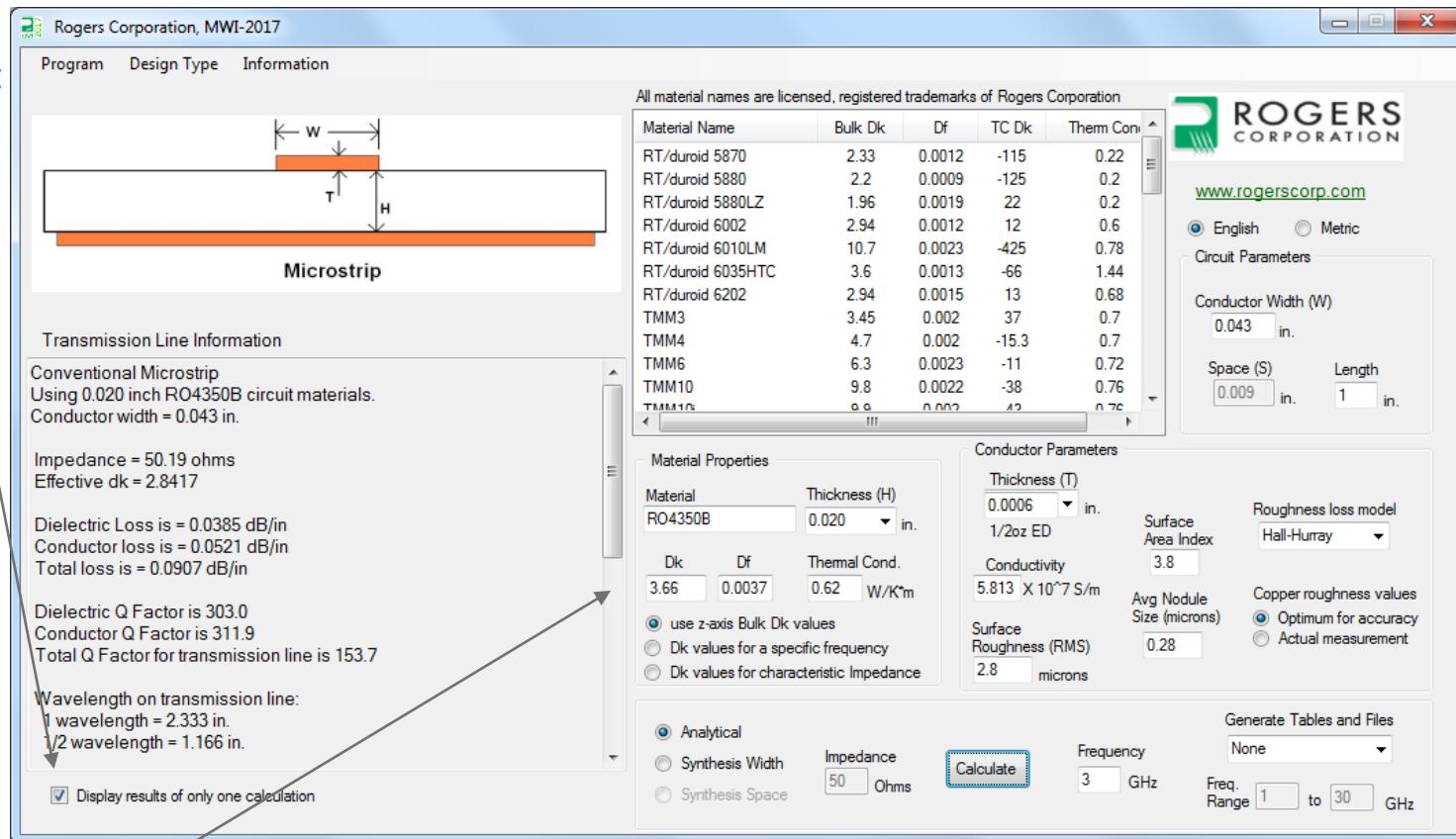
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## Software Operations, Summary window

If this is checked, the text window will clear each time the calculate button is pressed.

If not checked, all of the models ran will accumulate in the text window; with no known limit.

With additional information, the window will default to the top, so the user will need to scroll down to see the most recent information.



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## Software Operations, Summary window

After pressing the Calculate button, the information can be highlighted and copied into other Windows® software such as a word processor.

The screenshot shows the MWI-2017 software interface. On the left, there is a diagram of a Microstrip line with labels for Conductor Width (W), Dielectric Thickness (T), and Substrate Thickness (H). Below the diagram, the text "Microstrip" is displayed. To the right of the diagram, the "Transmission Line Information" section contains the following text:  
Conventional Microstrip  
Using 0.020 inch RO4350B circuit materials.  
Conductor width = 0.043 in.  
  
Impedance = 50.19 ohms  
Effective dk = 2.8417  
  
Dielectric Loss is = 0.0385 dB/in  
Conductor loss is = 0.0521 dB/in  
Total loss is = 0.0907 dB/in  
  
Dielectric Q Factor is 303.0  
Conductor Q Factor is 311.9  
Total Q Factor for transmission line is 153.7  
  
Wavelength on transmission line:  
1 wavelength = 2.333 in.  
1/2 wavelength = 1.166 in.

At the bottom left, there is a checked checkbox for "Display results of only one calculation".

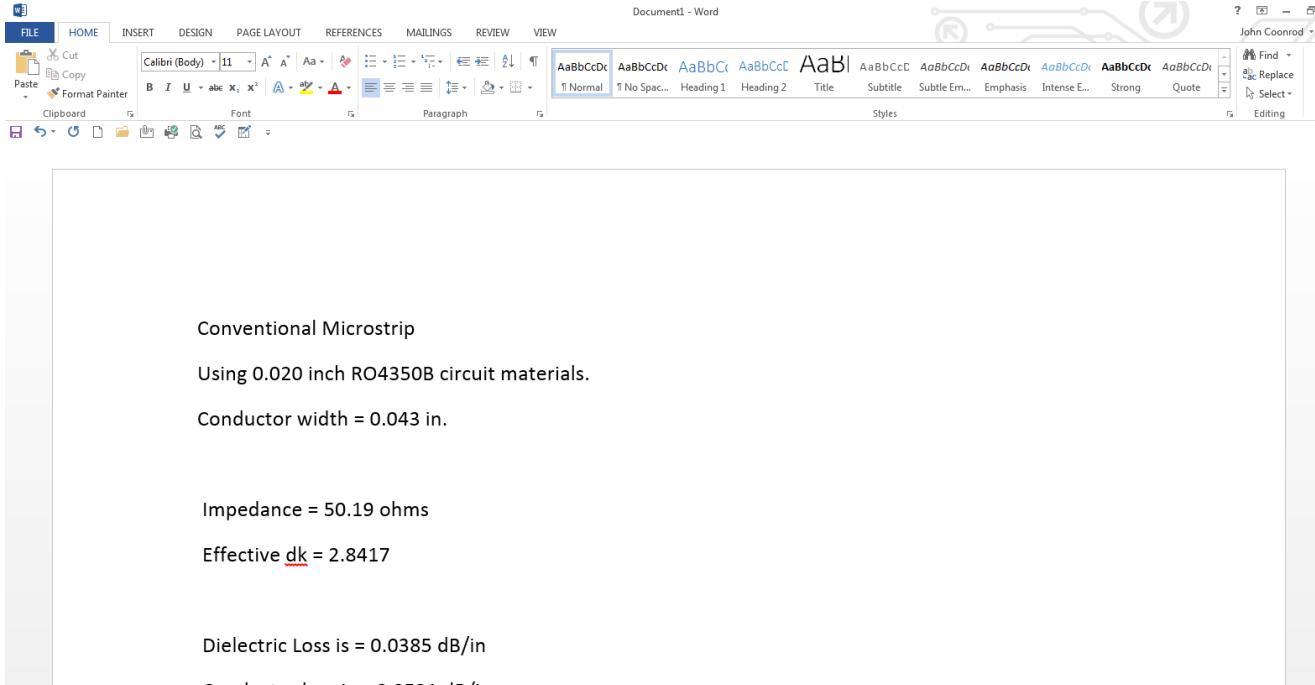
The right side of the interface contains several panels:

- Material Database:** A table listing various Rogers materials with their Bulk Dk, Df, TC Dk, and Therm Cond values.
- Material Properties:** Fields for Material (RO4350B), Thickness (H) (0.020 in.), Dk (3.66), Df (0.0037), Thermal Cond. (0.62 W/Km), and a radio button for "use z-axis Bulk Dk values".
- Conductor Parameters:** Fields for Thickness (T) (0.0006 in.), 1/2oz ED, Conductivity (5.813 X 10<sup>7</sup> S/m), Surface Area Index (3.8), and a radio button for "Optimum for accuracy".
- Generate Tables and Files:** Buttons for "Calculate", "Frequency" (3 GHz), "Impedance" (50 Ohms), and "Freq. Range" (1 to 30 GHz).

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## Software Operations, Copy to other programs

Example: copy from  
MWI-2017 and  
paste into Windows®  
Word



Document1 - Word

Conventional Microstrip

Using 0.020 inch RO4350B circuit materials.

Conductor width = 0.043 in.

Impedance = 50.19 ohms

Effective dk = 2.8417

Dielectric Loss is = 0.0385 dB/in

Conductor Loss is = 0.0521 dB/in

The screenshot shows a Microsoft Word document window titled "Document1 - Word". The "HOME" tab is selected in the ribbon. The text "Conventional Microstrip" is highlighted with a blue selection bar. The Word ribbon includes tabs for FILE, HOME, INSERT, DESIGN, PAGE LAYOUT, REFERENCES, MAILINGS, REVIEW, and VIEW. The "Clipboard" section of the ribbon shows "Paste" and "Format Painter" options. The "Font" and "Paragraph" sections of the ribbon are visible. The "Styles" section shows a list of styles: Normal, No Spac..., Heading 1, Heading 2, Title, Subtitle, Subtle Em..., Emphasis, Intense E..., Strong, and Quote. The "Editing" section includes "Find", "Replace", and "Select" buttons. The status bar at the bottom right shows "John Coonrod".

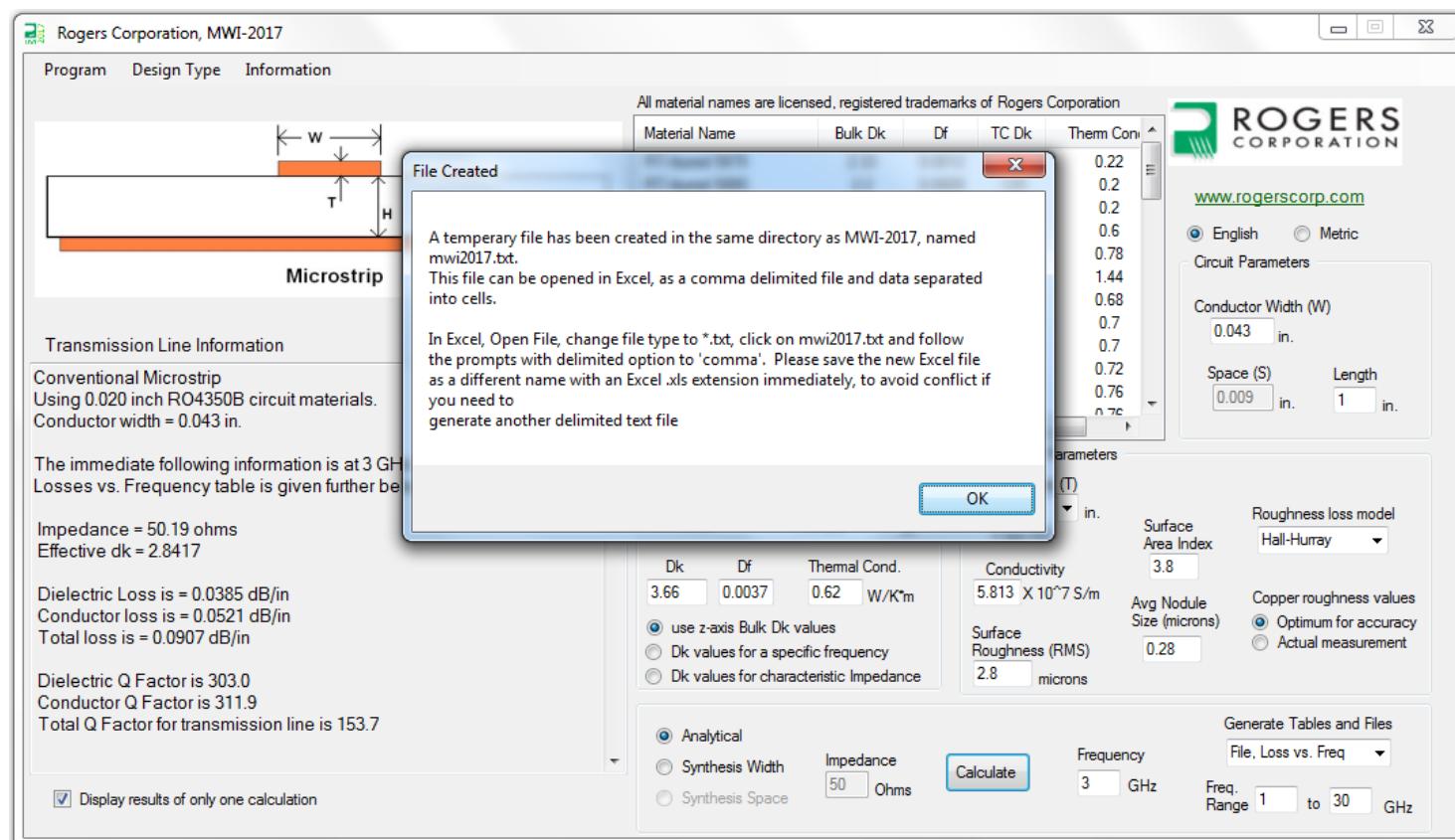
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## Software Operations, Generating comma delimited file

A comma delimited file can be generated with a table of information.

A file will be saved in the same directory as the MWI-2016 software and named "mwi2017.txt".

The user can open this file with Excel and follow the prompts for importing the file as a comma delimited file. This will allow the user to manipulate the data and generate graphs.



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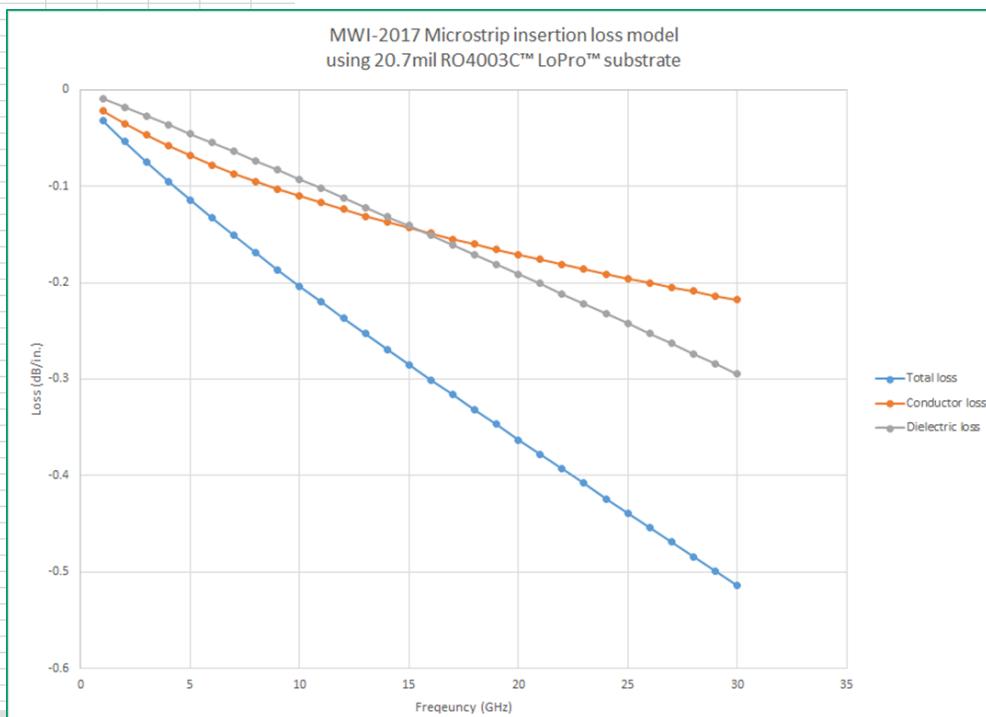
# Software Operations, Generating Charts

Open Excel® spreadsheet, change file type to "All Files" and open "mwi2017.txt".

Click on delimited, click on Next, click on comma delimited, click Next and Finish.

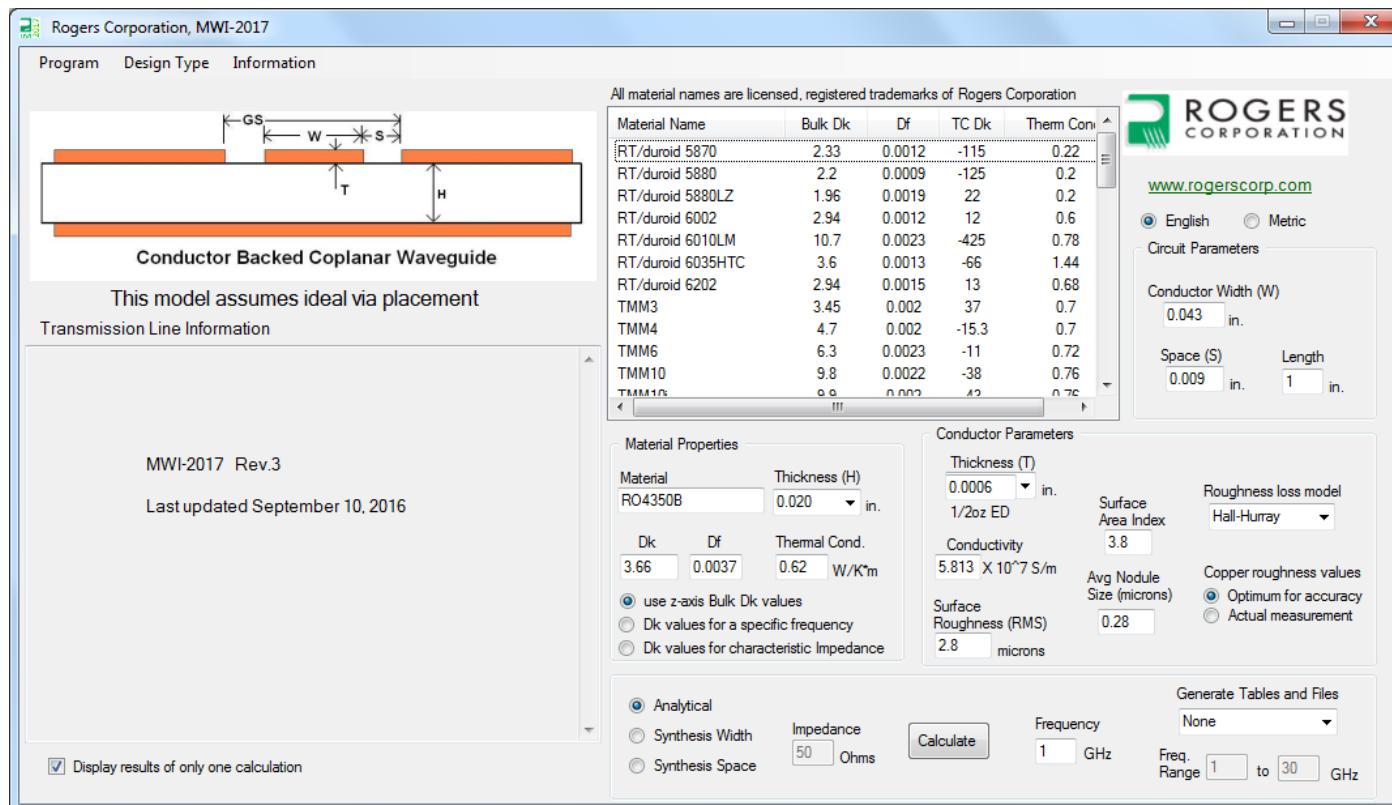
- With the table of information, you can easily generate a graph.

To avoid complications, the user should rename this new Excel file immediately, to something other than "mwi2016.txt" and with the ".xls" extension.



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## Software Operations, Grounded Coplanar Waveguide



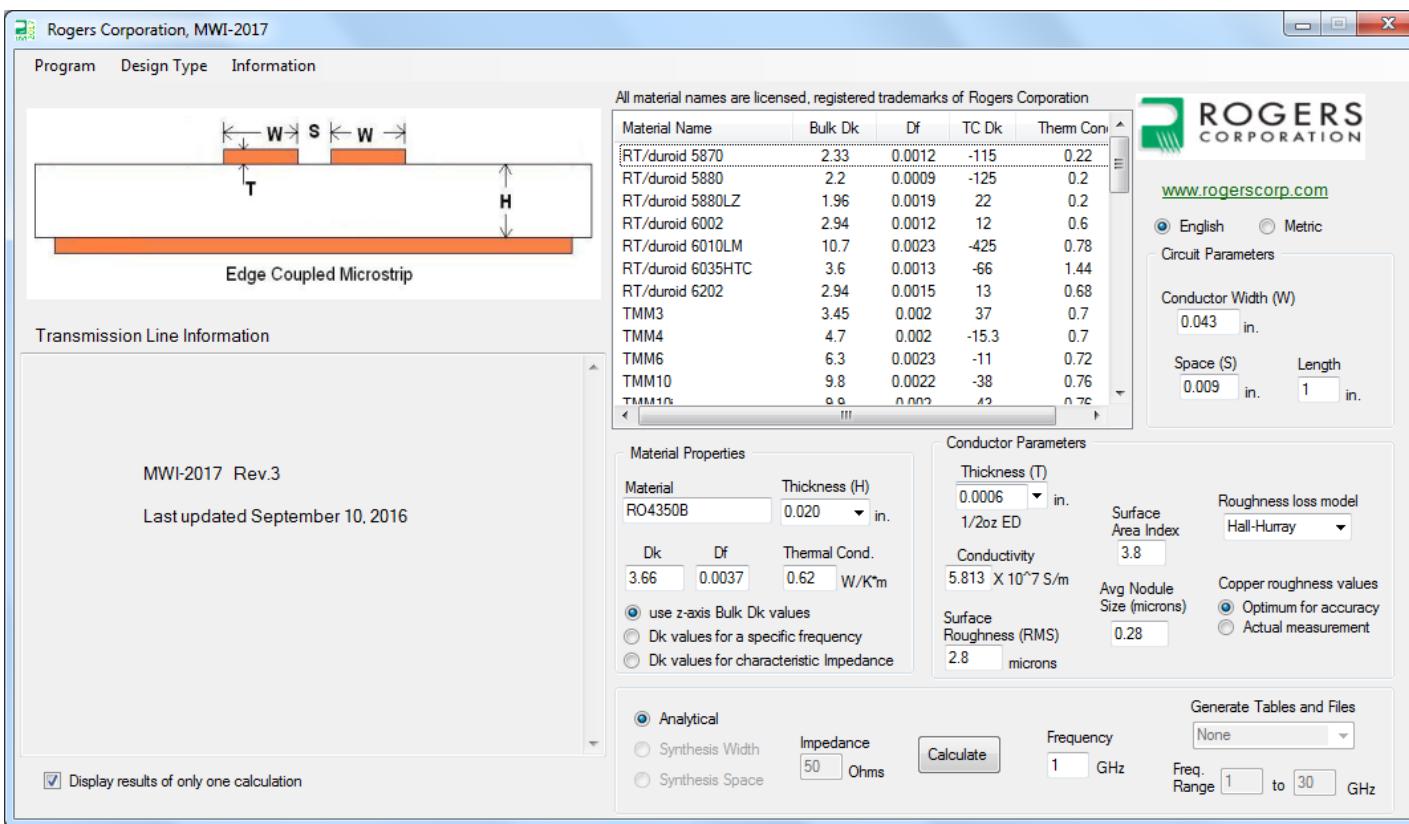
Click on Design Type, then Coplanar, then Conductor Backed

Typically this model has some accuracy issues with thinner constructions and copper thickness variance.

Since this model cannot determine the effects of grounding via's on impedance and loss, some differences may occur between an actual circuit and this model

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## Software Operations, Microstrip Edge Coupled

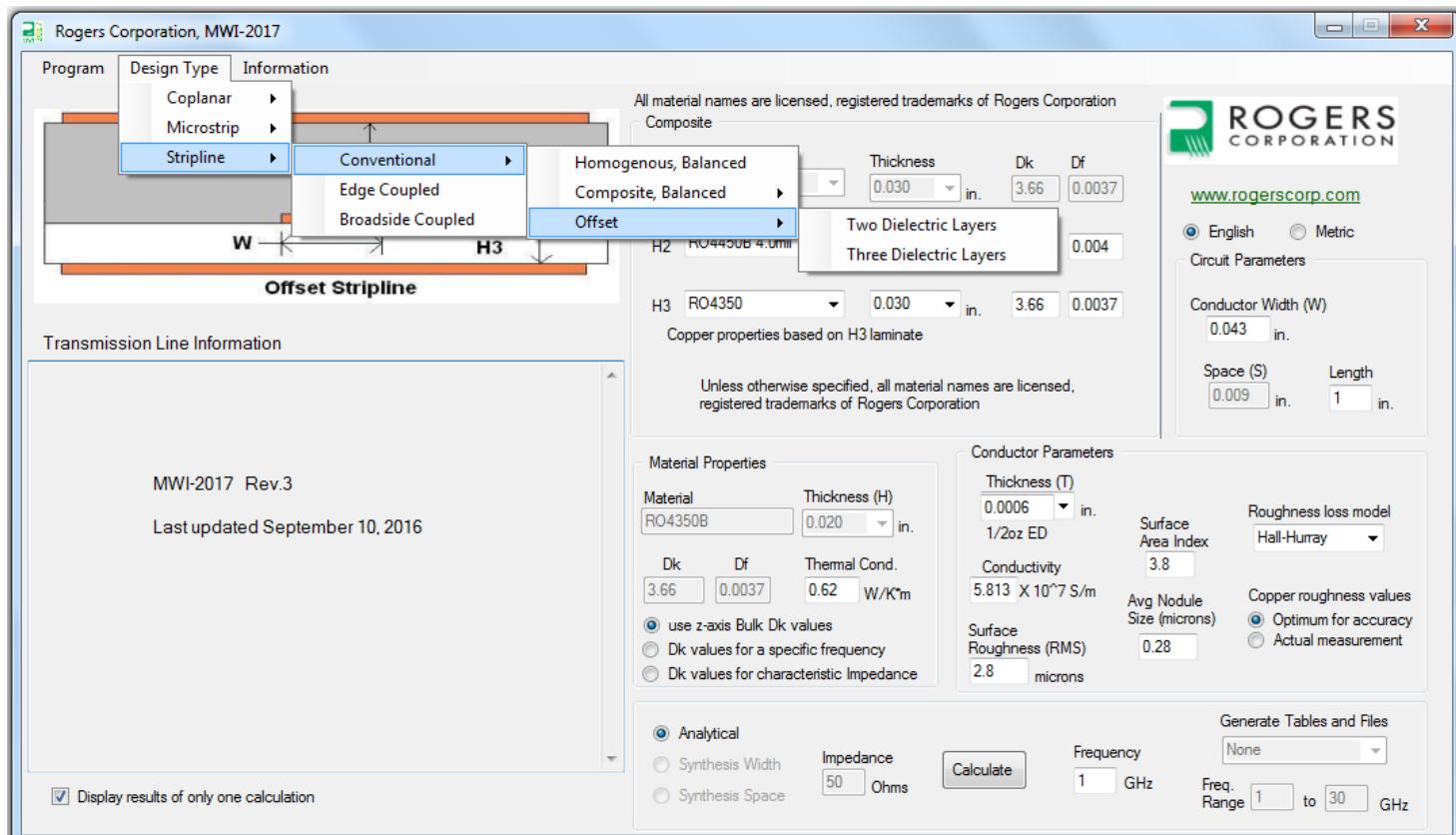


Click on Design Type,  
then Microstrip and then  
Edge Coupled

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## Software Operations, Stripline line models

There are multiple methods to build stripline circuits and additional models have been added to consider the most common constructions.

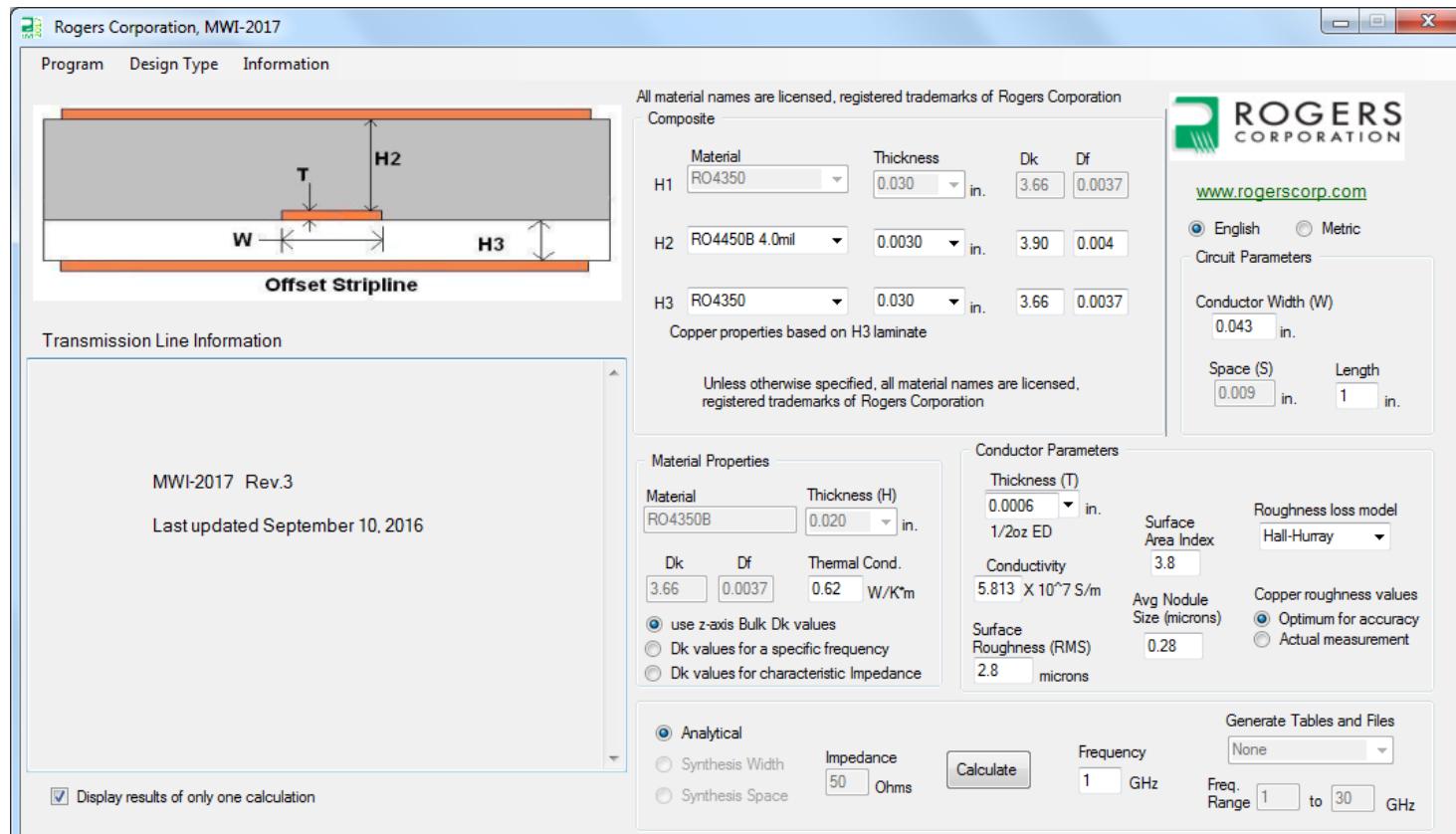


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## Software Operations, Stripline line models

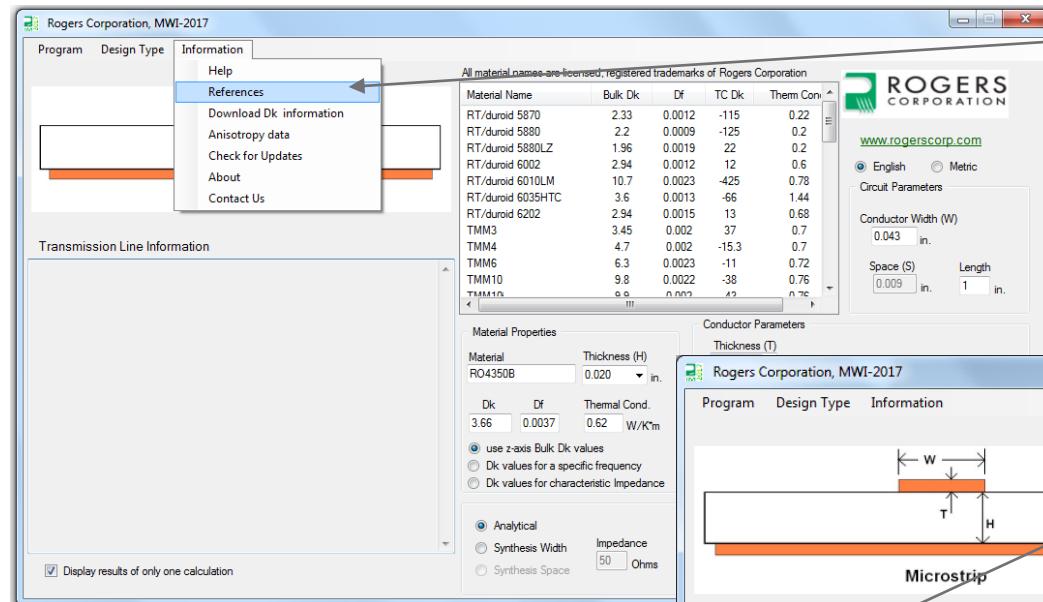
For a composite or offset composite stripline circuit, the conductor roughness number is taken from the bottom substrate properties.

In this example the RO4000® family of materials are used. However any of Rogers' laminates can be chosen.



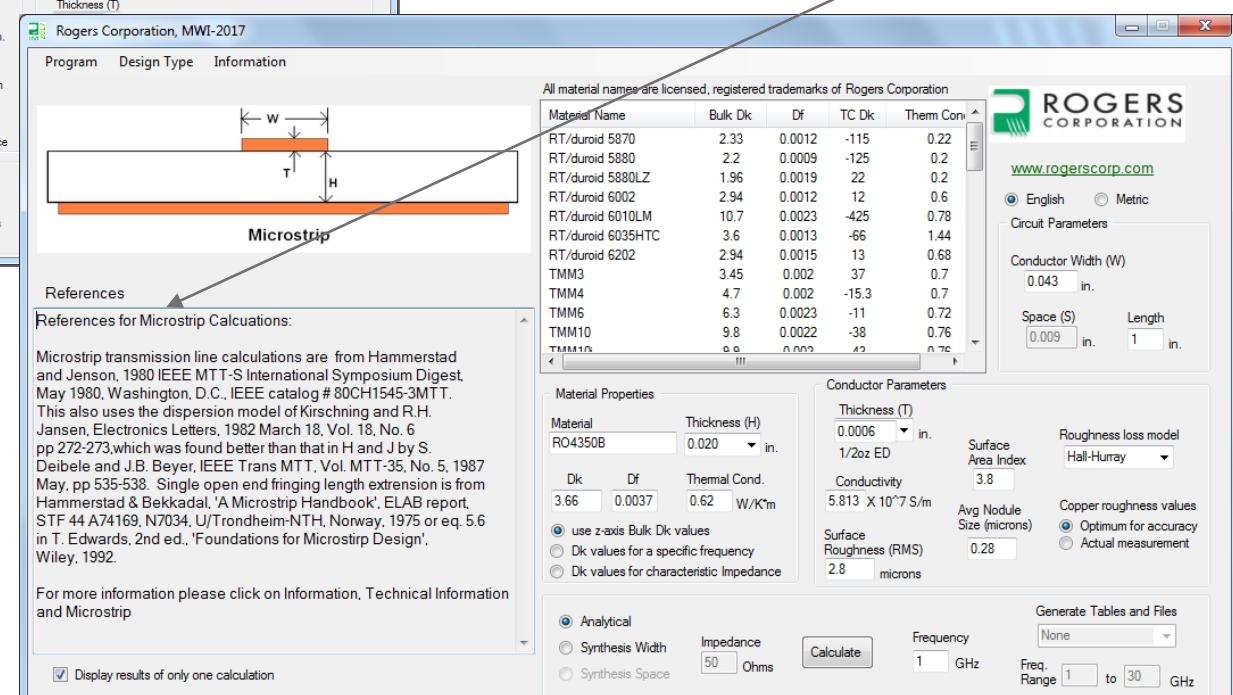
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## Software Operations, Reference information



User can get the references for whichever transmission line is selected.

Example to the left: after microstrip design is selected, click on Information and click on References. The technical references used for the calculations are shown.



For more information please click on Information, Technical Information and Microstrip

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