

MWI-2019 Software Instruction Manual



Advanced Connectivity Solutions

Helping **power, protect, connect** our world™

MWI-2019 Software Instruction Manual

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

MWI-2019 Software Instruction Manual

Installing:

- After downloading the mwi2019.exe file, save it on the primary hard drive of the computer that will be using the software
 - Do not install on a network system
 - Do not run from a thumb drive
 - 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 "mwi2019.exe"
- The computer that runs the software must have an operating system with the dot-net framework, from 2004 or more recent

MWI-2019 Software Instruction Manual

Software Operations, material list

Dielectric Constant
"Bulk 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.

The screenshot displays the MWI-2019 software interface. On the left, a diagram of a microstrip is shown with dimensions W, T, and H. Below it, the 'Transmission Line Information' section is visible. The main window features a material list table with columns for Material Name, Bulk Dk, Df, TC Dk, and Therm Cond. A tooltip for 'RT/duroid 6202' is shown, providing details about its PTFE material, woven glass ceramic, moisture absorption, thermal expansion, and UL flame rating. The bottom section contains 'Material Properties' and 'Conductor Parameters' for the selected material, along with calculation options and a 'Calculate' button.

Material Name	Bulk Dk	Df	TC Dk	Therm Cond
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
TMM3	3.45	0.002	27	0.7
TMM4	3.45	0.002	27	0.7
TMM6	3.45	0.002	27	0.7
TMM10	3.45	0.002	27	0.7

Material Properties for RO4350B:

Material	Thickness (H)	Dk	Df	Thermal Cond.
RO4350B	0.020 in.	3.66	0.0037	0.62 W/K*m

Conductor Parameters for RO4350B:

Thickness (T)	Surface Area Index	1/2oz ED	Conductivity	Average Nodule radius (microns)	Surface Roughness (RMS)
0.0006 in.	3.8	1/2oz ED	5.813 X 10 ⁻⁷ S/m	0.28	2.8 microns

MWI-2019 Software Instruction Manual

Software Operations, material thickness

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

Rogers Corporation, MWI-2019

Program Design Type Information

Microstrip

Transmission Line Information

MWI-2019 Rev.1
Last updated January 2019

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Con
RT/duroid 5870	2.33	0.0012	-15	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	0.003	-66	1.44
RT/duroid 6202	2.94	0.0015	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
TMM10B	9.8	0.002	42	0.76

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
☐ Dk values for a specific frequency
☐ Dk values for characteristic Impedance

Conductor Parameters

Thickness (T): 0.0006 in. Surface Area Index: 3.8
 1/2oz ED Roughness loss model: Hall-Huray
 Conductivity: 5.813×10^{-7} S/m Average Nodule radius (microns): 0.28
 Surface Roughness (RMS): 2.8 microns
☒ Optimum for accuracy
☐ Actual measurement

Circuit Parameters

Conductor Width (W): 0.043 in.
 Space (S): 0.009 in. Length: 1 in.

Generate Tables and Files

☒ Analytical Impedance: 50 Ohms Frequency: 1 GHz
☐ Synthesis Width
☐ Synthesis Space

Calculate

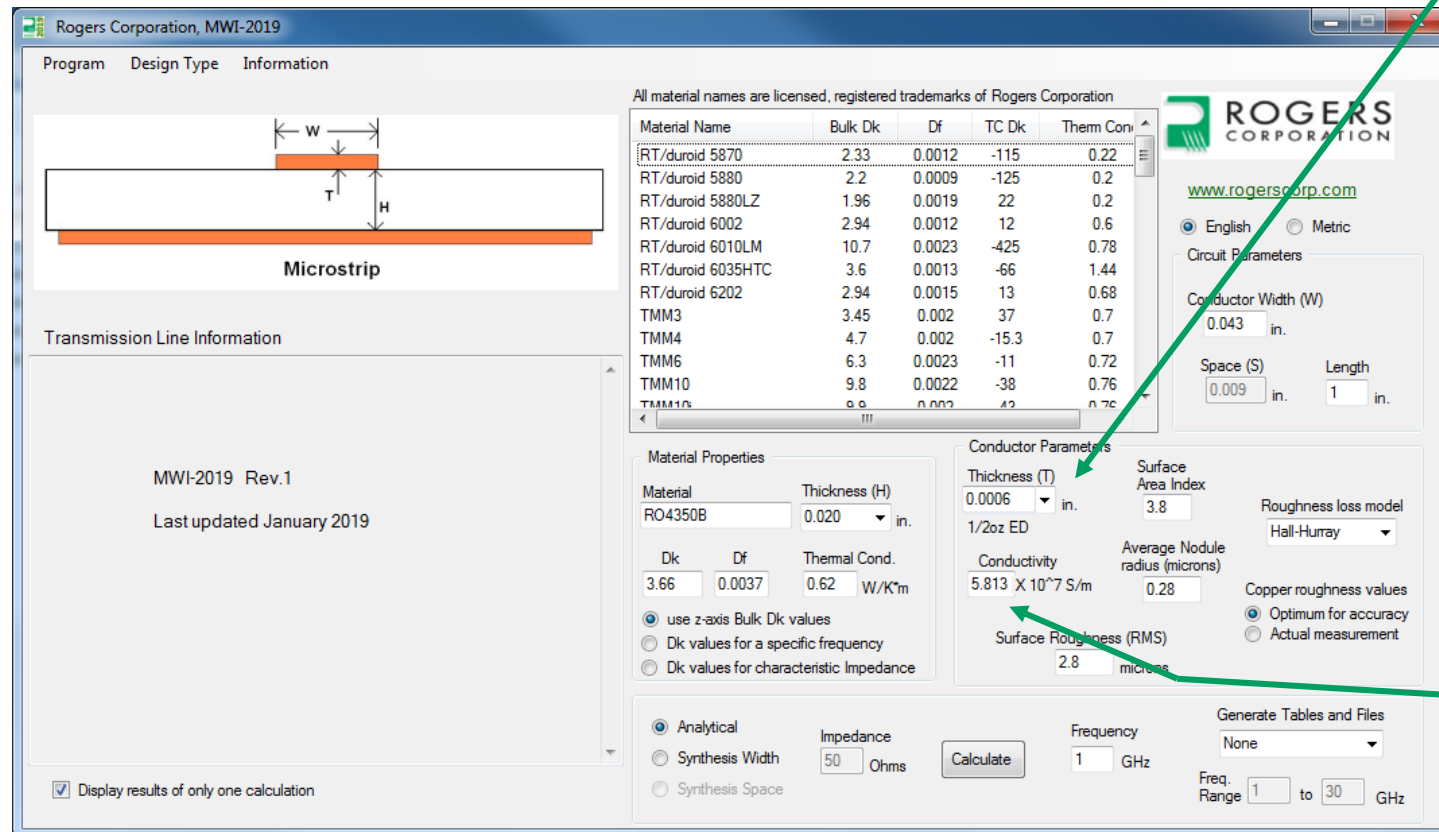
Freq. Range: 1 to 30 GHz

☒ Display results of only one calculation

MWI-2019 Software Instruction Manual

Software Operations, copper definition

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



The screenshot displays the MWI-2019 software interface for defining copper properties. The top left shows a diagram of a microstrip with dimensions w , T , and H . The top right features the Rogers Corporation logo and website. The main area contains a table of material properties and several input fields for conductor parameters.

Material Properties Table:

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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
TMM11	9.9	0.002	43	0.76

Material Properties Section:

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
☐ Dk values for a specific frequency
☐ Dk values for characteristic Impedance

Conductor Parameters Section:

Thickness (T): 0.0006 in.
Conductivity: 5.813×10^7 S/m
Surface Roughness (RMS): 2.8 microns

Other Parameters:

Surface Area Index: 3.8
Average Nodule radius (microns): 0.28
Roughness loss model: Hall-Huray
Copper roughness values: ☒ Optimum for accuracy, ☐ Actual measurement

Calculation Options:

☒ Analytical, ☐ Synthesis Width, ☐ Synthesis Space
Impedance: 50 Ohms, Frequency: 1 GHz
Generate Tables and Files: None
Freq. Range: 1 to 30 GHz

☒ Display results of only one calculation

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

MWI-2019 Software Instruction Manual

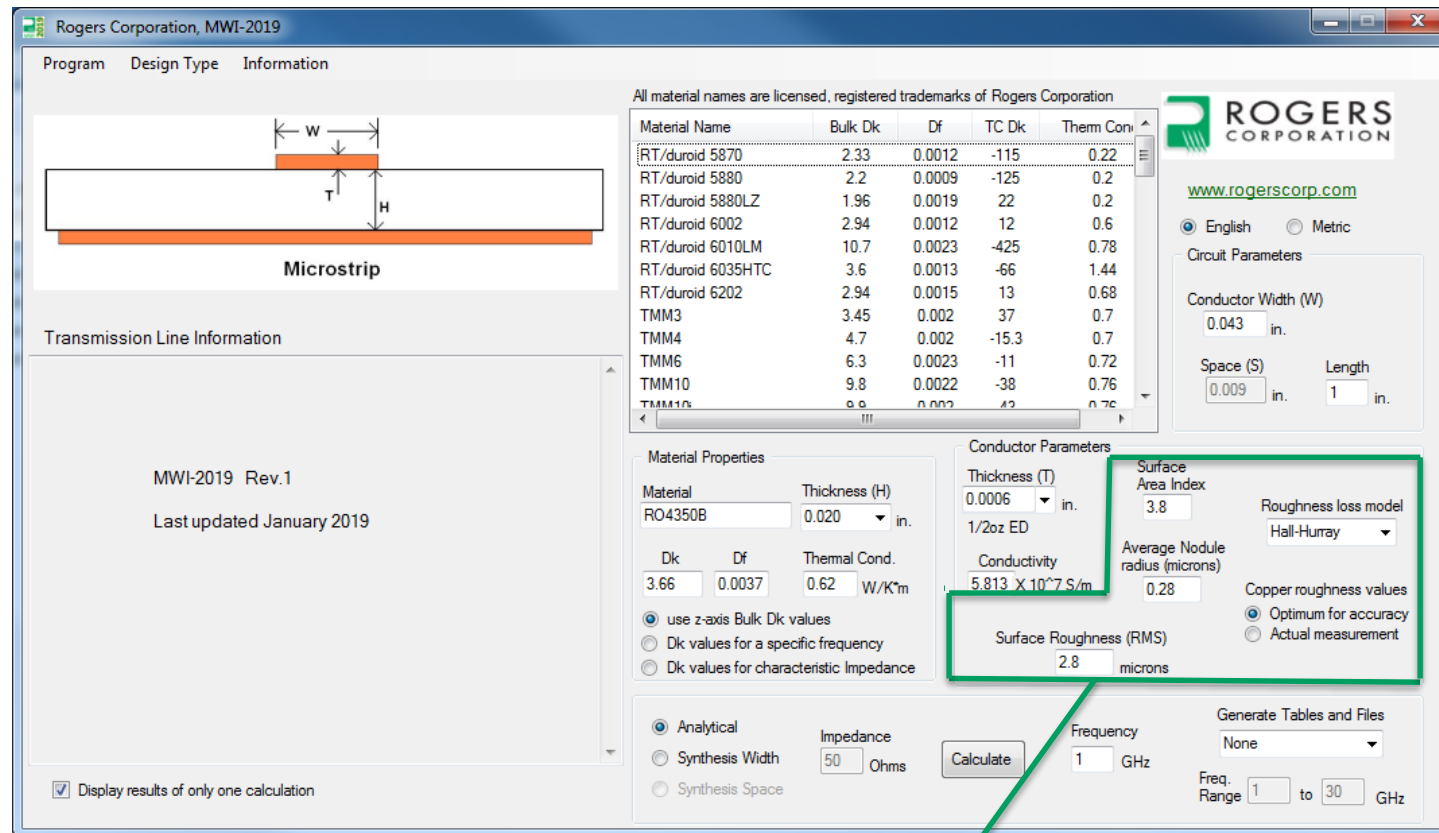
Software Operations, copper definition

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 accurate when used below about 10 GHz

The Hall-Huray model is most accurate at higher frequencies and very wideband

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



Program Design Type Information

Microstrip

Transmission Line Information

MWI-2019 Rev.1
Last updated January 2019

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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
TMM11	9.9	0.002	43	0.76

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
☐ Dk values for a specific frequency
☐ Dk values for characteristic Impedance

☒ Analytical
☐ Synthesis Width
☐ Synthesis Space

Impedance: 50 Ohms

Frequency: 1 GHz

Generate Tables and Files: None

Freq. Range: 1 to 30 GHz

Calculate

Conductor Parameters

Thickness (T): 0.0006 in.

1/2oz ED

Conductivity: 5.813×10^7 S/m

Surface Roughness (RMS): 2.8 microns

Surface Area Index: 3.8

Average Nodule radius (microns): 0.28

Roughness loss model: Hall-Huray

Copper roughness values:
☒ Optimum for accuracy
☐ Actual measurement

Display results of only one calculation

Copper roughness information

MWI-2019 Software Instruction Manual

Software Operations, changing materials

The screenshot displays the MWI-2019 software interface. On the left, a diagram of a microstrip is shown with dimensions W (width), T (thickness), and H (height). Below it, the text 'Microstrip' is visible. The main window is titled 'Rogers Corporation, MWI-2019' and contains a 'Program Design Type Information' tab. A table of material properties is shown, with columns for Material Name, Bulk Dk, Df, TC Dk, and Therm Cond. The table lists various materials, including RT/duroid 5870, RT/duroid 5880, RT/duroid 5880LZ, RT/duroid 6002, RT/duroid 6010LM, RT/duroid 6035HTC, TMM3, TMM4, TMM6, TMM10, and TMM10S. The 'Material Properties' section shows the selected material 'RO4350B' with a thickness of 0.020 in. The 'Conductor Parameters' section shows the selected conductor type '1/2oz ED' with a thickness of 0.0006 in. The 'Surface Roughness (RMS)' is set to 2.8 microns. The 'Frequency' is set to 1 GHz. The 'Calculate' button is visible. The bottom left corner shows 'MWI-2019 Rev.1' and 'Last updated January 2019'. The bottom right corner has a checkbox for 'Display results of only one calculation'.

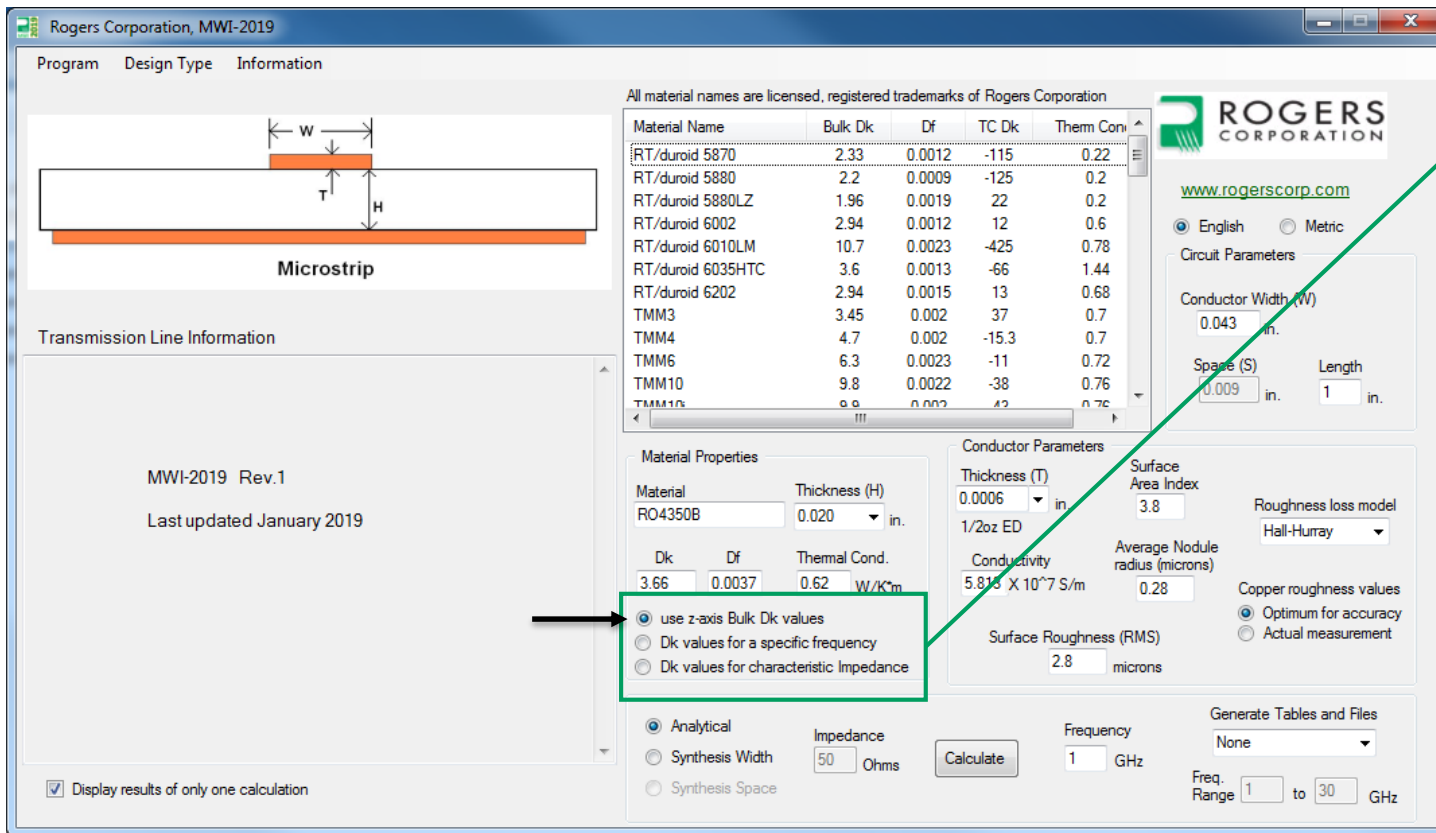
When changing from one material to another, the nearest standard thickness of new material selected will be chosen.

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

Both of these can be overridden.

MWI-2019 Software Instruction Manual

Software Operations, Design Dk values



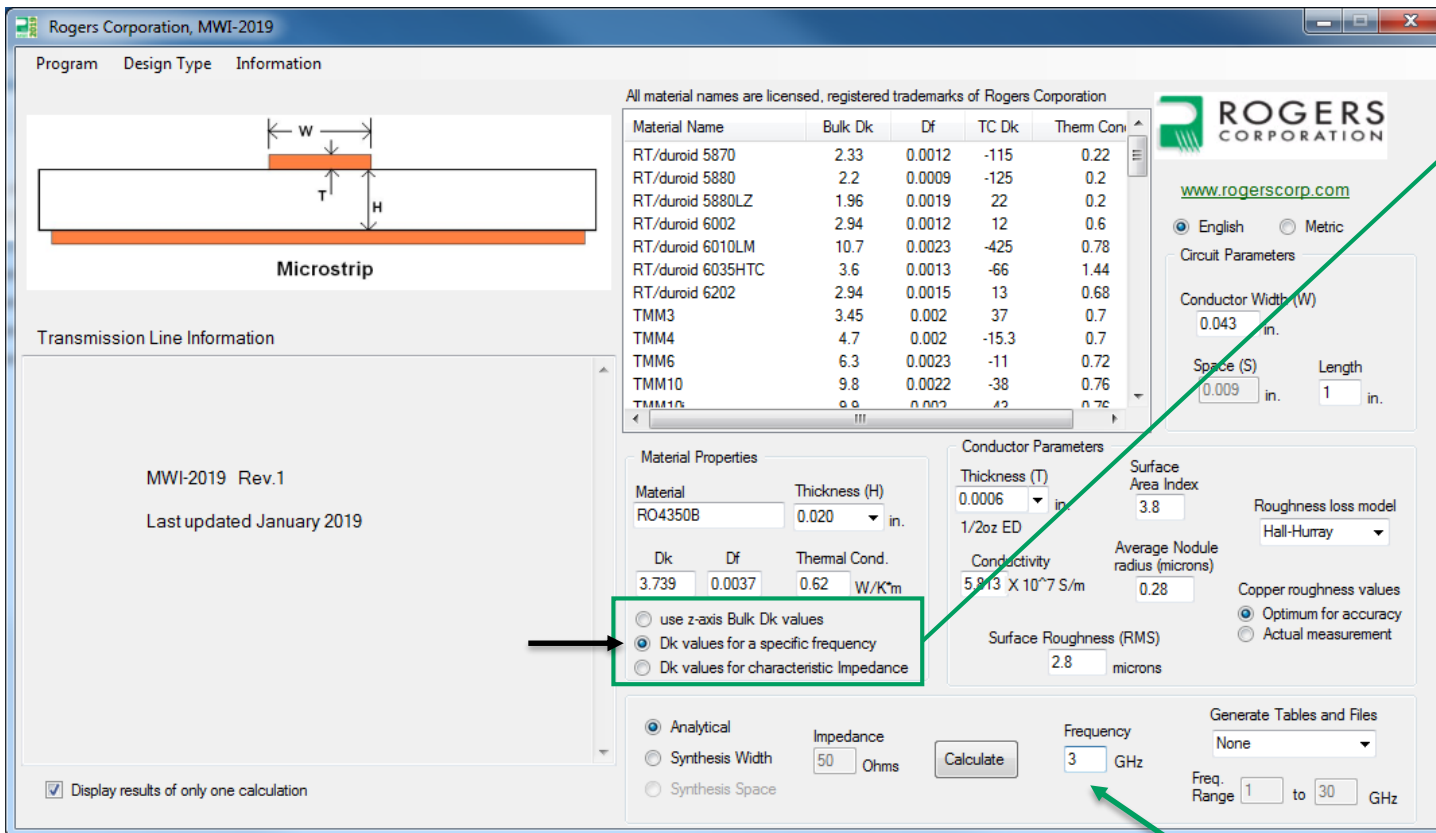
Design Dk is built into
this software

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

MWI-2019 Software Instruction Manual

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

MWI-2019 Software Instruction Manual

Software Operations, Design Dk values

The screenshot shows the MWI-2019 software interface. On the left, there is a diagram of a microstrip with dimensions W, T, and H. Below it, the text "Microstrip" is displayed. The main window is divided into several sections. At the top, there is a "Program Design Type Information" tab. Below this, there is a "Transmission Line Information" section. In the center, there is a table of material properties. To the right of the table, there is a "Material Properties" section. At the bottom, there is a "Conductor Parameters" section. A green box highlights the "Dk values for characteristic Impedance" option in the "Material Properties" section. A black arrow points to this option. The "Conductor Parameters" section includes fields for Thickness (T), Surface Area Index, Roughness loss model, Average Nodule radius (microns), Copper roughness values, and Surface Roughness (RMS). The "Material Properties" section includes fields for Material, Thickness (H), Dk, Df, and Thermal Cond. The "Conductor Parameters" section also includes a "Calculate" button and a "Frequency" field.

Material Name	Bulk Dk	Df	TC Dk	Therm Cond
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
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
TMM16	9.9	0.002	42	0.76

Material Properties

Material: RO4350B Thickness (H): 0.020 in.

Dk: 3.717 Df: 0.0037 Thermal Cond.: 0.62 W/K*m

☐ use z-axis Bulk Dk values

☐ Dk values for a specific frequency

☒ Dk values for characteristic Impedance

Conductor Parameters

Thickness (T): 0.0006 in. Surface Area Index: 3.8

1/2oz ED Conductivity: 5.813×10^{-7} S/m Average Nodule radius (microns): 0.28

Surface Roughness (RMS): 2.8 microns

Roughness loss model: Hall-Huray

Copper roughness values: ☒ Optimum for accuracy ☐ Actual measurement

Analytical ☒ Synthesis Width ☐ Synthesis Space

Impedance: 50 Ohms Frequency: 1 GHz

Generate Tables and Files: None

Freq. Range: 1 to 30 GHz

Calculate

Display results of only one calculation

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

MWI-2019 Software Instruction Manual

Software Operations, Analytical and Synthesis

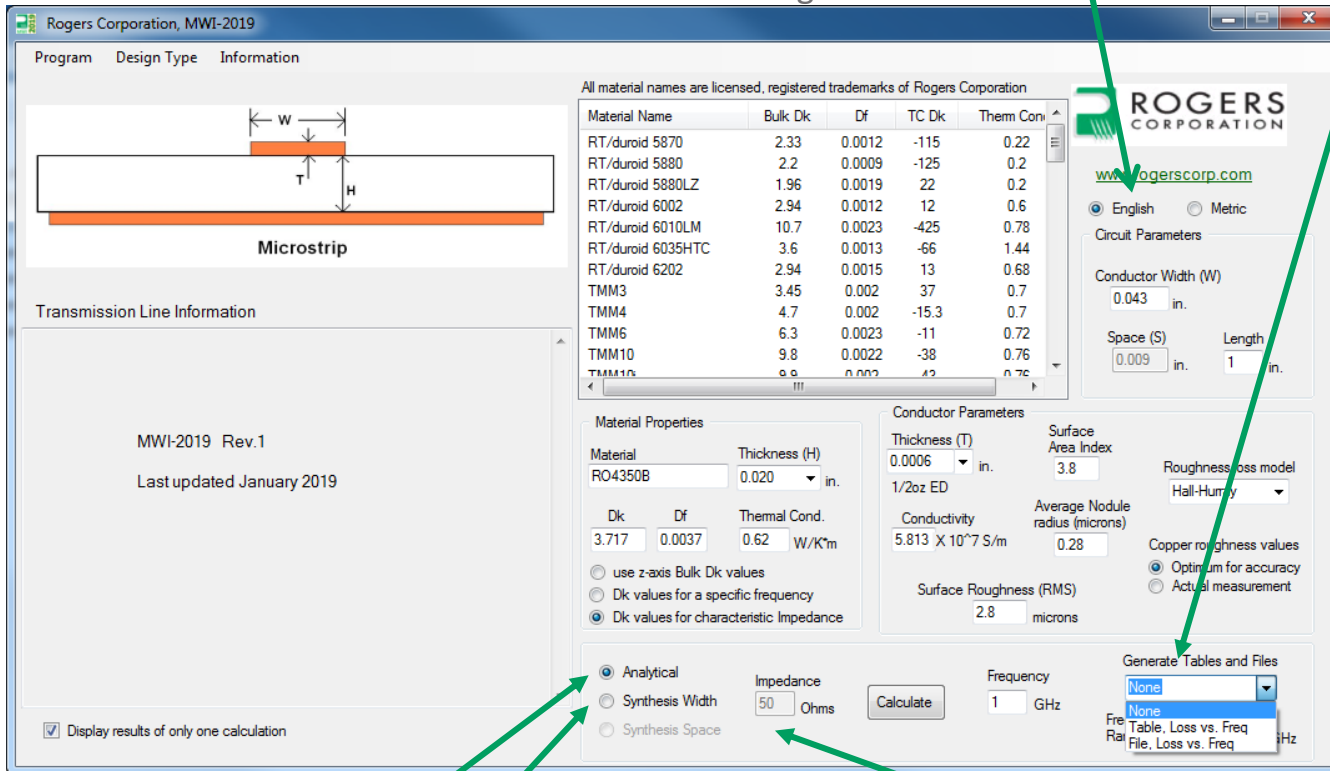
Units can be changed between English and Metric

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.

It is highly recommended for the user to do a simple Synthesis calculation, then click 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.

MWI-2019 Software Instruction Manual

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.

Rogers Corporation, MWI-2019

Program Design Type Information

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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
TMM12	9.8	0.002	42	0.76

Microstrip

Transmission Line Information

Conventional Microstrip
Using 0.020 inch RO4350B circuit materials.
Conductor width = 0.043 in.

Impedance = 49.70 ohms
Effective dk = 2.8724

Dielectric Loss is = 0.0129 dB/in
Conductor loss is = 0.0251 dB/in
Total loss is = 0.0381 dB/in

Dielectric Q Factor is 303.0
Conductor Q Factor is 180.1
Total Q Factor for transmission line is 112.9

Wavelength on transmission line:
wavelength = 6.964 in.
1/2 wavelength = 3.482 in.

☒ Display results of only one calculation

Material Properties

Material: RO4350B Thickness (H): 0.020 in.

Dk: 3.717 Df: 0.0037 Thermal Cond.: 0.62 W/K*m

☐ use z-axis Bulk Dk values
☐ Dk values for a specific frequency
☒ Dk values for characteristic Impedance

Conductor Parameters

Thickness (T): 0.0006 in. Surface Area Index: 3.8 Roughness loss model: Hall-Huray

1/2oz ED Conductivity: 5.813×10^{-7} S/m Average Nodule radius (microns): 0.28 Copper roughness values: ☒ Optimum for accuracy ☐ Actual measurement

Surface Roughness (RMS): 2.8 microns

Analytical ☒ Synthesis Width ☐ Synthesis Space

Impedance: 50 Ohms Calculate

Frequency: 1 GHz

Generate Tables and Files: None

Freq. Range: 1 to 30 GHz

MWI-2019 Software Instruction Manual

Software Operations, Summary window

Rogers Corporation, MWI-2019

Program Design Type Information

Microstrip

Transmission Line Information

Conventional Microstrip
Using 0.020 inch RO4350B circuit materials.
Conductor width = 0.043 in.

Impedance = 49.70 ohms
Effective dk = 2.8724

Dielectric Loss is = 0.0129 dB/in
Conductor loss is = 0.0251 dB/in
Total loss is = 0.0381 dB/in

Dielectric Q Factor is 303.0
Conductor Q Factor is 180.1
Total Q Factor for transmission line is 112.9

Wavelength on transmission line:
1 wavelength = 6.964 in.
1/2 wavelength = 3.482 in.

☒ Display results of only one calculation

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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
TMM10	9.8	0.002	42	0.76

Material Properties

Material: RO4350B Thickness (H): 0.020 in.

Dk: 3.717 Df: 0.0037 Thermal Cond.: 0.62 W/K*m

☐ use z-axis Bulk Dk values
☐ Dk values for a specific frequency
☒ Dk values for characteristic impedance

Conductor Parameters

Thickness (T): 0.0006 in. Surface Area Index: 3.8

1/2oz ED Conductivity: 5.813×10^{-7} S/m Average Nodule radius (microns): 0.28

Surface Roughness (RMS): 2.8 microns

Roughness loss model: Hall-Huray

Copper roughness values
☒ Optimum for accuracy
☐ Actual measurement

☒ Analytical Impedance: 50 Ohms Frequency: 1 GHz
☐ Synthesis Width
☐ Synthesis Space

Calculate

Generate Tables and Files: None

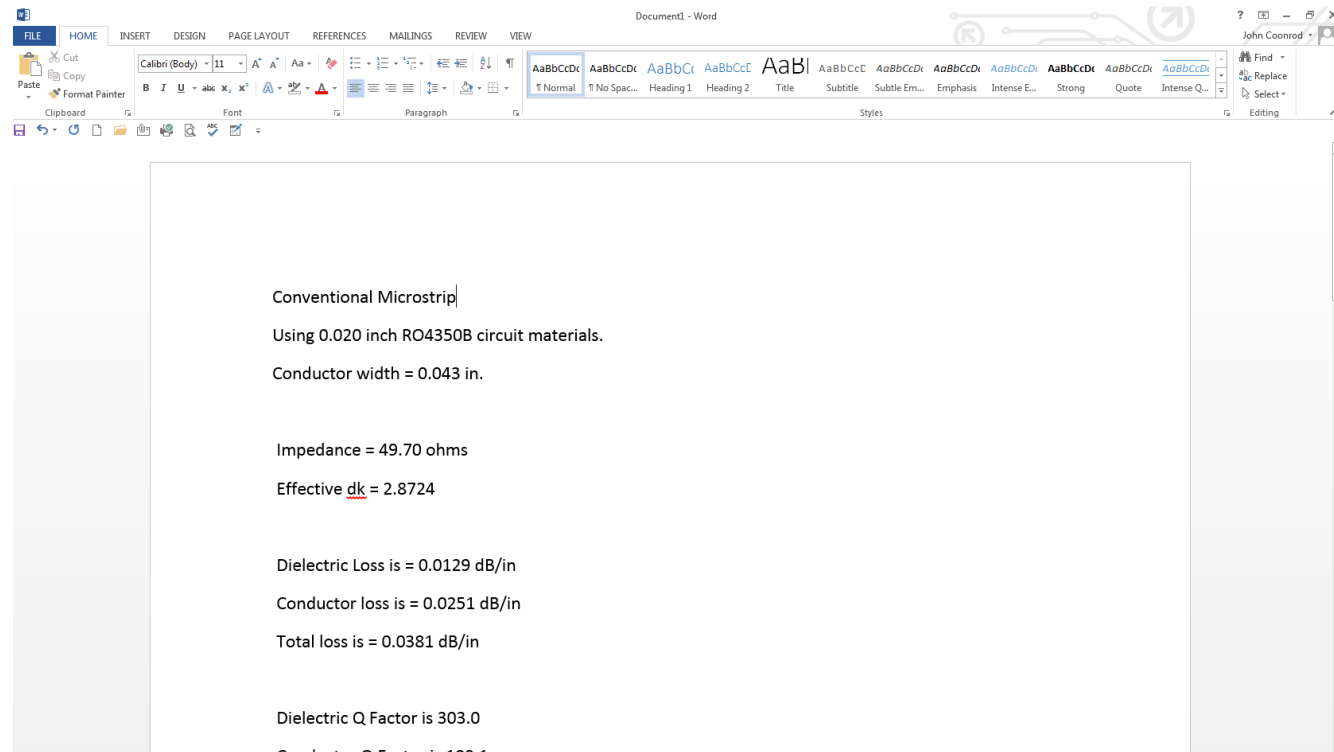
Freq. Range: 1 to 30 GHz

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

MWI-2019 Software Instruction Manual

Software Operations, Copy to other programs

Example: copy from
MWI-2019 and
paste into Windows®
Word



MWI-2019 Software Instruction Manual

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-2019 software and named "mwi2018.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.

The screenshot displays the Rogers Corporation MWI-2019 software interface. The main window is titled "Rogers Corporation, MWI-2019" and has tabs for "Program", "Design Type", and "Information". The "Design Type" tab is active, showing a diagram of a microstrip on a substrate with dimensions W, T, and H. Below the diagram is the label "Microstrip".

On the right side, there is a table of material names and their properties:

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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

Below the table, there are sections for "Transmission Line Information" and "Conductor Parameters". The "Transmission Line Information" section shows "Conventional Microstrip" and "Using 0.020 inch RO4350B circuit material". The "Conductor Parameters" section shows "Thickness (T)" as 0.0006 in. and "Surface Area Index" as 3.8.

A "File Created" dialog box is open in the center, stating: "A temporary file has been created in the same directory as MWI-2019, named mwi2019.txt. This file can be opened in Excel, as a comma delimited file and data separated into cells. In Excel, Open File, change file type to *.txt, click on mwi2019.txt and follow the prompts with delimited option to 'comma'. Please save the new Excel file as a different name with an Excel .xls extension immediately, to avoid conflict if you need to generate another delimited text file".

The bottom of the interface includes a "Calculate" button and a "Frequency" section with a value of 1 GHz. The "Generate Tables and Files" section has a dropdown menu set to "File, Loss vs. Freq".

MWI-2019 Software Instruction Manual

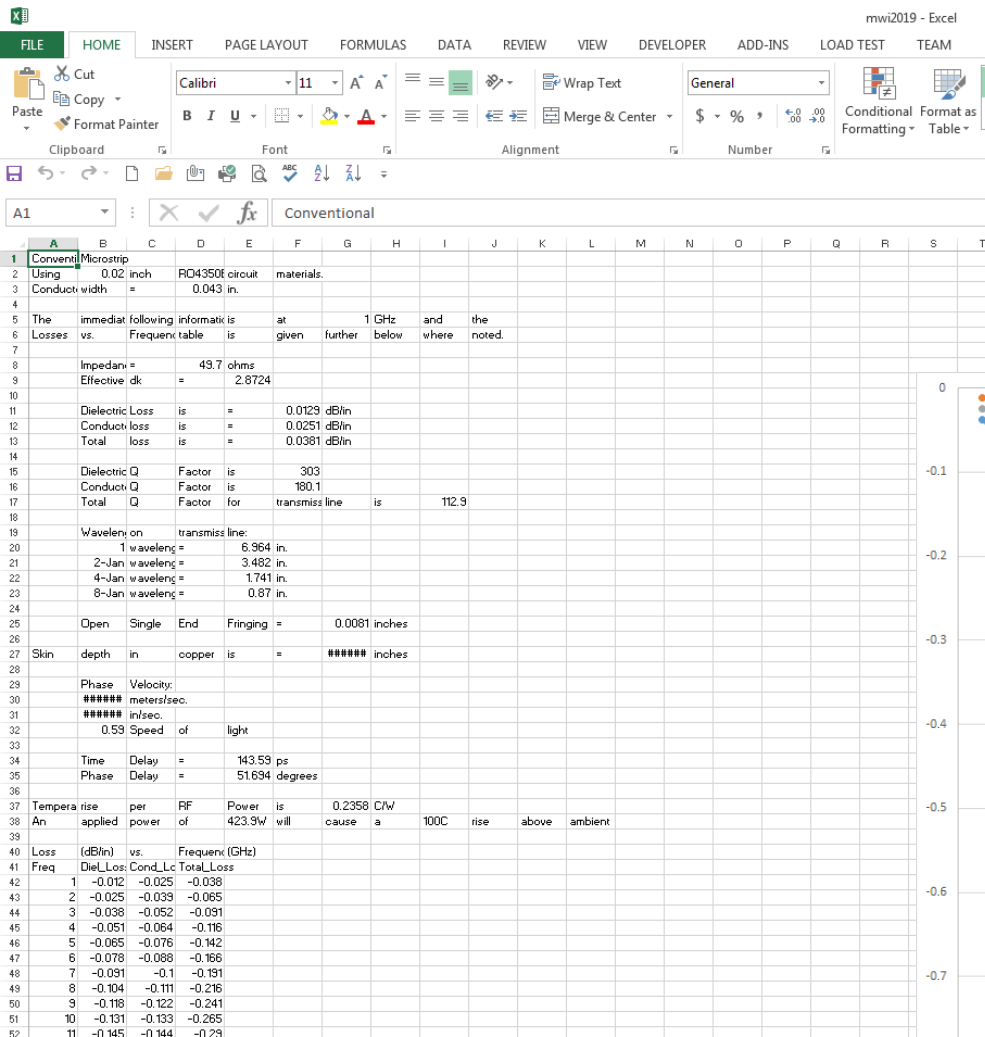
Software Operations, Generating Charts

Open Excel® spreadsheet, change file type to "All Files" and open "mwi2019.txt".

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

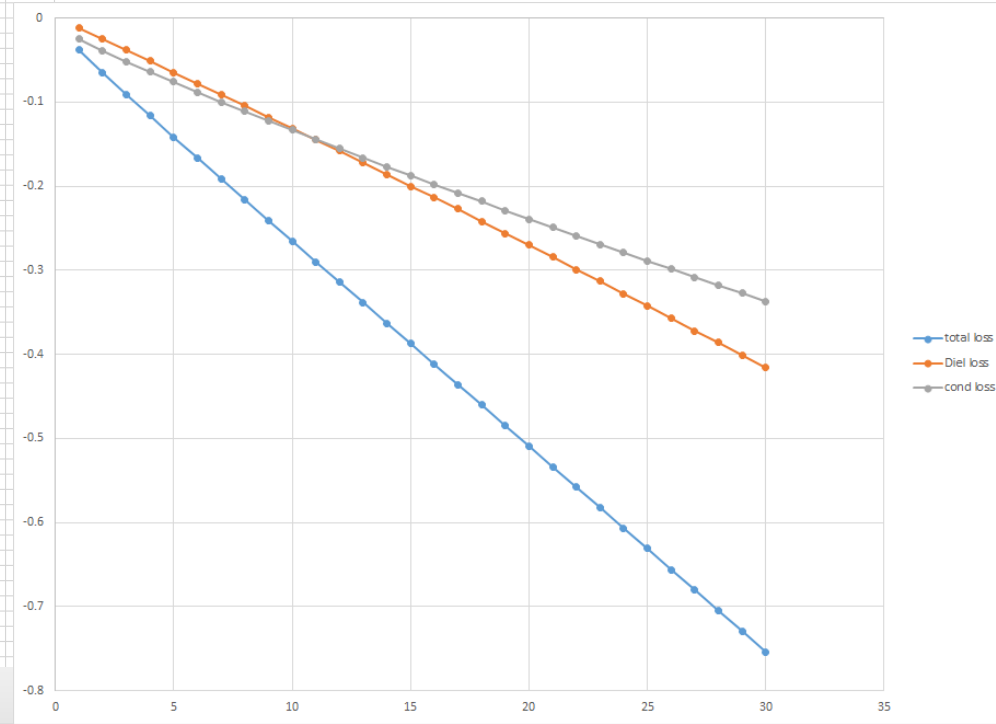
With the table of information, you can easily generate a graph.

To avoid complications, the user should rename this new Excel file immediately, to something other than "mwi2019.txt" and with the ".xls" extension.



The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Conventional	Microstrip																		
2	Using	0.02 inch	=	RO4350F circuit	materials.															
3	Conduct width			0.043 in.																
4																				
5	The	immediat	following	informati	is	at	1 GHz	and	the											
6	Losses	vs.	Frequen	table	is	given	further	below	where	noted.										
7																				
8		Impedan	=	43.7 ohms																
9		Effective dk	=	2.8724																
10																				
11		Dielectric Loss	is	=	0.0123 dB/in															
12		Conduct loss	is	=	0.0251 dB/in															
13		Total loss	is	=	0.0381 dB/in															
14																				
15		Dielectric Q	Factor	is	303															
16		Conduct Q	Factor	is	180.1															
17		Total Q	Factor	for	transmiss line	is	112.9													
18																				
19		Wavelength	on	transmiss line																
20		1 wavelength	=	6.364 in.																
21		2-Jan wavelength	=	3.482 in.																
22		4-Jan wavelength	=	1.741 in.																
23		8-Jan wavelength	=	0.87 in.																
24																				
25		Open	Single	End	Fringing	=	0.0081 inches													
26																				
27	Skin	depth	in	copper	is	=	##### inches													
28																				
29		Phase Velocity:																		
30		##### meters/sec.																		
31		##### in/sec.																		
32		0.59 Speed of	light																	
33																				
34		Time Delay	=	143.53 ps																
35		Phase Delay	=	51694 degrees																
36																				
37	Tempera	rise	per	RF of	Power	is	0.2358 C/W													
38	An	applied	power		423.5W	will	cause	a	100C	rise	above	ambient								
39																				
40	Loss	(dB/in)	vs	Frequen																
41	Freq	Diel_Loss	Cond_Loss	Total_Loss																
42	1	-0.012	-0.025	-0.038																
43	2	-0.025	-0.039	-0.065																
44	3	-0.038	-0.052	-0.091																
45	4	-0.051	-0.064	-0.116																
46	5	-0.065	-0.076	-0.142																
47	6	-0.078	-0.088	-0.166																
48	7	-0.091	-0.1	-0.191																
49	8	-0.104	-0.111	-0.216																
50	9	-0.118	-0.122	-0.241																
51	10	-0.131	-0.133	-0.265																
52	11	-0.145	-0.144	-0.29																

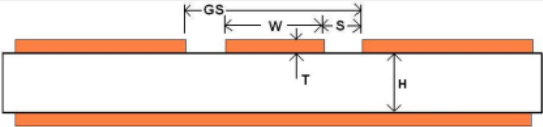


MWI-2019 Software Instruction Manual

Software Operations, Grounded Coplanar Waveguide

Rogers Corporation, MWI-2019

Program Design Type Information



Conductor Backed Coplanar Waveguide

This model assumes ideal via placement

Transmission Line Information

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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
TMM11	9.9	0.002	42	0.76

ROGERS CORPORATION
www.rogerscorp.com

English Metric

Circuit Parameters

Conductor Width (W)
0.043 in.

Space (S) Length
0.009 in. 1 in.

Material Properties

Material Thickness (H)
RO4350B 0.020 in.

Dk Df Thermal Cond.
3.66 0.0037 0.62 W/K*m

☒ use z-axis Bulk Dk values
☐ Dk values for a specific frequency
☐ Dk values for characteristic Impedance

Conductor Parameters

Thickness (T)
0.0006 in.

Surface Area Index
3.8

1/2oz ED

Conductivity
5.813 X 10⁷ S/m

Average Nodule radius (microns)
0.28

Surface Roughness (RMS)
2.8 microns

Roughness loss model
Hall-Huray

Copper roughness values
☒ Optimum for accuracy
☐ Actual measurement

☒ Analytical
☐ Synthesis Width
☐ Synthesis Space

Impedance
50 Ohms

Frequency
1 GHz

Calculate

Generate Tables and Files
File, Loss vs. Freq

Freq. Range 1 to 30 GHz

☒ Display results of only one calculation

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

MWI-2019 Software Instruction Manual

Software Operations, Microstrip Edge Coupled

Click on Design Type, then Microstrip and then Edge Coupled

Rogers Corporation, MWI-2019

Program Design Type Information

Edge Coupled Microstrip

Transmission Line Information

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Con
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
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

ROGERS CORPORATION

www.rogerscorp.com

☒ English ☐ Metric

Circuit Parameters

Conductor Width (W)
0.043 in.

Space (S) Length
0.009 in. 1 in.

Material Properties

Material: RO4350B Thickness (H): 0.020 in.

Dk	Df	Thermal Cond.
3.66	0.0037	0.62 W/K*m

☒ use z-axis Bulk Dk values
☐ Dk values for a specific frequency
☐ Dk values for characteristic Impedance

Conductor Parameters

Thickness (T): 0.0006 in.

Surface Area Index: 3.8

1/2oz ED

Conductivity: $5.813 \times 10^{-7} \text{ S/m}$

Average Nodule radius (microns): 0.28

Surface Roughness (RMS): 2.8 microns

Roughness loss model: Hall-Huray

Copper roughness values
☒ Optimum for accuracy
☐ Actual measurement

☒ Analytical
☐ Synthesis Width
☐ Synthesis Space

Impedance: 50 Ohms

Frequency: 1 GHz

Calculate

Generate Tables and Files
File, Loss vs. Freq

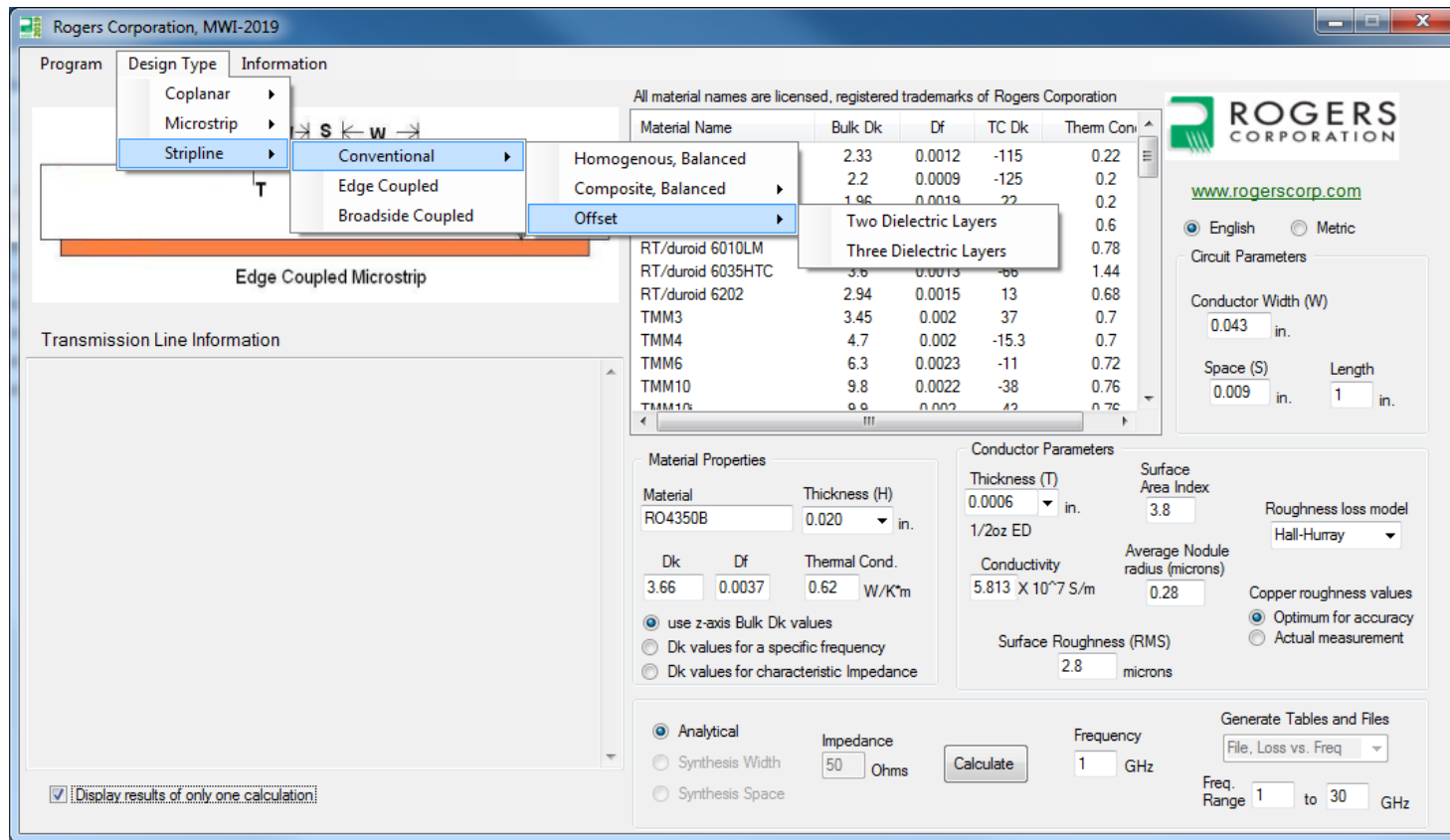
Freq. Range: 1 to 30 GHz

☒ Display results of only one calculation

MWI-2019 Software Instruction Manual

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.



MWI-2019 Software Instruction Manual

Software Operations, Stripline line models

For a composite or offset 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.

The screenshot displays the MWI-2019 software interface for a Composite Stripline design. The top menu bar includes 'Program', 'Design Type', and 'Information'. The main window is divided into several sections:

- Diagram:** A schematic of an offset stripline showing a central conductor of width W and thickness T , positioned between two substrate layers. The distance from the conductor to the top substrate is $H2$, and the distance to the bottom substrate is $H3$. The label 'Offset Stripline' is centered below the diagram.
- Material Properties:** A table for selecting materials for layers H1, H2, and H3.

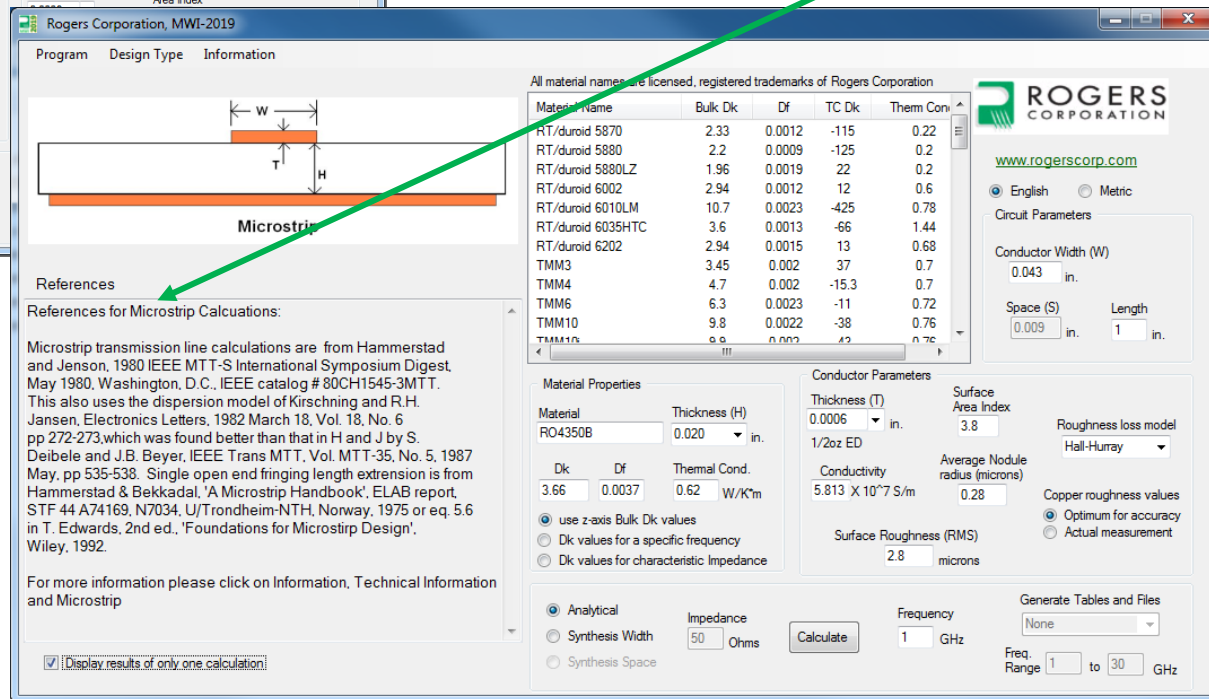
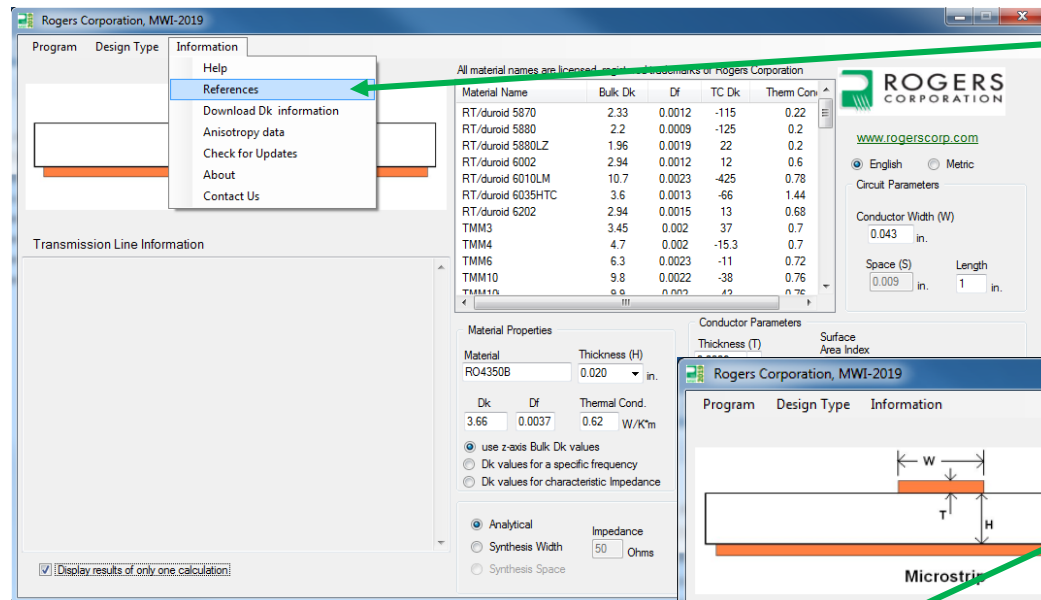
Material	Thickness	Dk	Df	Thickness (T)
H1: RO4350B	0.0066 in.	3.66	0.0037	0.0006 in.
H2: RO4450F	0.004 in.	3.70	0.004	1/2oz ED
H3: RO4350B	0.01 in.	3.66	0.0037	0.0006 in.
- Conductor Parameters:** Fields for Thickness (T) (0.0006 in.), Surface Area Index (3.8), Average Nodule radius (microns) (0.28), and Conductivity (5.813 X 10⁻⁷ S/m). It also includes a 'Roughness loss model' dropdown set to 'Hall-Huray' and 'Copper roughness values' options: 'Optimum for accuracy' (selected) and 'Actual measurement'.
- Material Properties (Detailed):** Fields for Material (RO4350B), Thickness (H) (0.020 in.), Dk (3.66), Df (0.0037), Thermal Cond. (0.62 W/K*m), and checkboxes for 'use z-axis Bulk Dk values' (selected), 'Dk values for a specific frequency', and 'Dk values for characteristic Impedance'.
- Calculation Options:** Radio buttons for 'Analytical' (selected), 'Synthesis Width', and 'Synthesis Space'. Fields for Impedance (50 Ohms) and Frequency (1 GHz) are present, along with a 'Calculate' button.
- Generate Tables and Files:** A dropdown for 'File, Loss vs. Freq' and frequency range fields (1 to 30 GHz).
- Footer:** A checkbox for 'Display results of only one calculation'.

MWI-2019 Software Instruction Manual

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.



MWI-2019 Software Instruction Manual

Windows and Excel are licensed trademarks of Microsoft®

The Rogers' logo, RT/duroid, TMM, ULTRALAM, RO3000, RO3003, RO3006, RO3010, RO3035, RO4003, RO4450B, RO4000, LoPro, XT/duroid are licensed trademarks of Rogers Corporation

The information in this presentation is intended to assist you in working with Rogers' High-Frequency Materials. It is not intended to and does not create any warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose or that any results show in this presentation will be achieved by a user for a particular purpose. The user is responsible for determining the suitability of Rogers' High Frequency Materials for each application.

This presentation may not be reproduced, copied, published, broadcast, transmitted or otherwise distributed without the written approval of Rogers Corporation.

©2019 Rogers Corporation. All rights reserved