

Design a microstrip quad hybrid for a 75Ω system with a design frequency of 3 GHz on Rogers RO4003C, 1 oz. copper, 0.032" board thickness. Also, draw labeled sketch of design.

→ Selected ϵ_{eff} values for specific frequency MWI option

$$\frac{Z_0}{\sqrt{2}} = \frac{75}{\sqrt{2}} = \underline{\underline{53.03 \Omega}}$$

From MWI, $\underline{\underline{W_{S3} = 1.5345 \text{ mm}}}$

$$V_{P_{S3}} = 1.748 \times 10^8 \text{ m/s}$$

$$\lambda_{S3} = \frac{V_P}{f} = \frac{1.748 \times 10^8}{3 \times 10^9} = 58.26 \text{ mm}$$

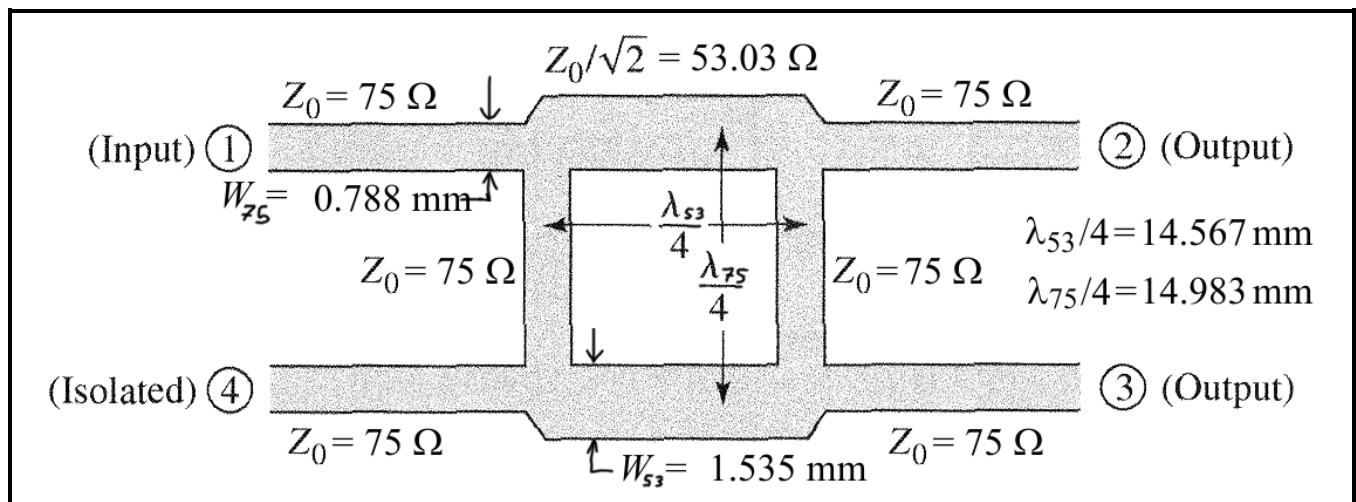
$$\underline{\underline{\frac{\lambda_{S3}}{4} = 14.567 \text{ mm}}}$$

From MWI, $\underline{\underline{W_{75} = 0.7878 \text{ mm}}}$ for $Z_0 = 75 \Omega$

$$V_{P_{75}} = 1.798 \times 10^8 \text{ m/s}$$

$$\lambda_{75} = \frac{V_P}{f} = \frac{1.798 \times 10^8}{3 \times 10^9} = 59.93 \text{ mm}$$

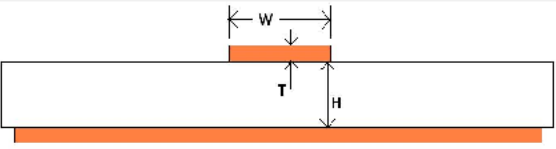
$$\underline{\underline{\frac{\lambda_{75}}{4} = 14.983 \text{ mm}}}$$



53.03 Ω case

MWI 2018

Program Design Type Information



Microstrip

Transmission Line Information

Conventional Microstrip
Using 0.812 mm RO4003C circuit materials.
Conductor width = 1.5345 mm

Impedance = 53.03 ohms
Effective dk = 2.9420

Dielectric Loss is = 1.12756 dB/m
Conductor loss is = 1.36135 dB/m
Total loss is = 2.48891 dB/m

Dielectric Q Factor is 415.3
Conductor Q Factor is 482.2
Total Q Factor for transmission line is 223.1

Wavelength on transmission line:
1 wavelength = 0.058 meters
1/2 wavelength = 0.029 meters
1/4 wavelength = 0.014 meters
1/8 wavelength = 0.007 meters

☒ Display results of only one calculation

All material names are licensed, registered trademarks of Rogers Corporation

Material Name	Bulk Dk	Df	TC Dk	Therm Co
TMM13i	12.2	0.0019	-43	0.76
ULTRALAM ...	3.1	0.0024	100	0.2
RO3003	3	0.001	13	0.5
RO3006	6.5	0.002	-160	0.72
RO3010	11.2	0.0023	-280	0.95
RO3035	3.6	0.0018	-34	0.5
RO3203	3.02	0.0016	13	0.5
RO3206	6.6	0.0027	-212	0.63
RO3210	10.8	0.0027	-459	0.81
RO4003C	3.55	0.0027	40	0.64
RO4003C Lo...	3.5	0.0027	40	0.64

Material Properties

Material: RO4003C Thickness (H): 0.812 mm

Dk: 3.851 Df: 0.0027 Thermal Cond.: 0.64 W/K*m

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

Conductor Parameters

Thickness (T): 33.02 microns Surface Area Index: 3.9

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

Surface Roughness (RMS): 3.4 microns

Roughness loss model: Hall-Huray

Copper roughness values:
☒ Optimum for accuracy
☐ Actual measurement

Circuit Parameters

Conductor Width (W): 1.5345 mm

Space (S): 0.2286 mm Length: 25.4 mm

Generate Tables and Files

None

Freq. Range: 1 to 30 GHz

Calculate

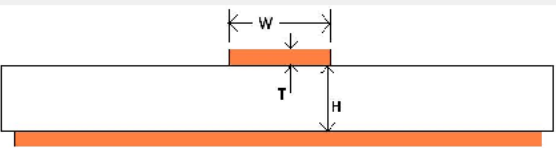
Impedance: 50 Ohms Frequency: 3 GHz

☒ Analytical
☐ Synthesis Width
☐ Synthesis Space

75 Ω case

MWI 2018

Program Design Type Information



Microstrip

Transmission Line Information

Conventional Microstrip
Using 0.812 mm RO4003C circuit materials.
Conductor width = 0.7878 mm

Impedance = 75.00 ohms
Effective dk = 2.7810

Dielectric Loss is = 1.06360 dB/m
Conductor loss is = 1.64470 dB/m
Total loss is = 2.70831 dB/m

Dielectric Q Factor is 428.1
Conductor Q Factor is 388.0
Total Q Factor for transmission line is 203.5

Wavelength on transmission line:
1 wavelength = 0.059 meters
1/2 wavelength = 0.029 meters
1/4 wavelength = 0.014 meters
1/8 wavelength = 0.007 meters

☒ Display results of only one calculation

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Calculate

Impedance: 50 Ohms Frequency: 3 GHz

☒ Analytical
☐ Synthesis Width
☐ Synthesis Space