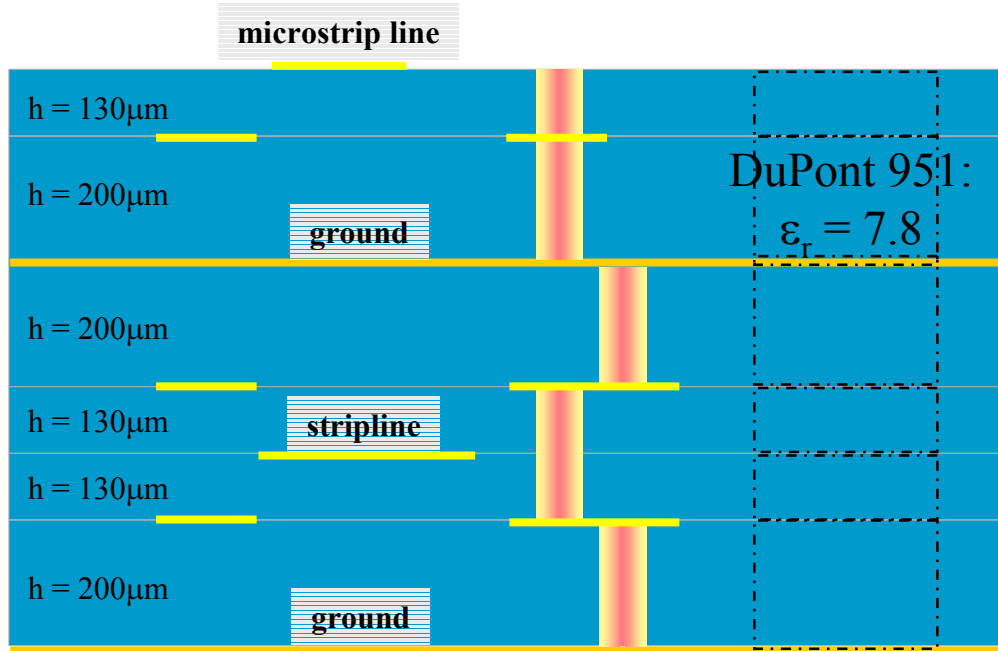


LTCC RF-Benchmarking



Conductors

Vias

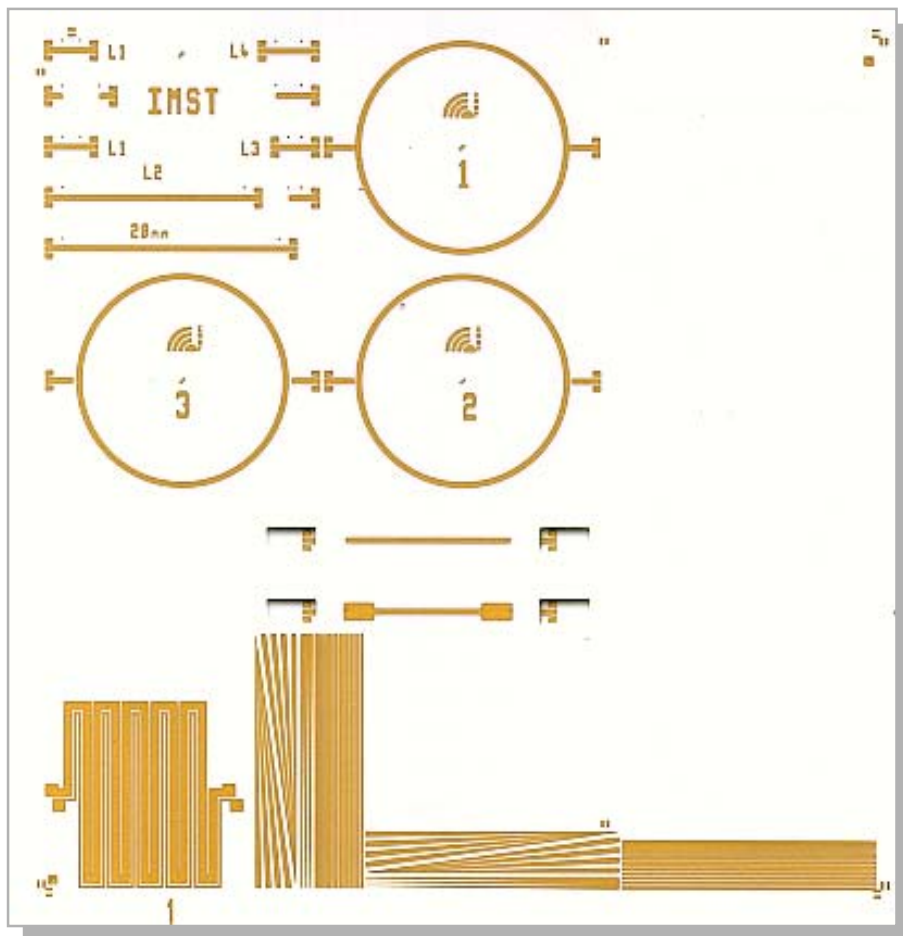
Cavities



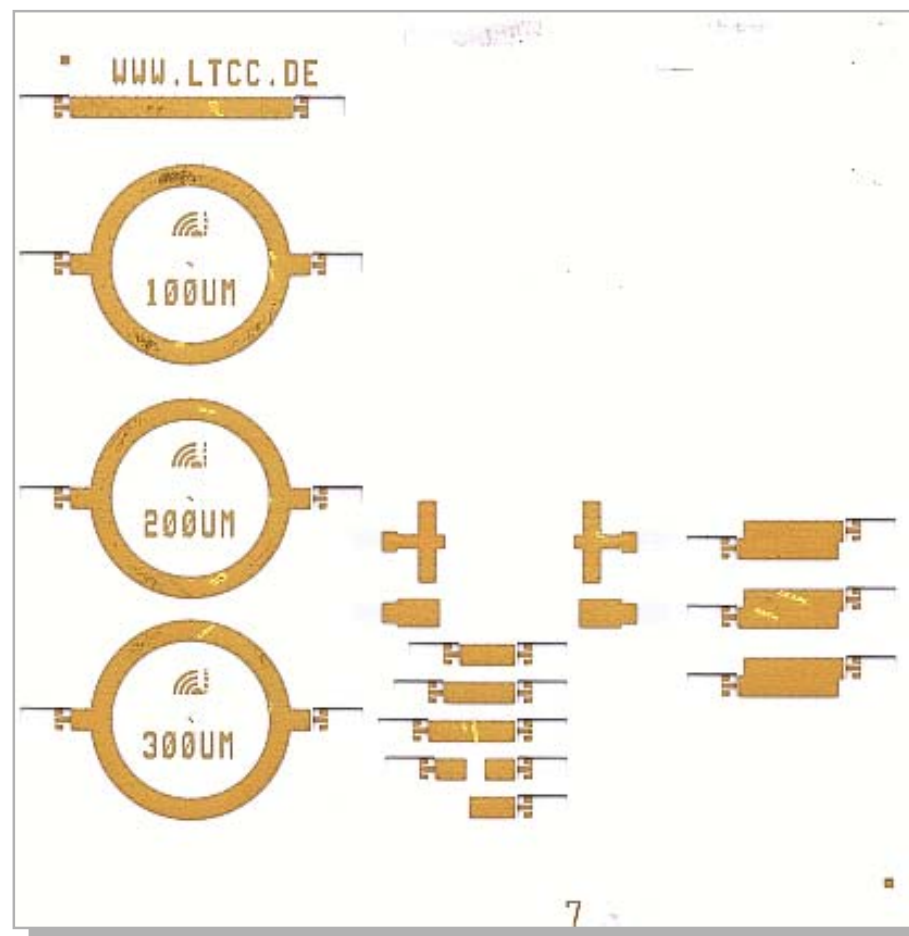
ThinkCera



Part Overview



Front View



Back View

Test Layout

Square in Layer 0:
66 x 66 mm

X = 66 mm
Y = 66 mm

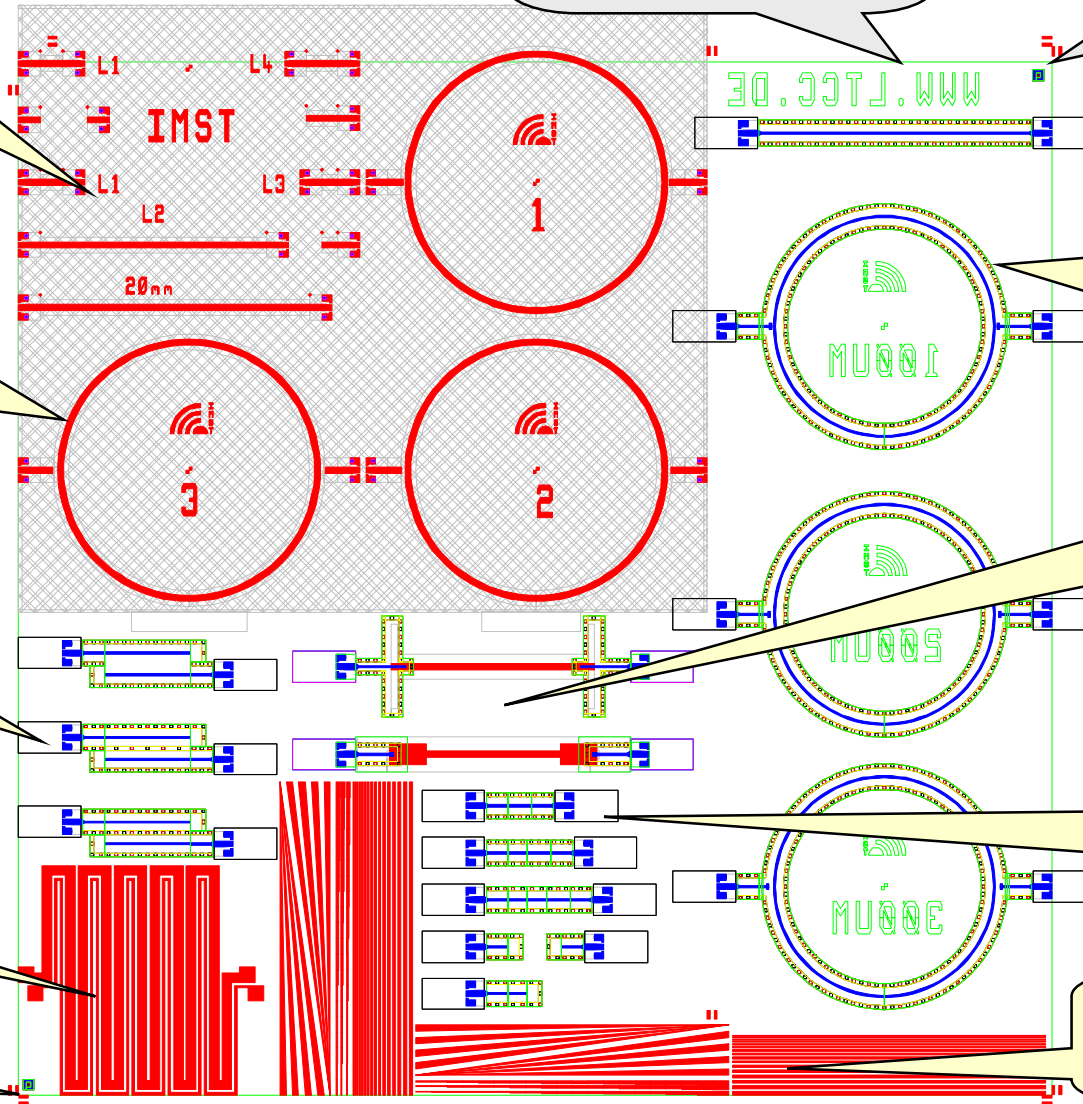
Microstrip
Calibration
Lines

Microstrip
Ring-
Resonators
w = 390μm

Coupled
Striplines

Conductivity
Measurement

X = 0
Y = 0



Stripline
Ring-
Resonators
w = 145μm

Microstrip to
Stripline
Transitions

Stripline
Calibration
Kit

Resolution
Test Lines



Comparison of MS and SL

Theoretical Investigations:

	$h / \mu\text{m}$	$k = \epsilon_r$	ϵ_{eff}	Z_L / Ω	$\alpha / \text{dB/cm}$	λ / mm
DuPont 951	330	7.8	5.57	50.1	0.381	6.352
DuPont 943	321	7.1	5.09	51.5	0.252	6.633
Heraeus CT2000	385	9.1	6.45	50.8	0.224	5.904
Ferro A6-M	278	5.9	4.29	51.6	0.201	7.236
Samsung G-6	281	6.3	4.57	50.5	0.235	7.010
NIKKO Ag3	300	7.1	5.12	49.6	0.288	6.632

Summary of microstrip line properties with $w = 390\mu\text{m}$ ($f = 20\text{GHz}$, $\rho_{\text{Au}} = 2.44\mu\Omega \text{ cm}$)

	$h / \mu\text{m}$	$k = \epsilon_r = \epsilon_{\text{eff}}$	Z_L / Ω	$\alpha / \text{dB/cm}$
DuPont 951	660	7.8	50.1	0.484
DuPont 943	642	7.1	51.8	0.319
Heraeus CT2000	765	9.1	49.3	0.341
Ferro A6-M	556	5.9	53.4	0.270
Samsung G-6	562	6.3	51.9	0.292
NIKKO Ag3	600	7.1	50.4	0.352

Summary of stripline properties with $w = 145\mu\text{m}$ ($f = 20\text{GHz}$, $\rho_{\text{Au}} = 2.44\mu\Omega \text{ cm}$)

Measured Parameters + Results

Geometry

- ✓ Substrate Thickness
- ✓ Microstrip Line Width and Thickness
- ✓ Stripline Width and Thickness
- ✓ Via Diameter and Position
- ✓ Conductor Diffusion into Substrate Surface
- ✓ Circuit Geometry (ring, gap, line length ...)

DC + RF Parameters

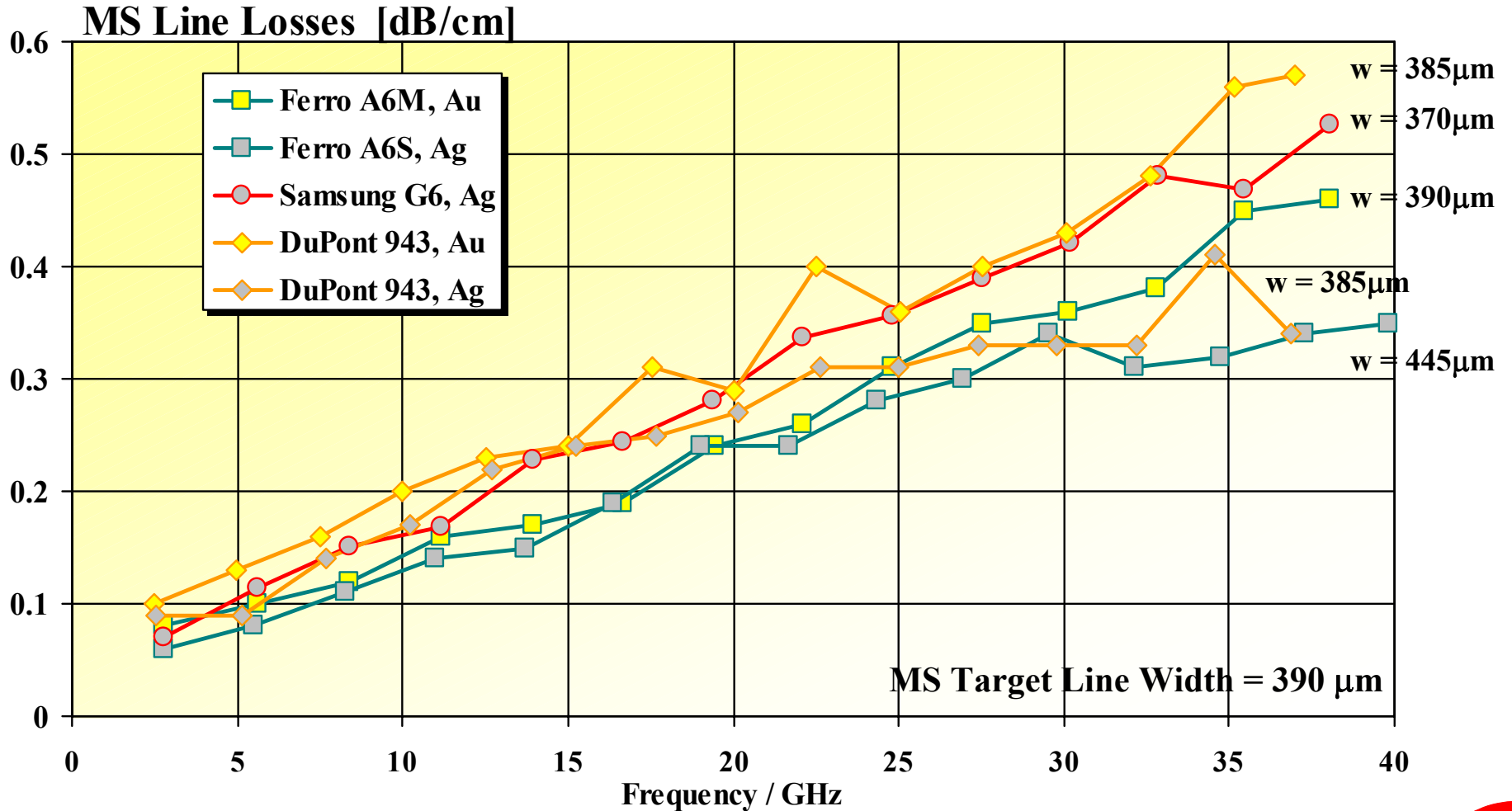
- ✓ DC-Conductivity
- ✓ S-Parameter or Spectrum up to 40 GHz (On-Wafer)

Evaluation Results

- Quality Factor Q
- Effective Permittivity ϵ_{eff} of Microstrip Line
- Relative Permittivity ϵ_r of Stripline
- Total Line Losses α

MS: Line Losses

Microstrip Line (MS)



SL: Line Losses

Triplate or Stripline (SL)

