Growing Business by the X-ray Lithography

Yuji Furumura
Philtech Inc.
June 29, 2004
NGL 2004

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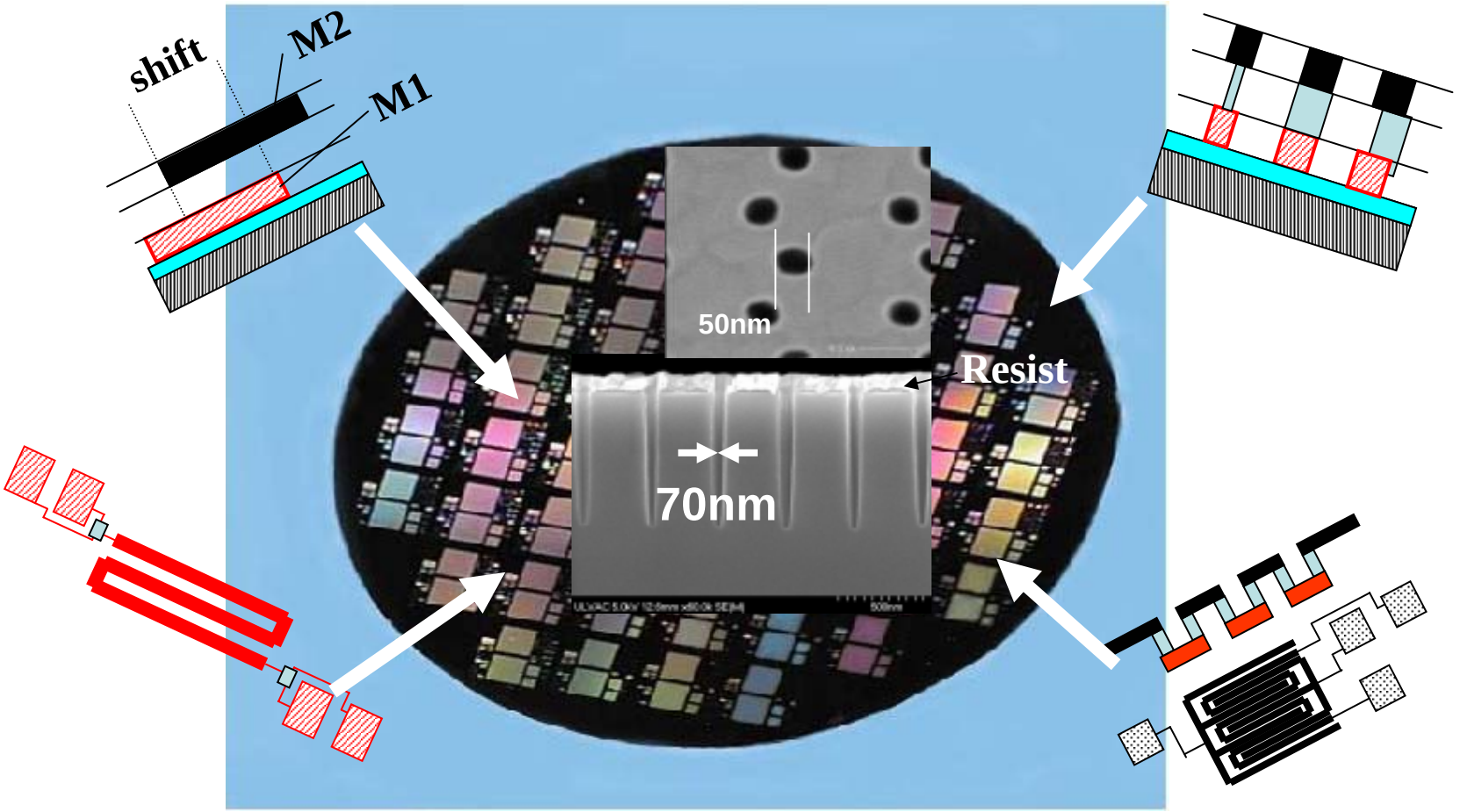
nm-Patterns on 300mm



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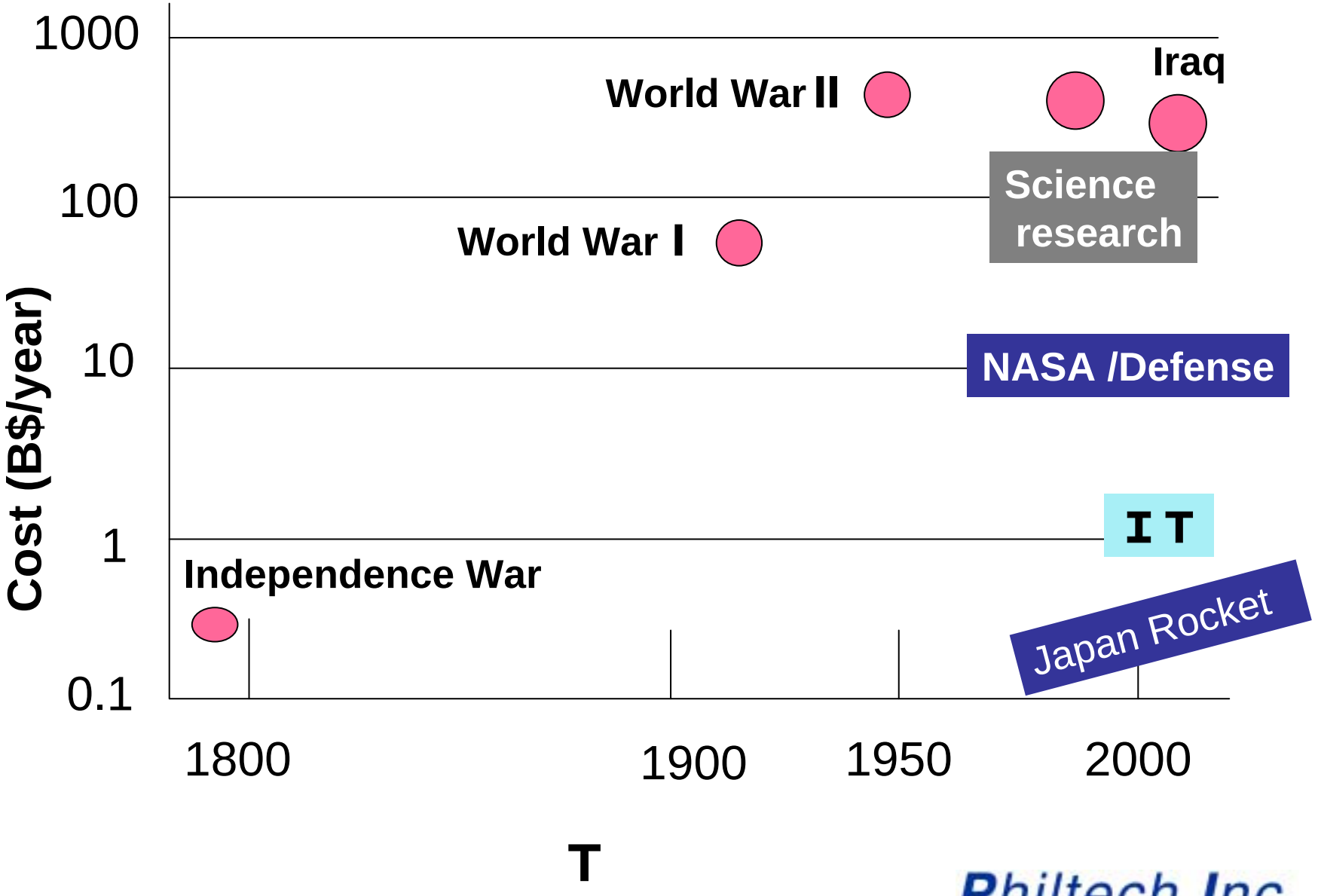

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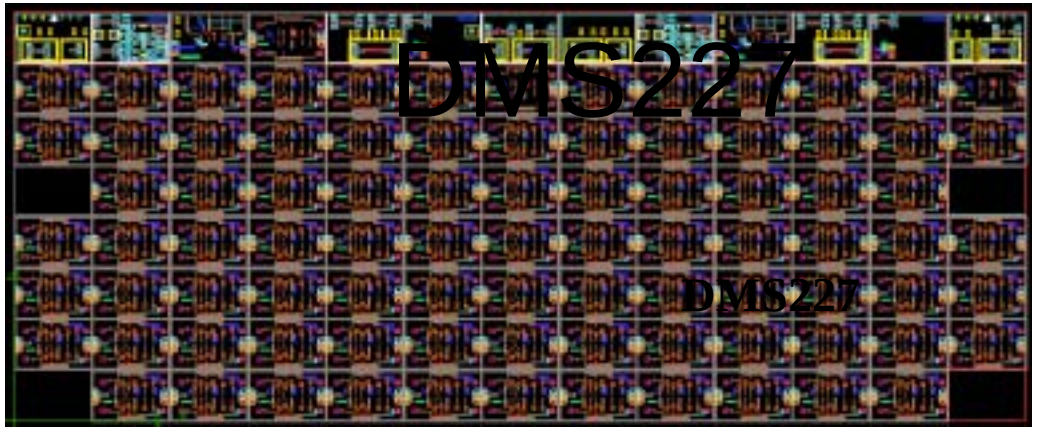
Application of X-ray

US：100GHz Wave for defense

Japan：ＭＥＭＳ, Test wafers, Probe Card, PZT device by LIGA(Lithographie, Galvonoformung, Abformung)

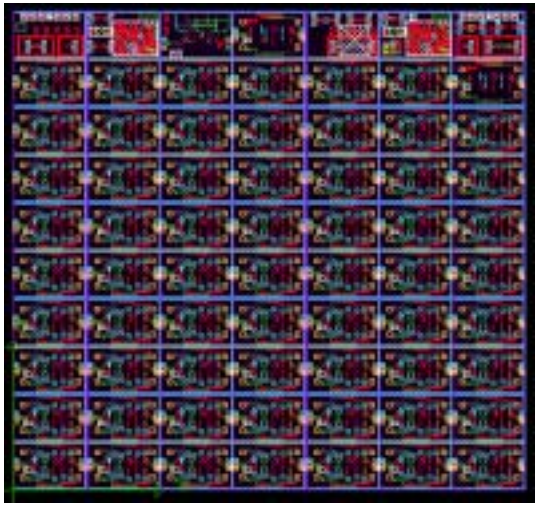
70 nm Device Demonstration



BAE SYSTEMS

DMS227

DMS187



90-100 GHz missile seeker

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Contributers to X-ray lithography

Tohuku U.

Waseda U.

MIT

Tools and facilities

X-ray : Mitsubishi SR 0.6GeV
Stepper : Canon ＸＲＡ 300mm
Coater/Developer:
Tokyo Electron ＡＣＴ１２
Mask: ＮＴＴ－ＡＴ

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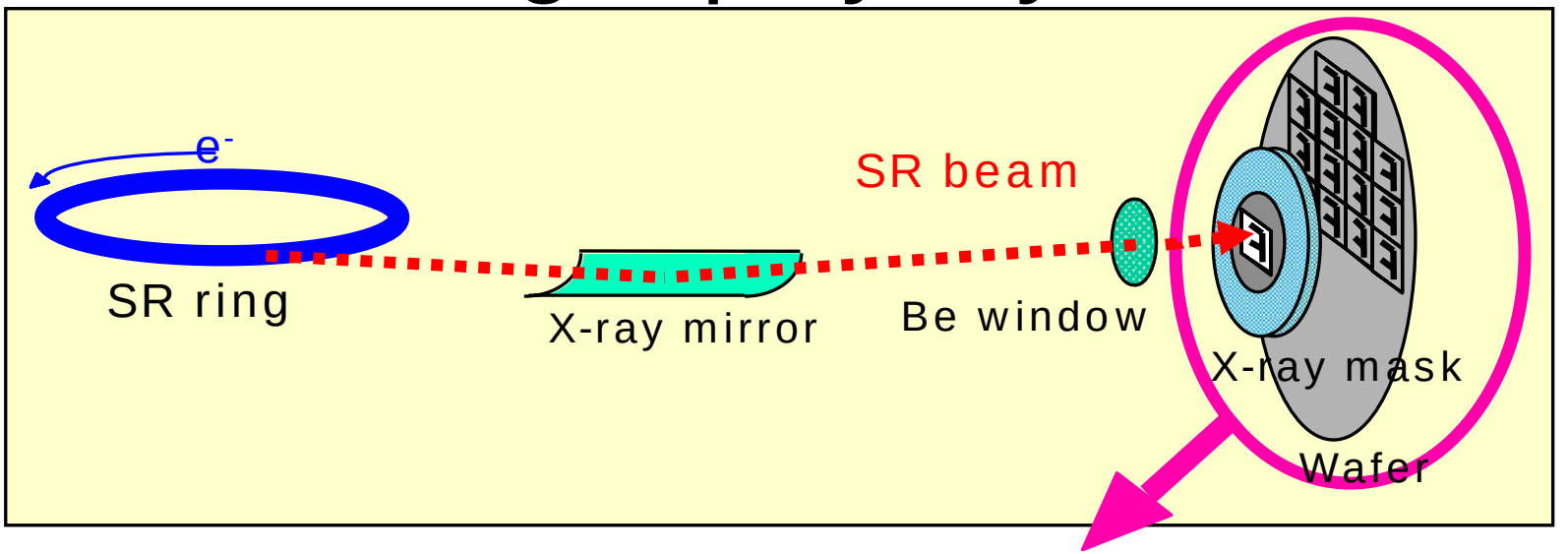
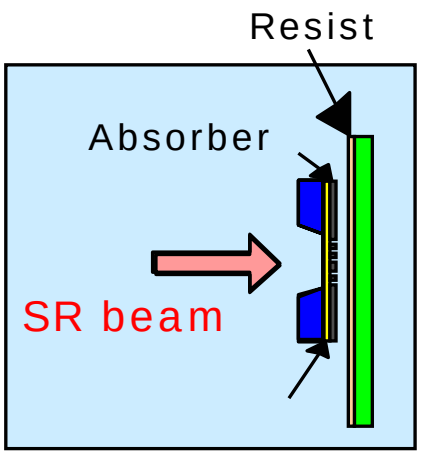
Lithography System





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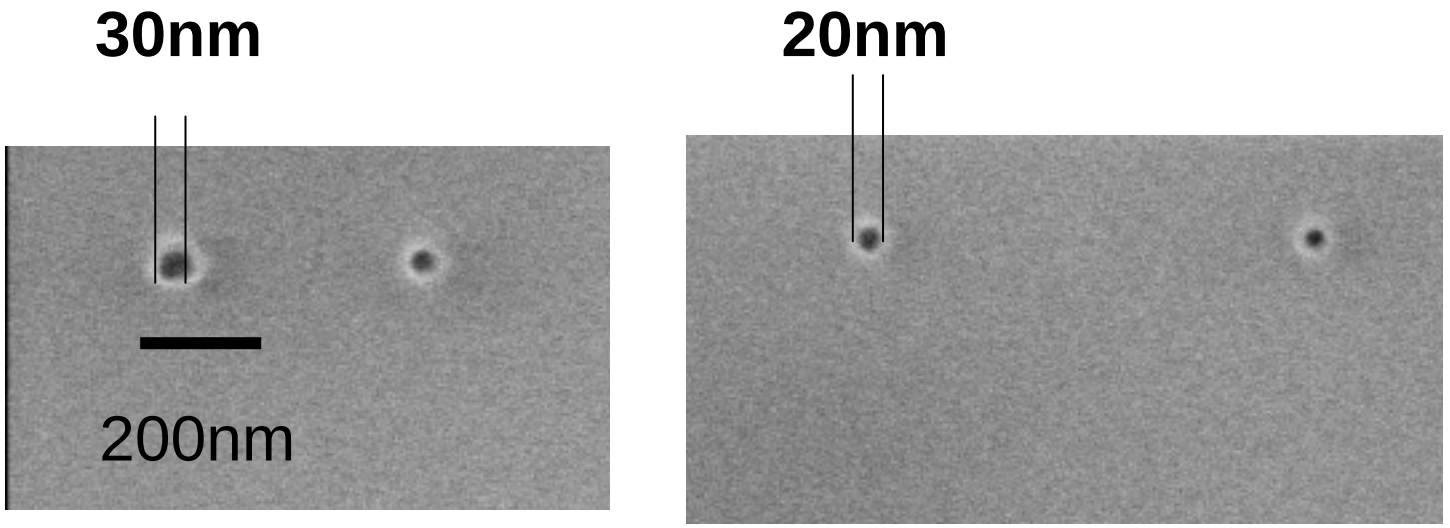
Resist patterns on a 300-mm wafer



By Waseda University

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Users of X-ray lithography on 300-mm wafers

AMAT
Tokyo Electron
Ulvac
Novellus
Ebara
Hitachi
Universities
Others

Why tool makers use?

They don’t wait for Lithography Development To win tool market

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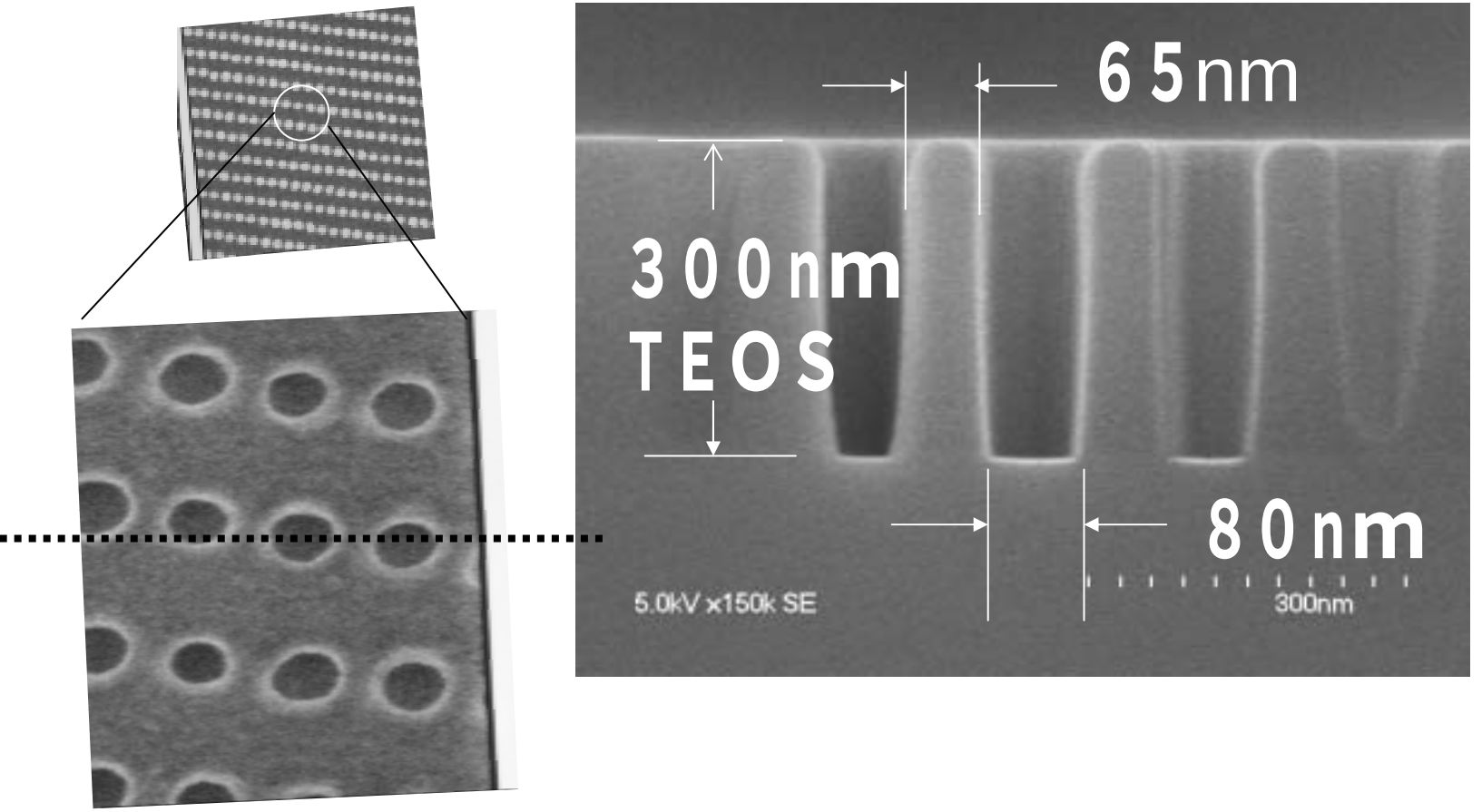
300mm-wafer with 80nm hole



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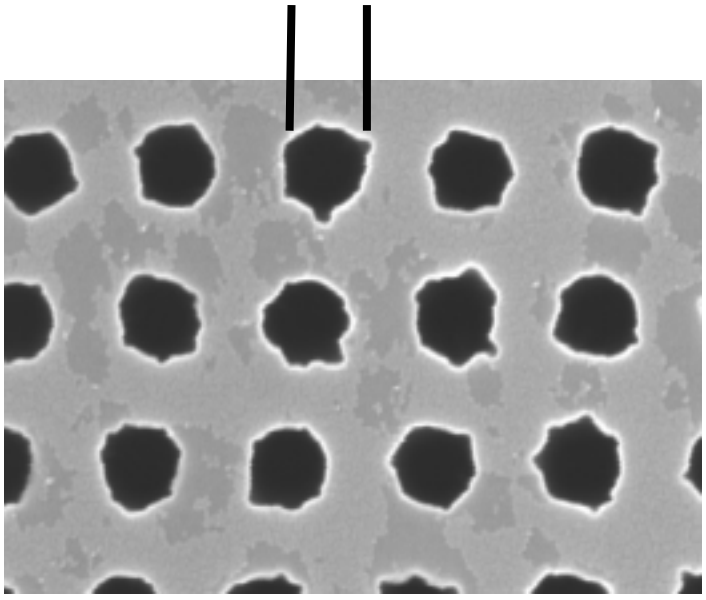
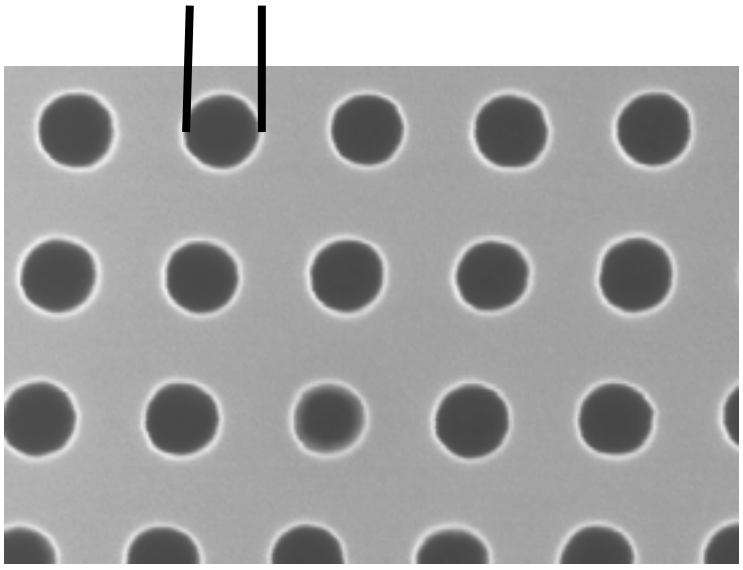
0.12um



Striation
Big problem

0.12um



Striation Solution
By KrF resist+X-ray

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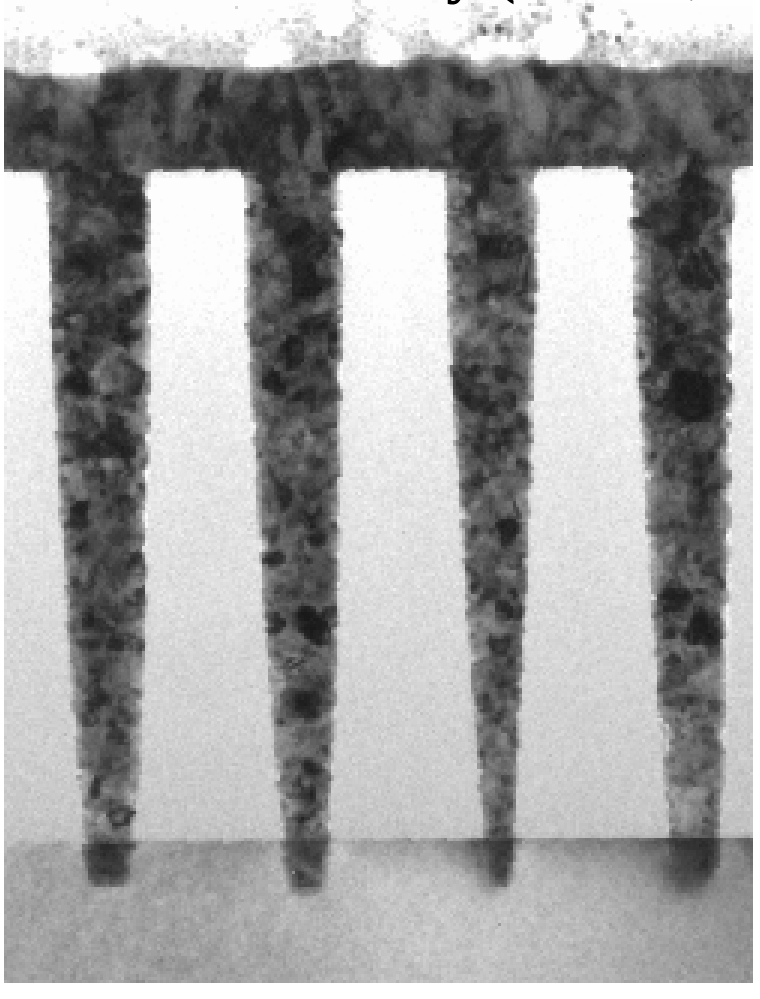
Via Holes filled by Electroless plating

(1 step deposition)

Hiroshima University (IEDM, Dec. 8th , 2003)

200nm



TEM

Diameter: 100nm

Depth: 950nm

Hole patterns were made by X-ray lithography

(Philtech Corp.)

No overgrowth

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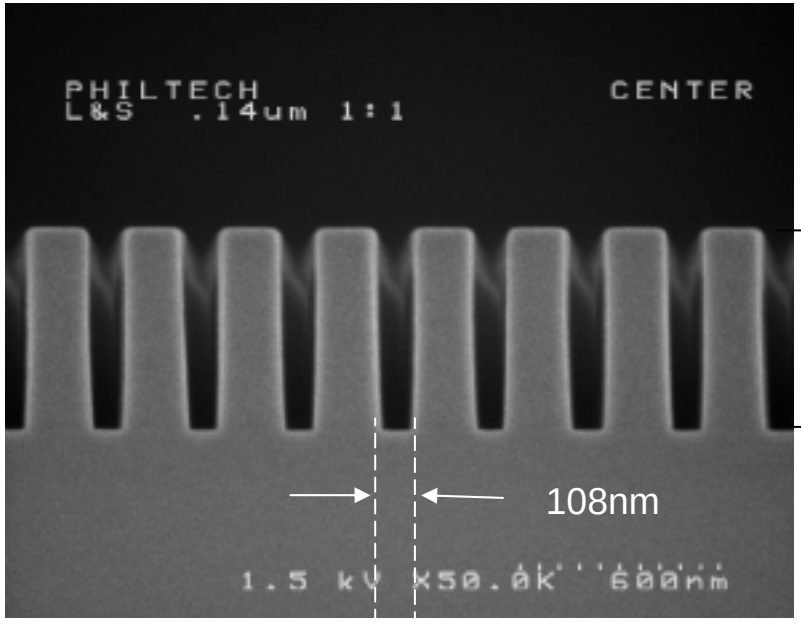
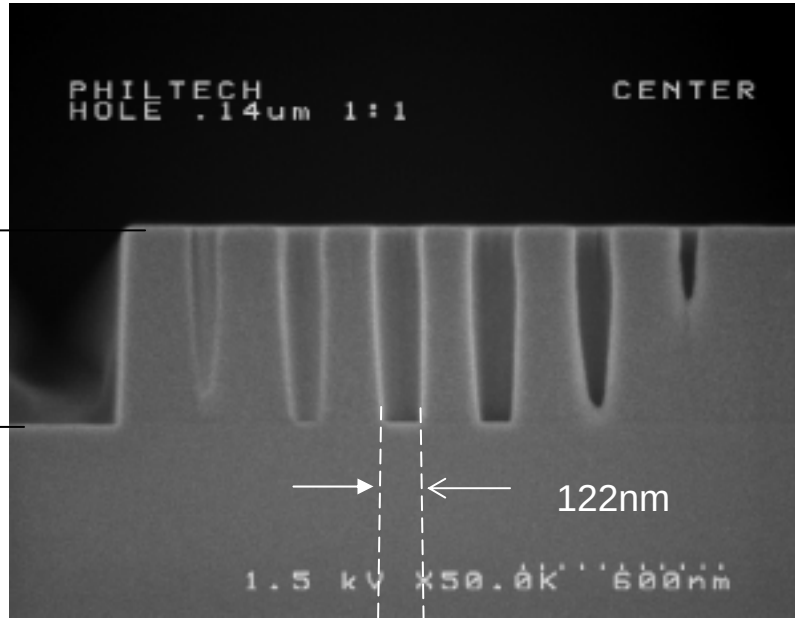
300mm wafer with 600nm-deep patterns

Trench **dense** **Hole**



TEOS
600nm



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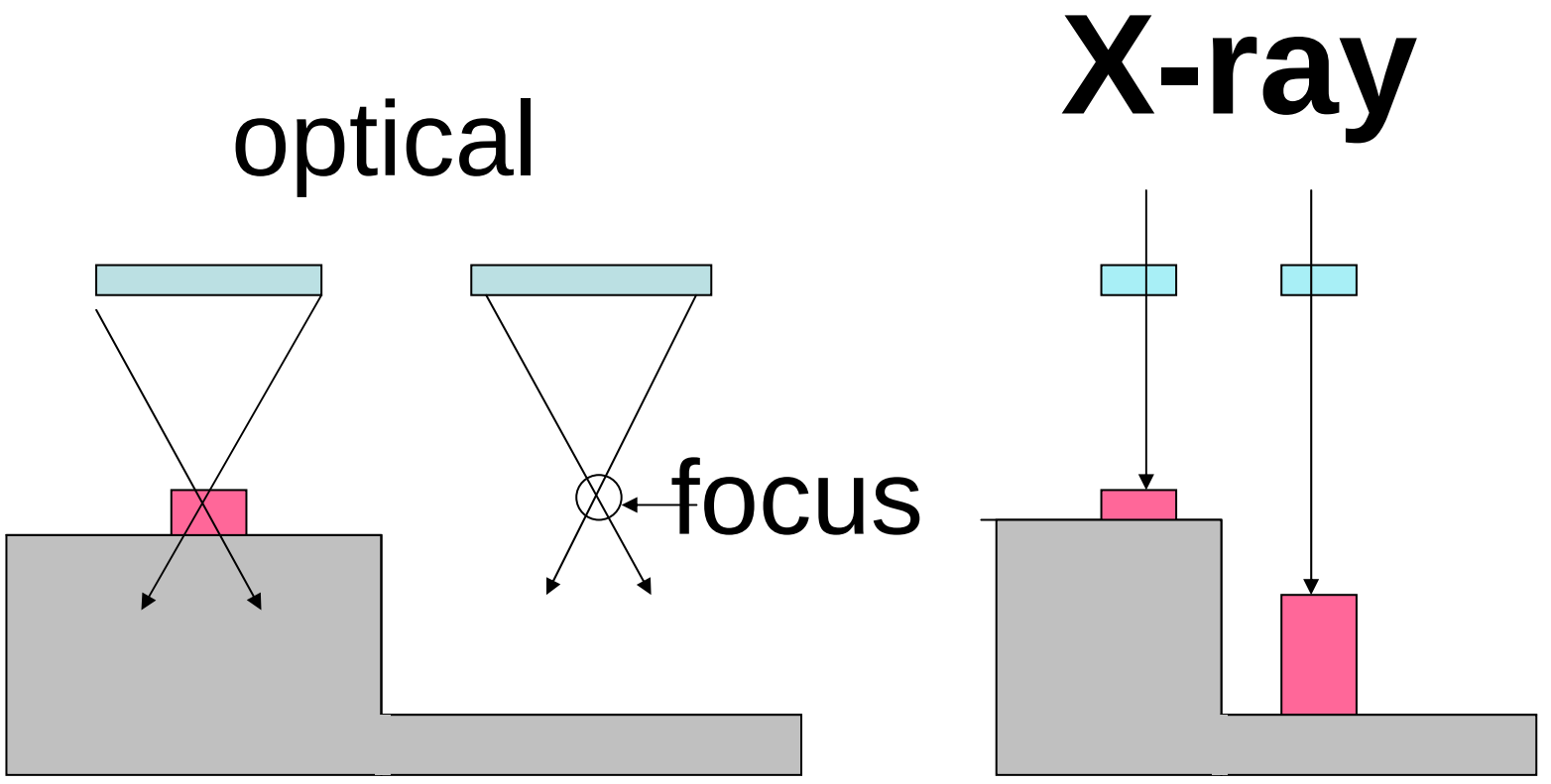
Advantage of X-ray litho.



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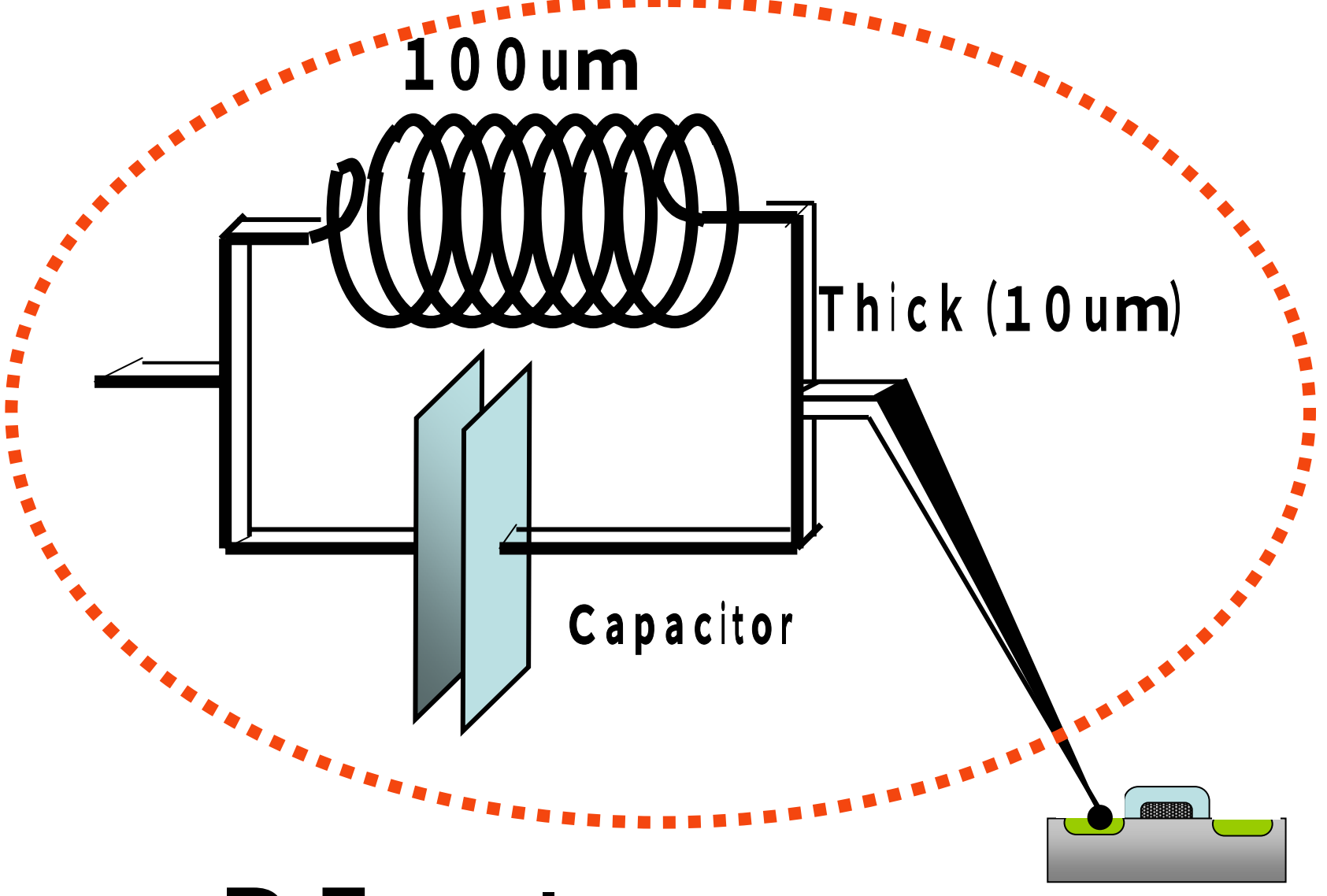

RF elements

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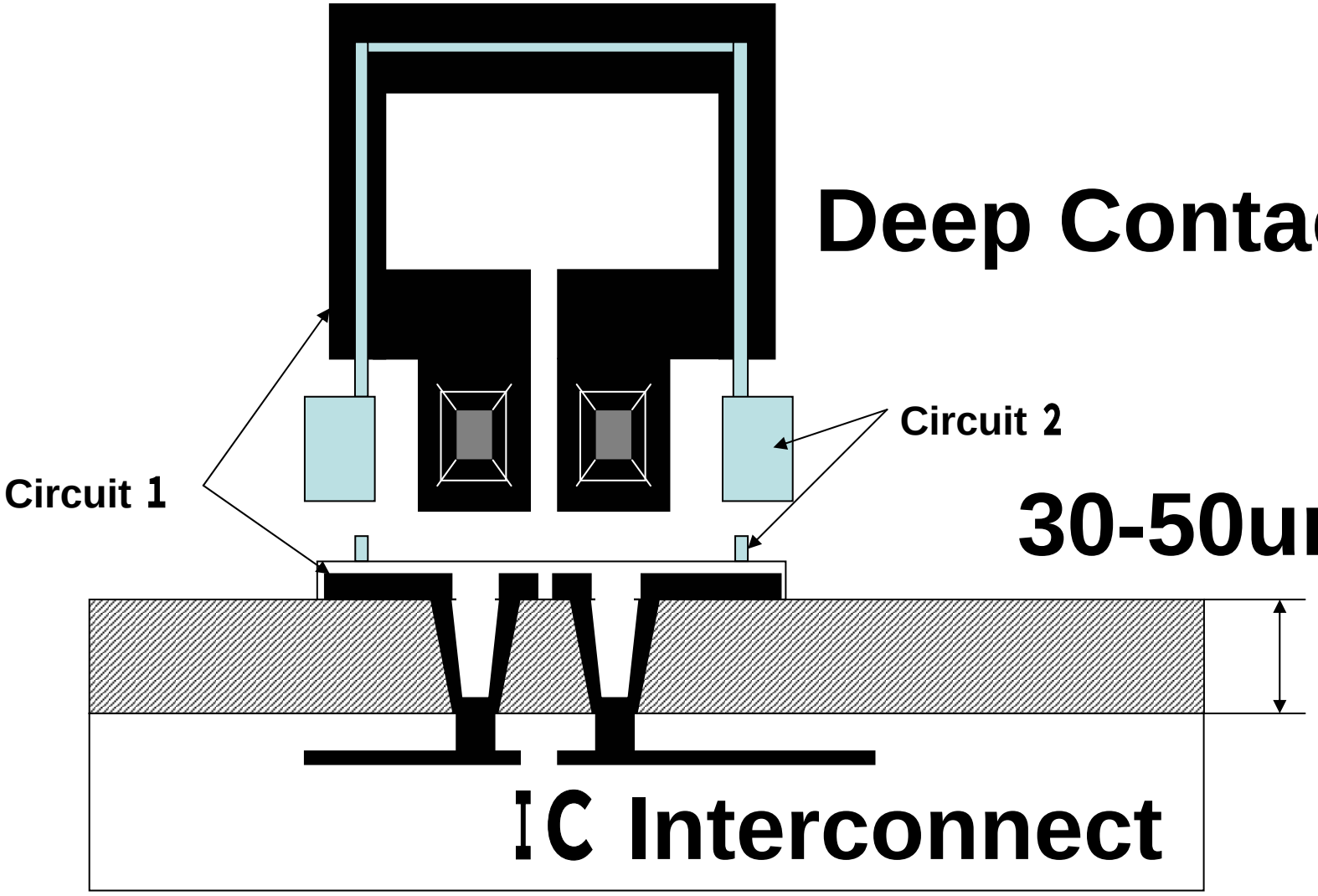

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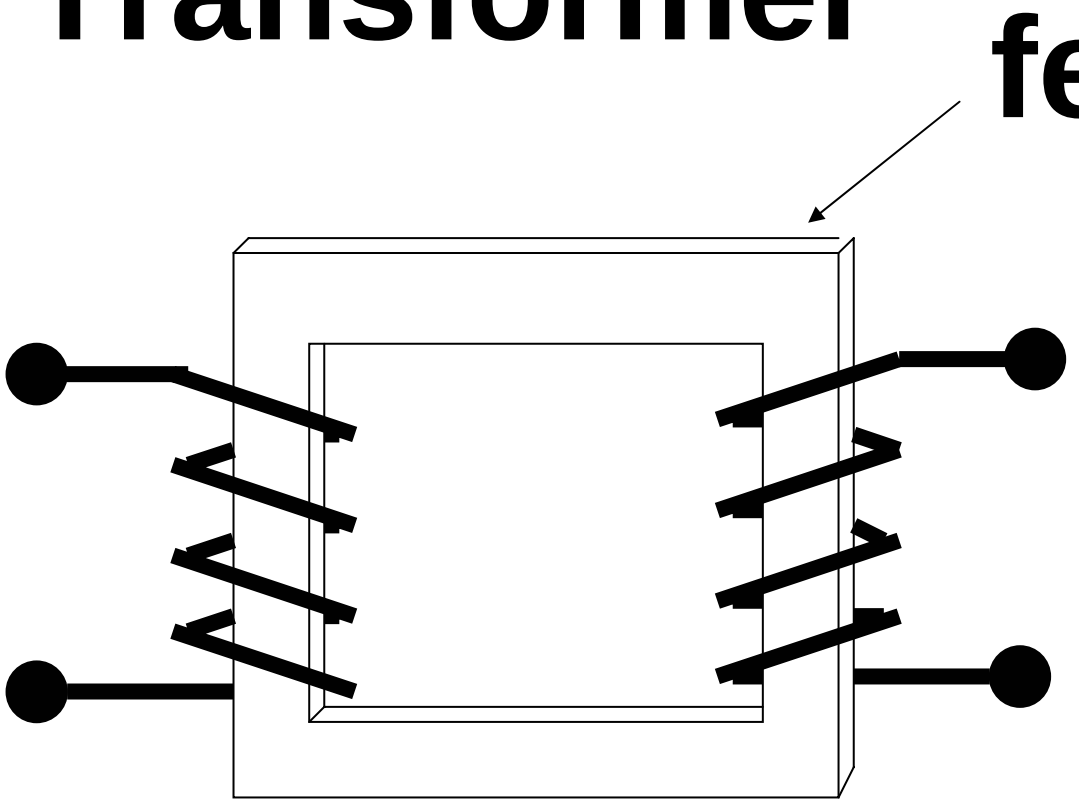
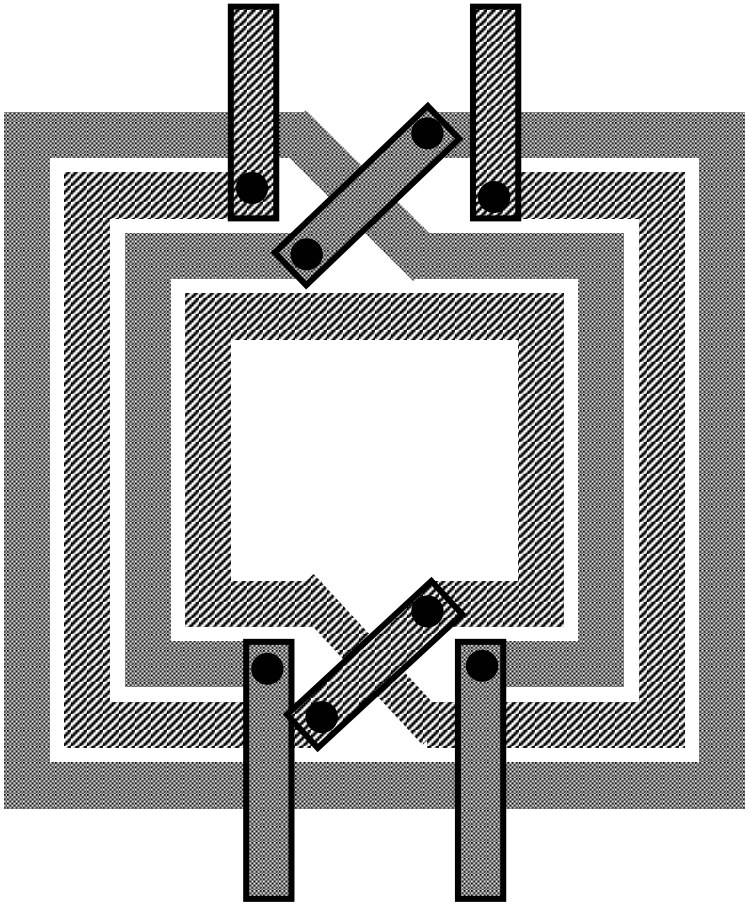
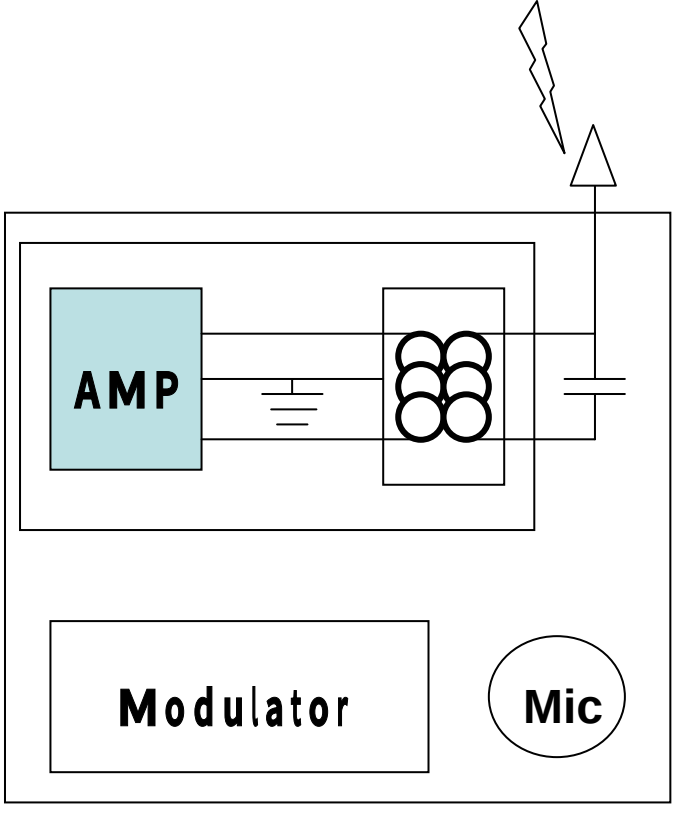
Transformer







US Patent No. US6577219B2
Jun. 10, 2003

Typical patent

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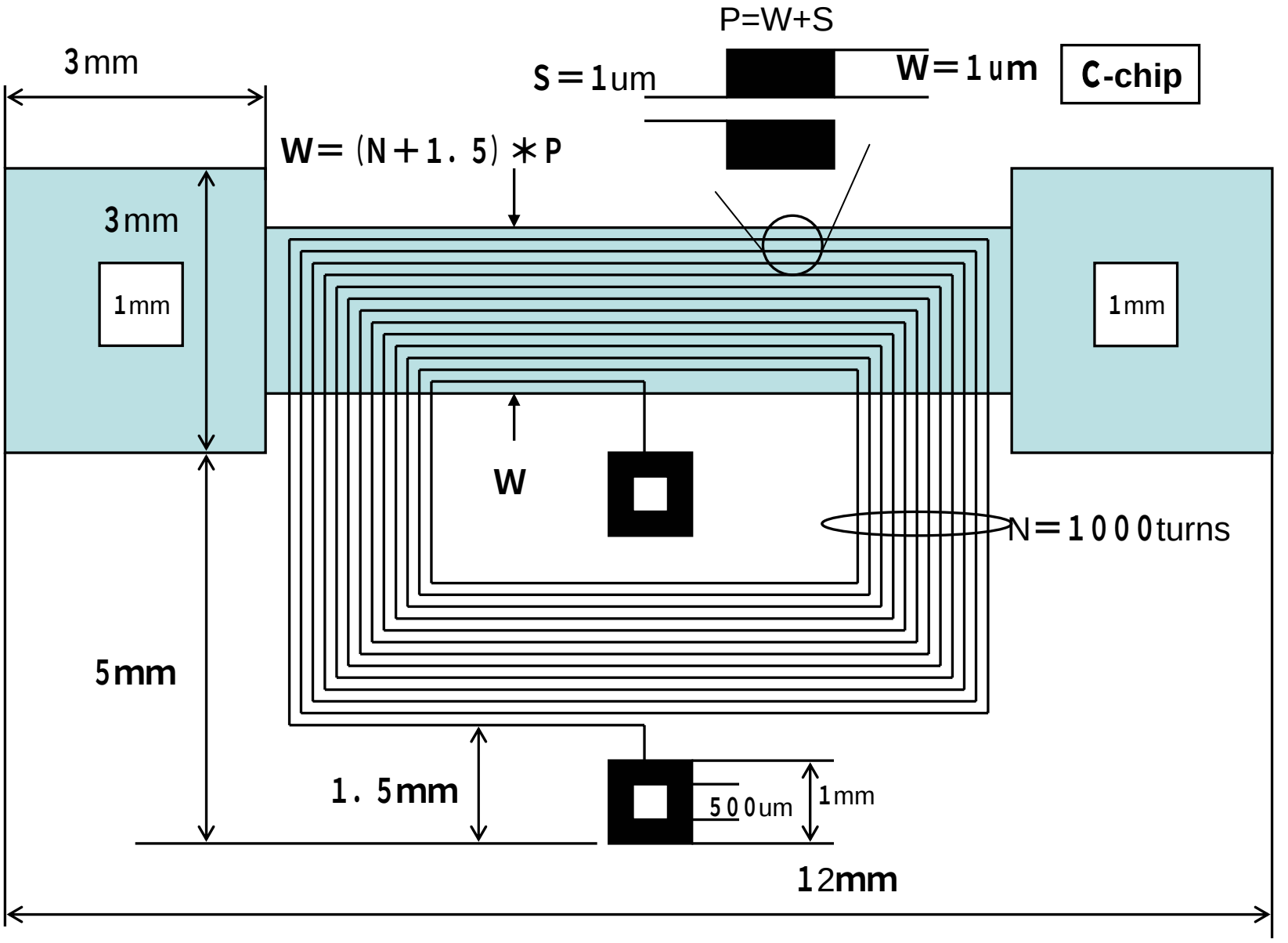

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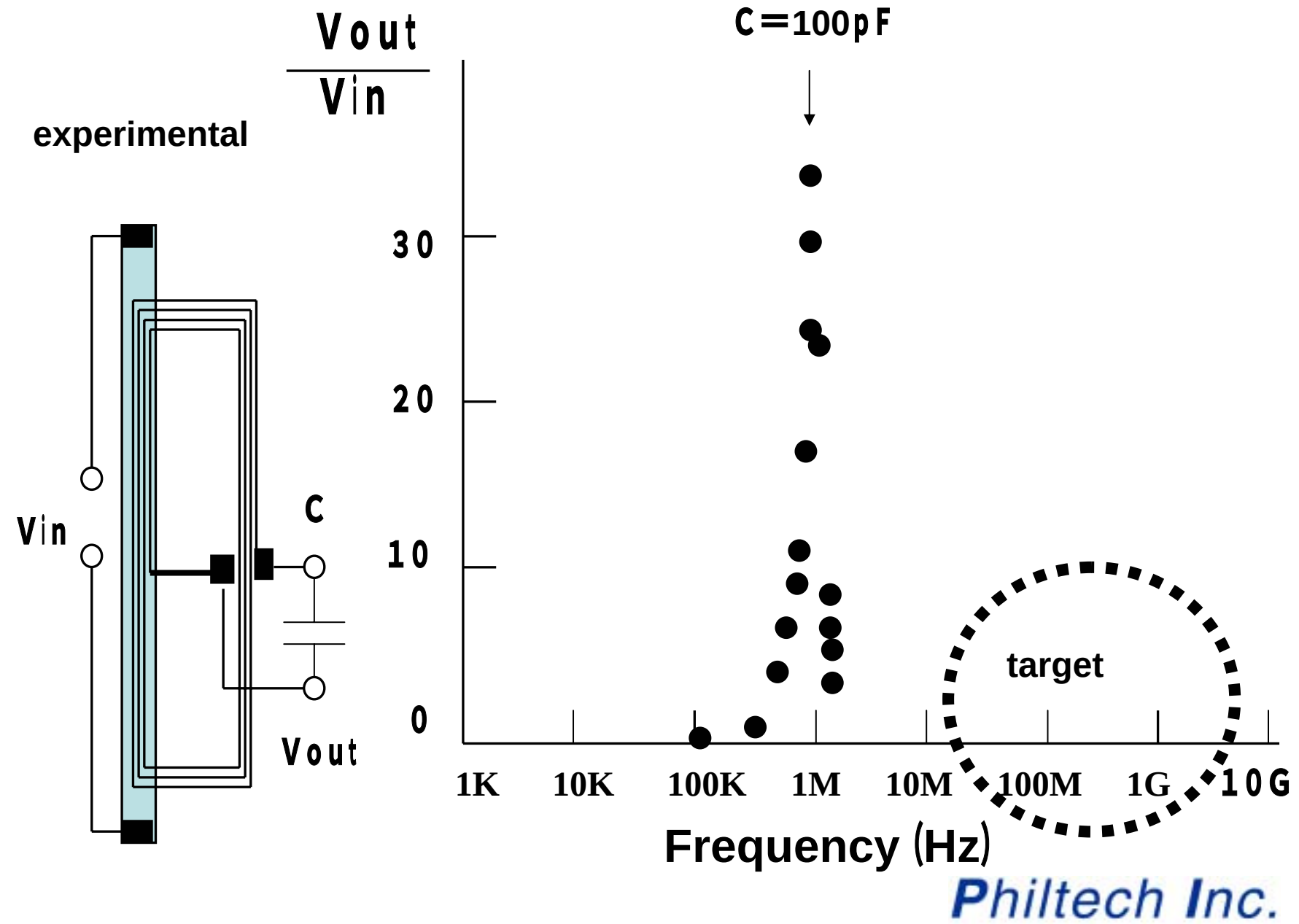

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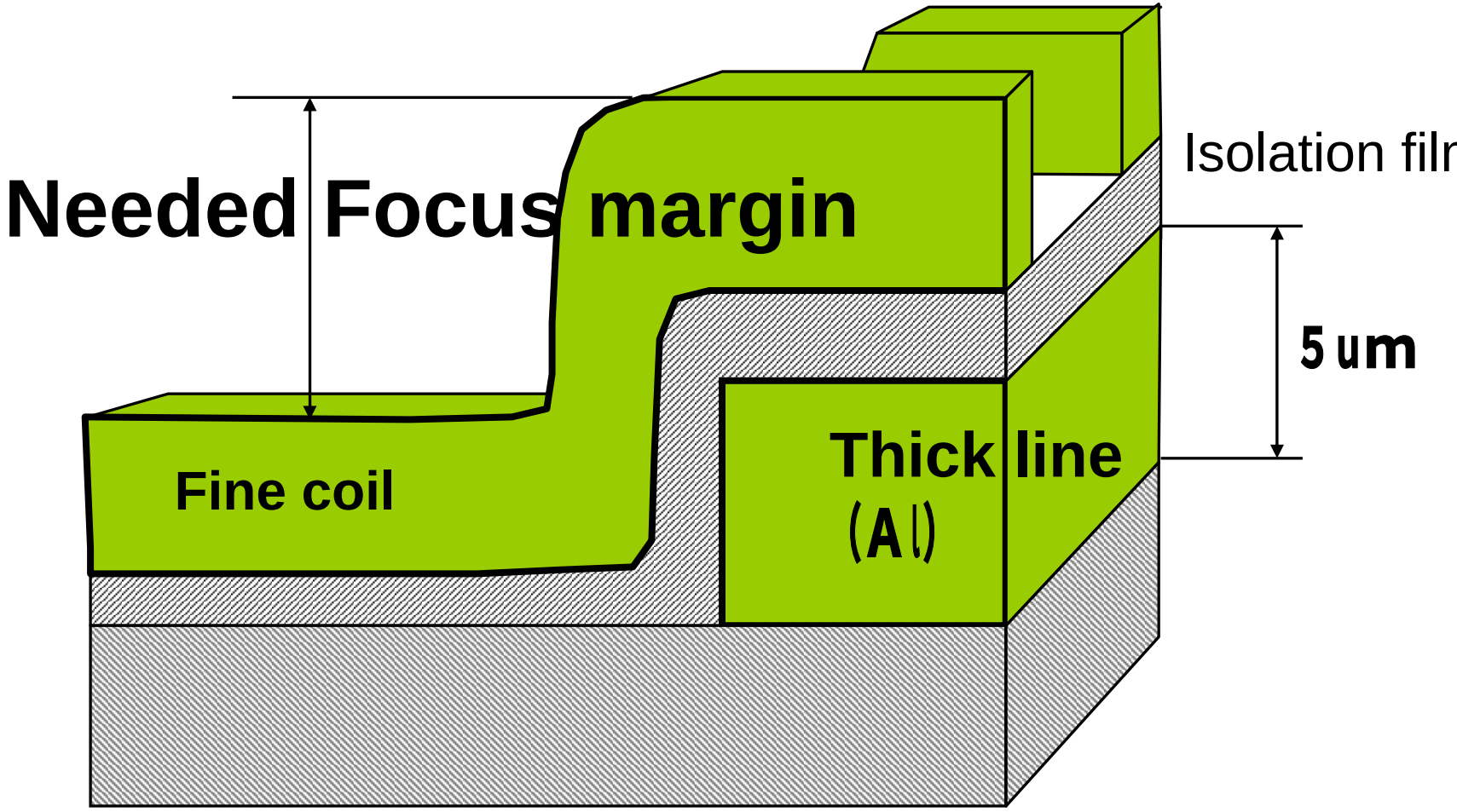
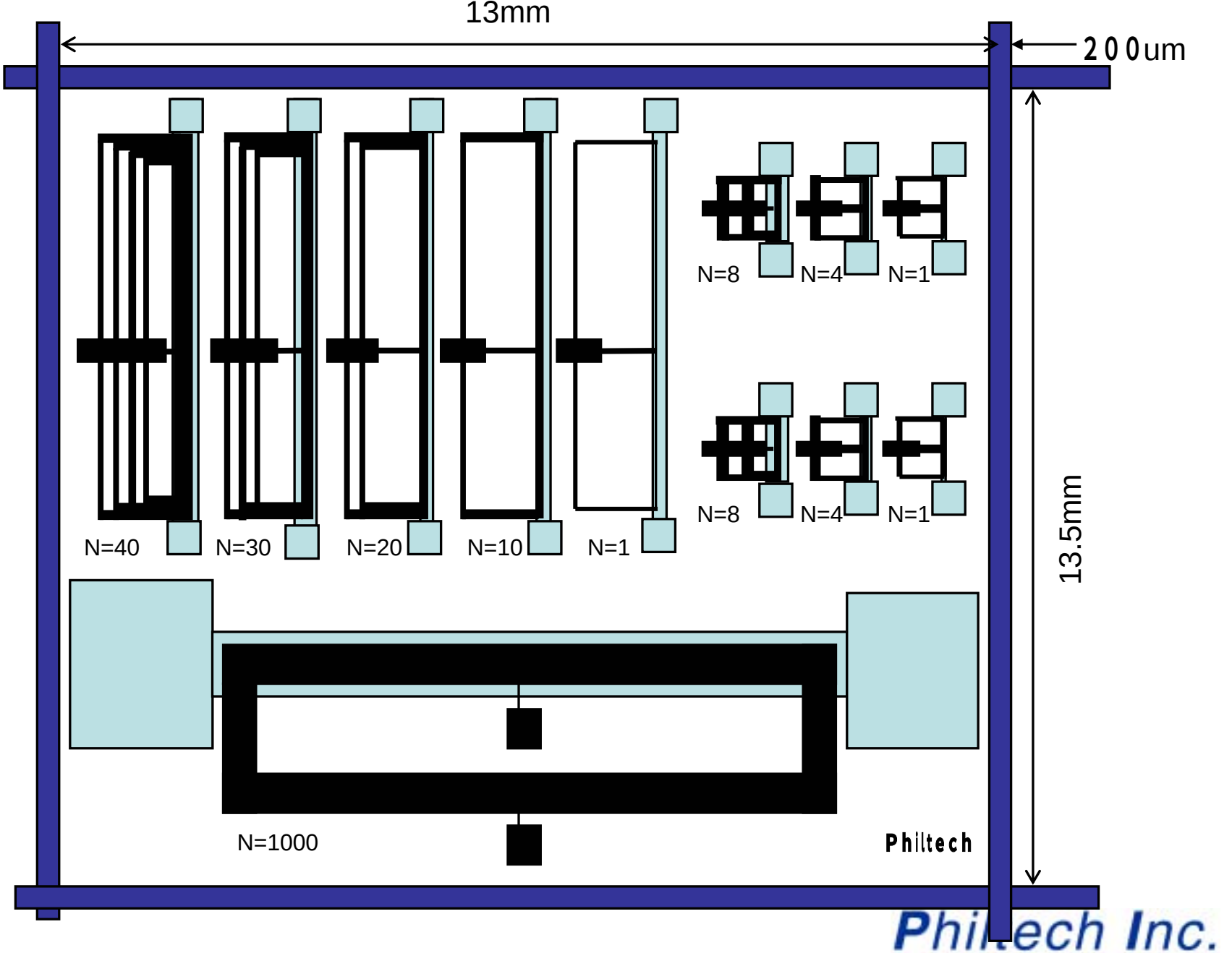

Needed Focus margin
Isolation film
5 um
Fine coil
Thick line
(Al)

No CMP



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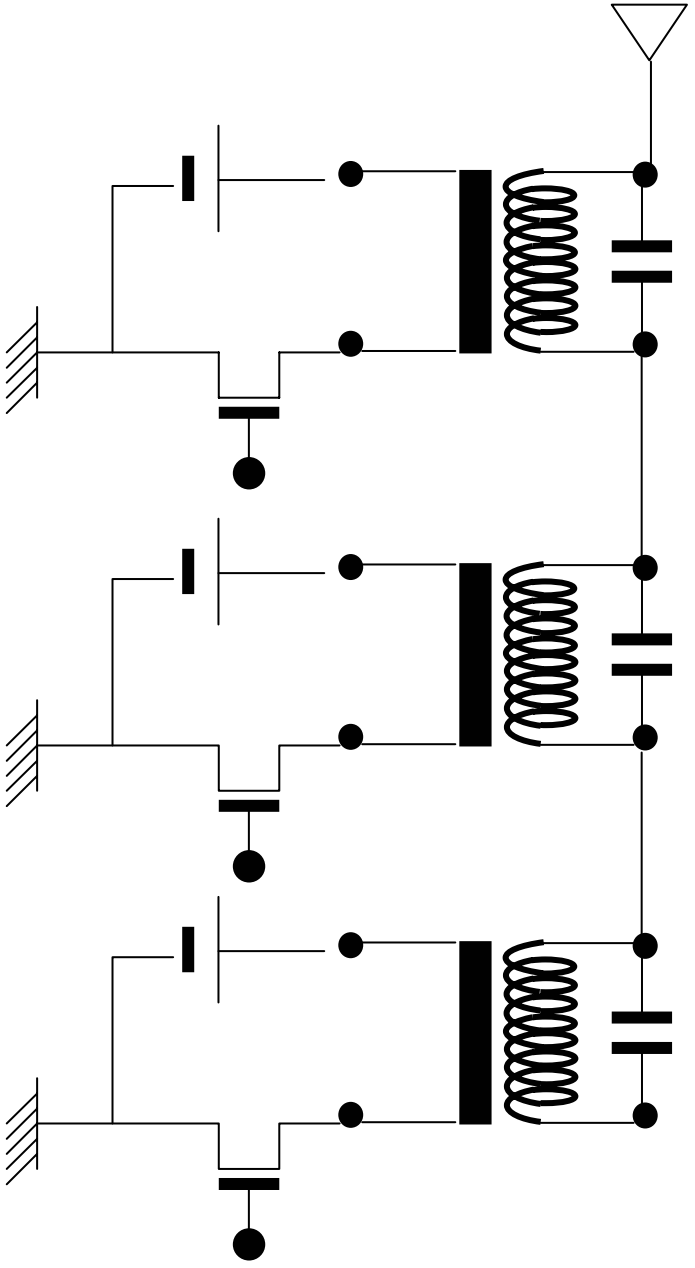

Example

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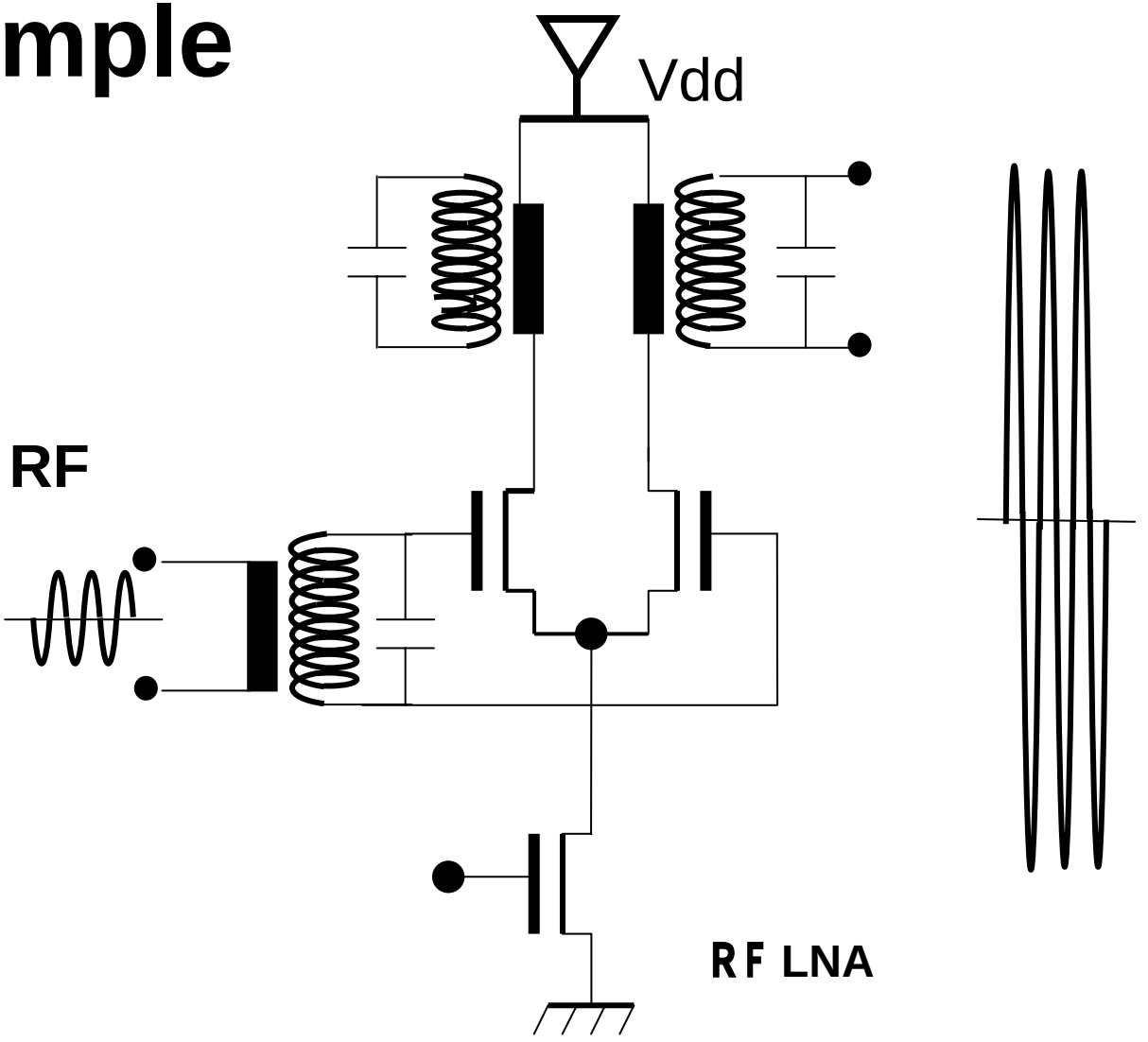
Example



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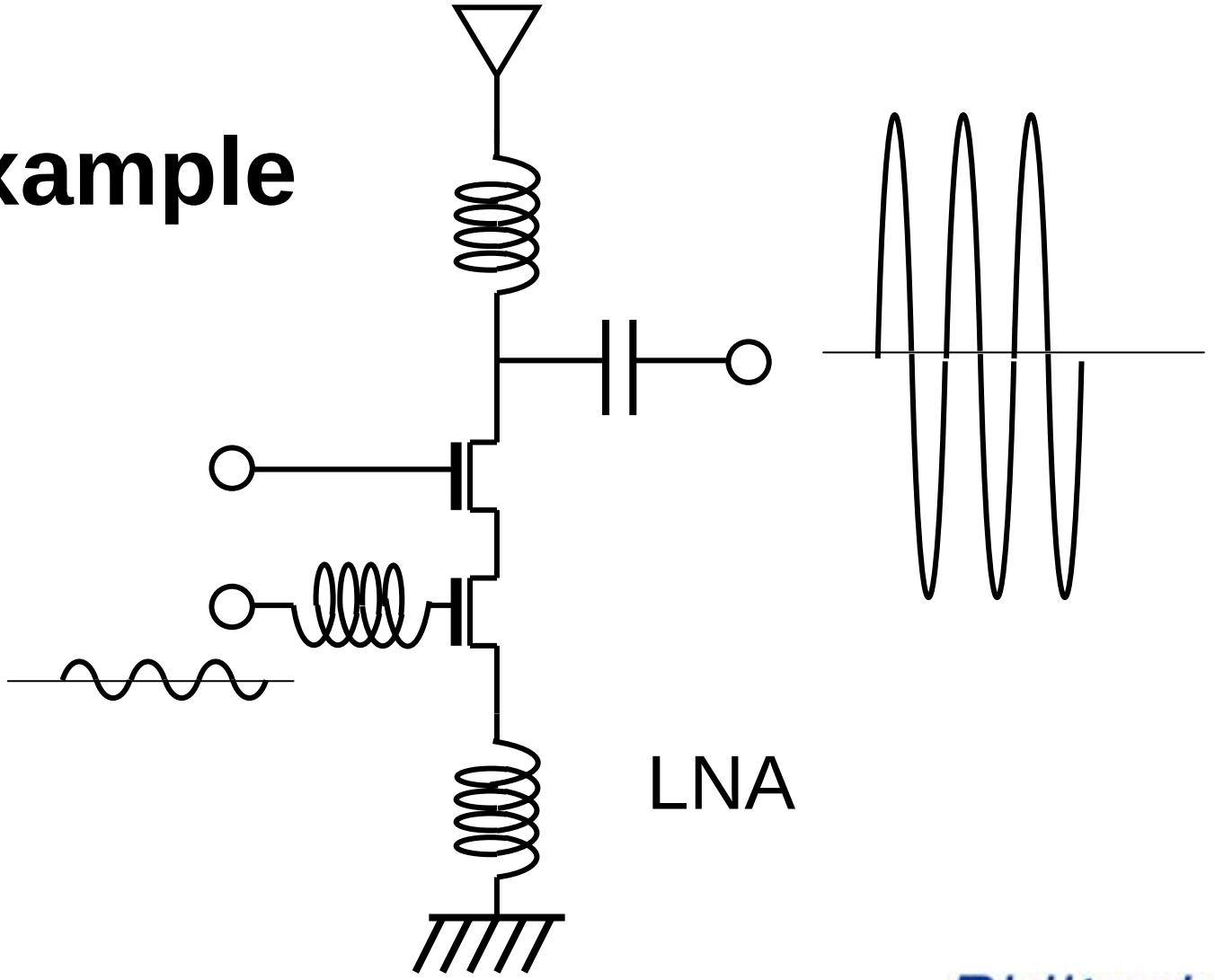
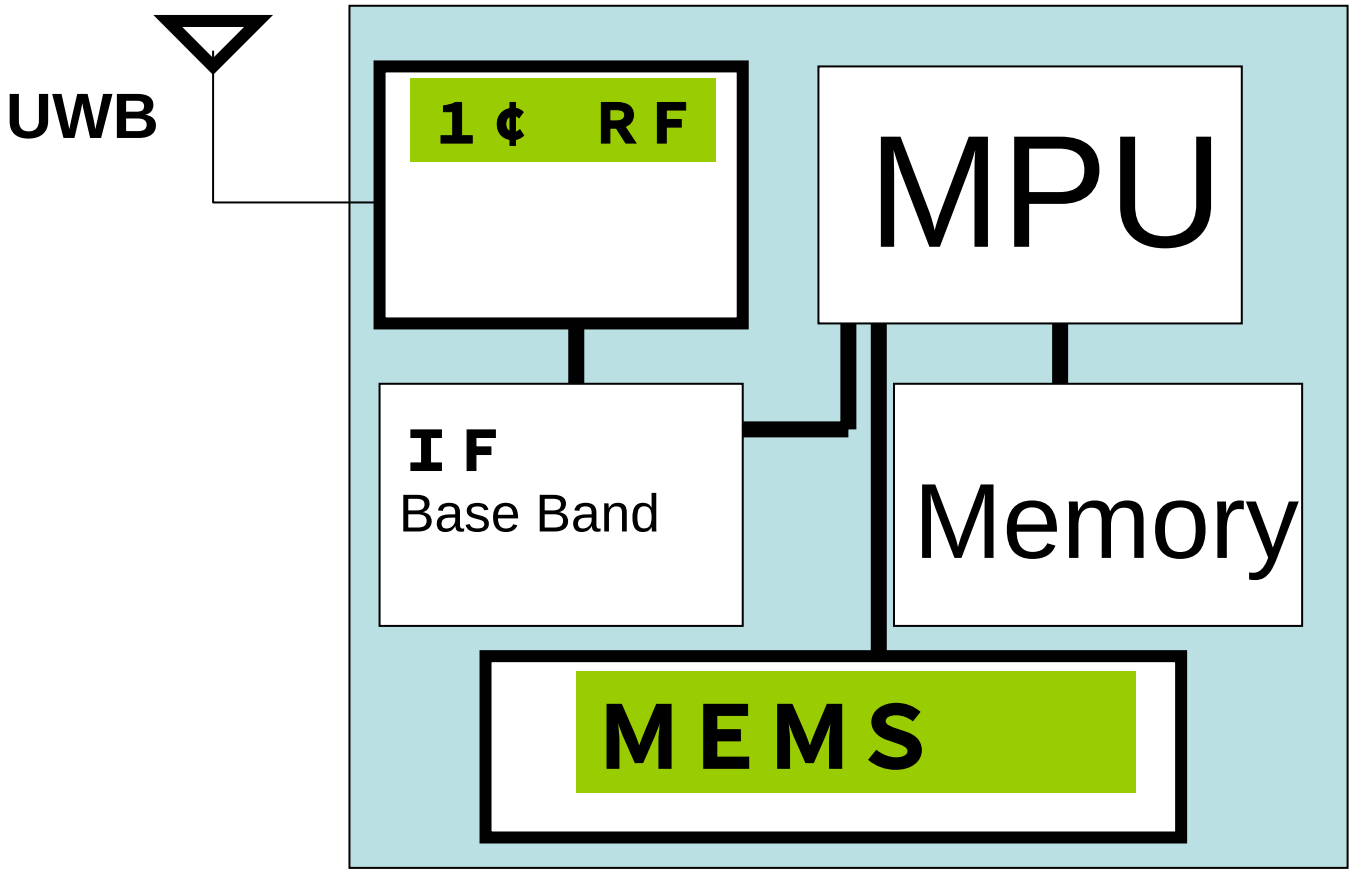
Example



RF-embedded **LSI**



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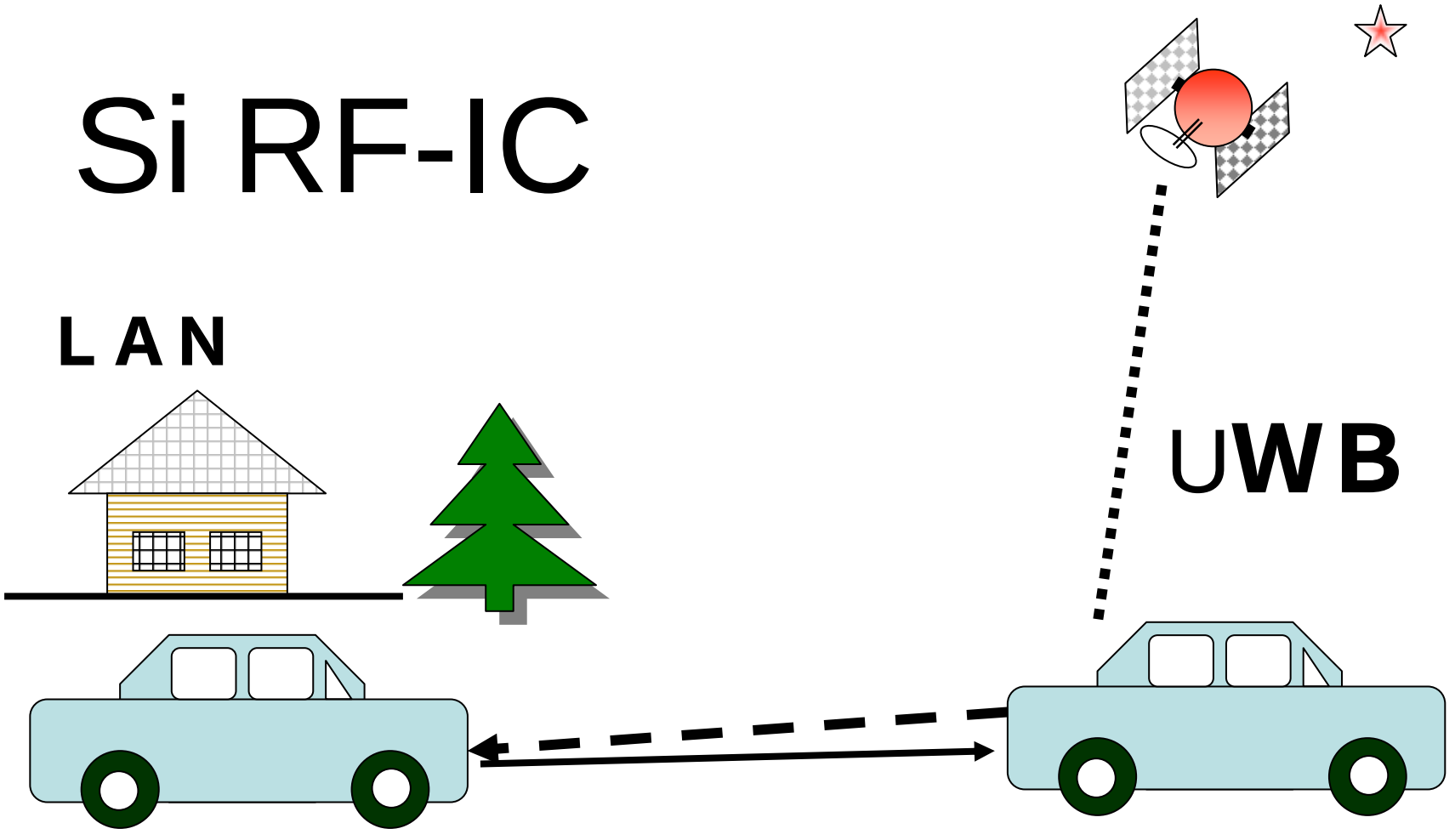
Si RF-IC



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Growing market with RF