Design Guide for Printable Flexible Electronics

DKN Research

Design Guide for the Printable Flexible Electronics

1. Selection of the Substrate Materials

Polyimide Film: 25, 50, 75 and 125 micron thick
PET Film: 50, 100 and 188 micron thick
PEN Film: 50 micron thick
LCP Film: 50 and 100 micron thick
PEEK Film: 50 micron thick

Resin Coated Metal Foils: Cu, Al and Stainless Steel
Other materials: Cloths, papers and more

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2. Selection of the Cover Material

#Polyimide resins
#Epoxy resins
#Polyester resins

Matching the heat resistant material of the substrate should be selected.

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3. Conductors

Materials: Silver paste, standard type
Silver paste, nano base
Carbon paste

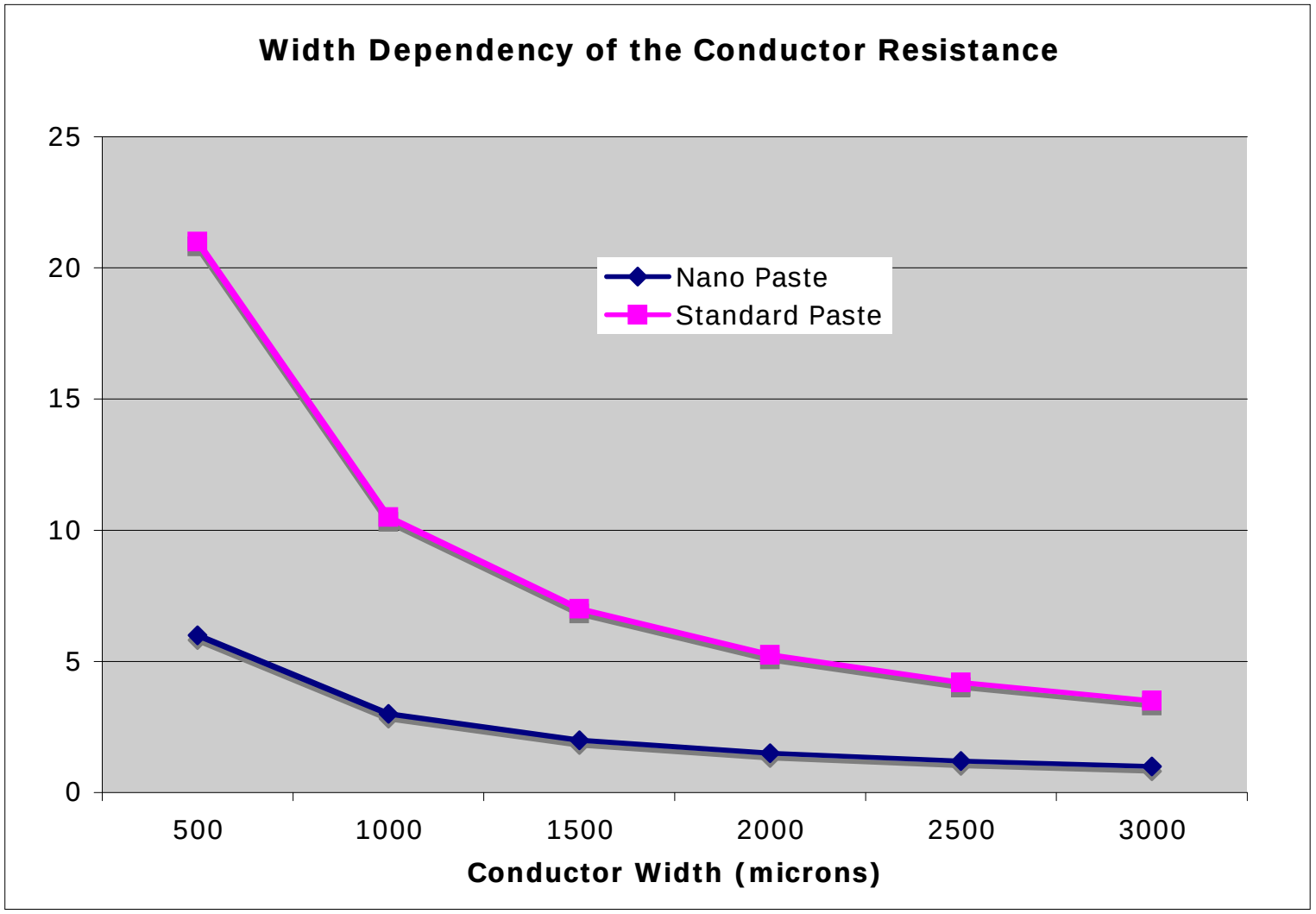
**** Silver paste conductors should be covered with carbon ink or coverlay to avoid migration.**

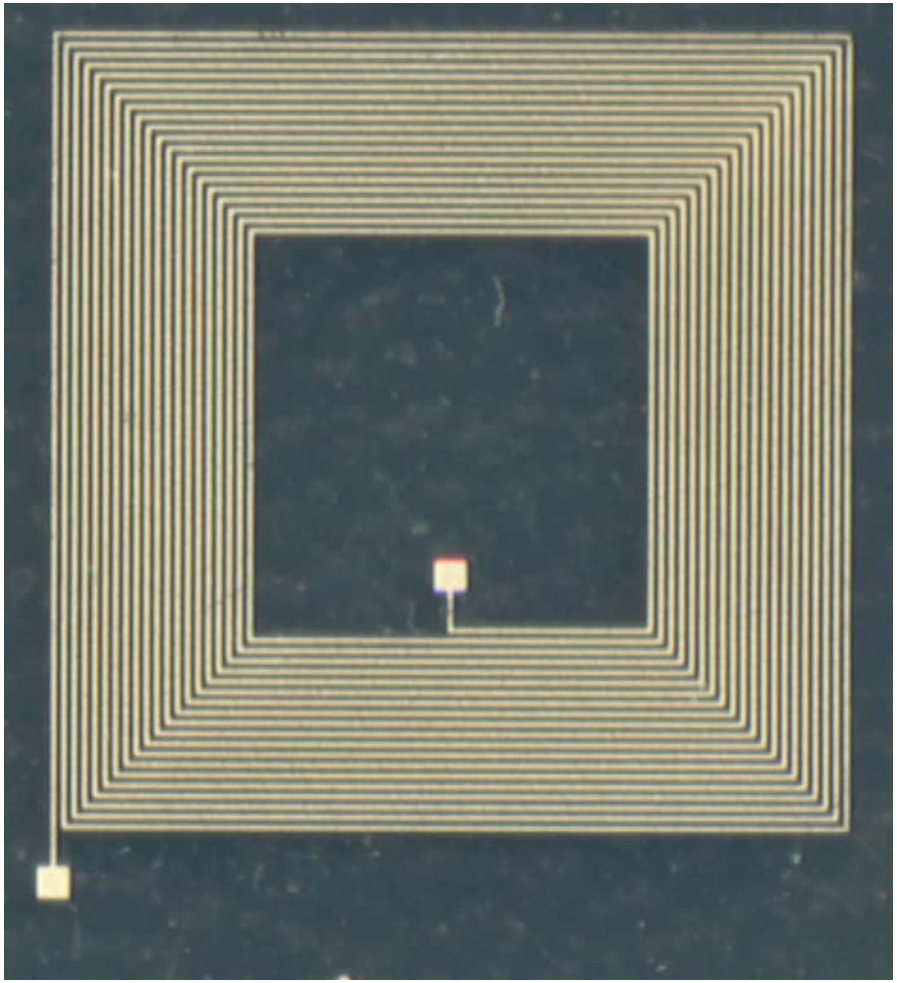
****Minimum pitches:**
PI, PET, PEN films: 100 microns
Resin coated paper: <60 microns

**** Generally, line widths could be smaller than spaces.**

Single side circuits

Single side circuits with cover coat


Width Dependency of the Conductor Resistance
25
20
15
10
5
0
Nano Paste
Standard Paste
500
1000
1500
2000
2500
3000
Conductor Width (microns)



Example of Printed Coil (100 micron pitch)

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4. Double side circuits with via holes

Double sided circuits with drilled via holes

Min. hole size: 80 micron diameter
Min. pad size: 200 micron diameter
Alignment: +/- 50 microns

***Double via holes are recommended to have higher reliability**

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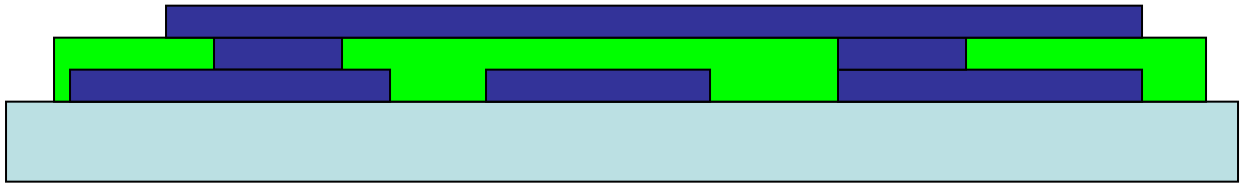
4. Double side circuits with via holes

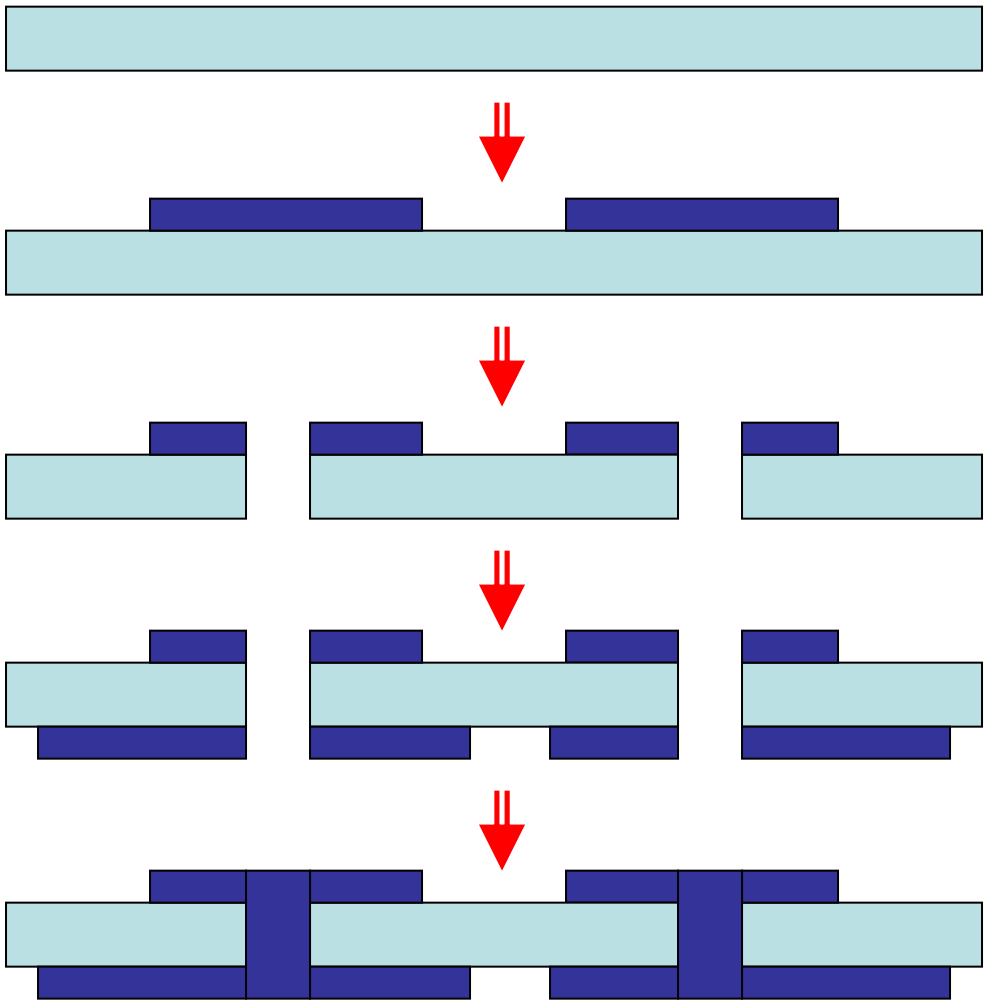
Double side circuits by printed via holes



Min. hole size: 0.5 mm diameter
Min. pad size: 1.0 mm diameter
Alignment: +/- 200 microns

***Double via holes are recommended to have higher reliability**

Double side process with drilled via holes



Base substrate

Screen print

Drill holes

Screen print

Fill via holes

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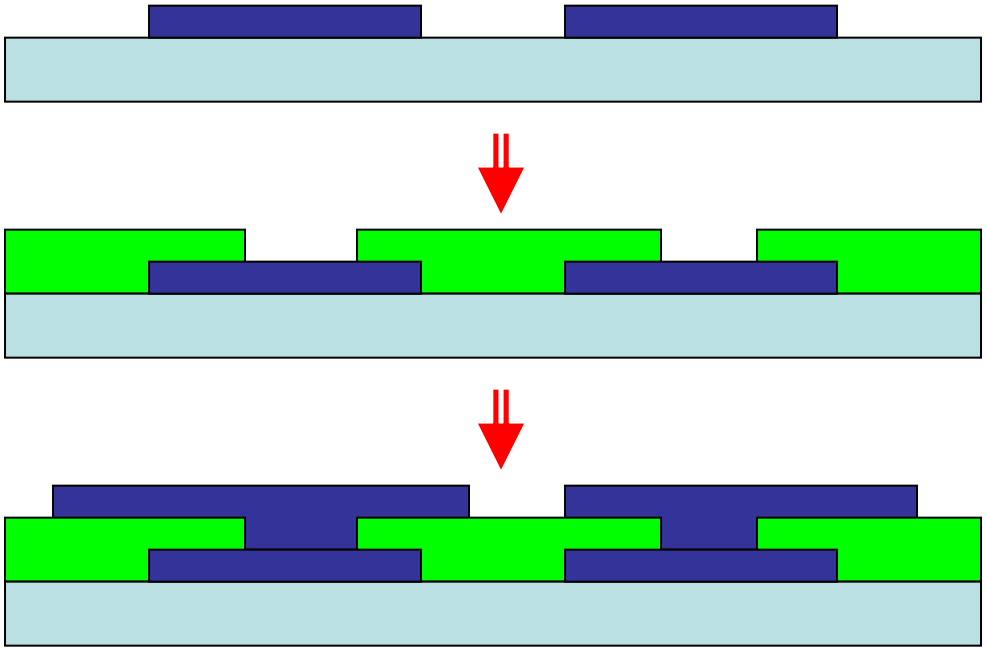
5. Build-up for multi-layer circuits



Printed conductors

Print insulation

Print conductor

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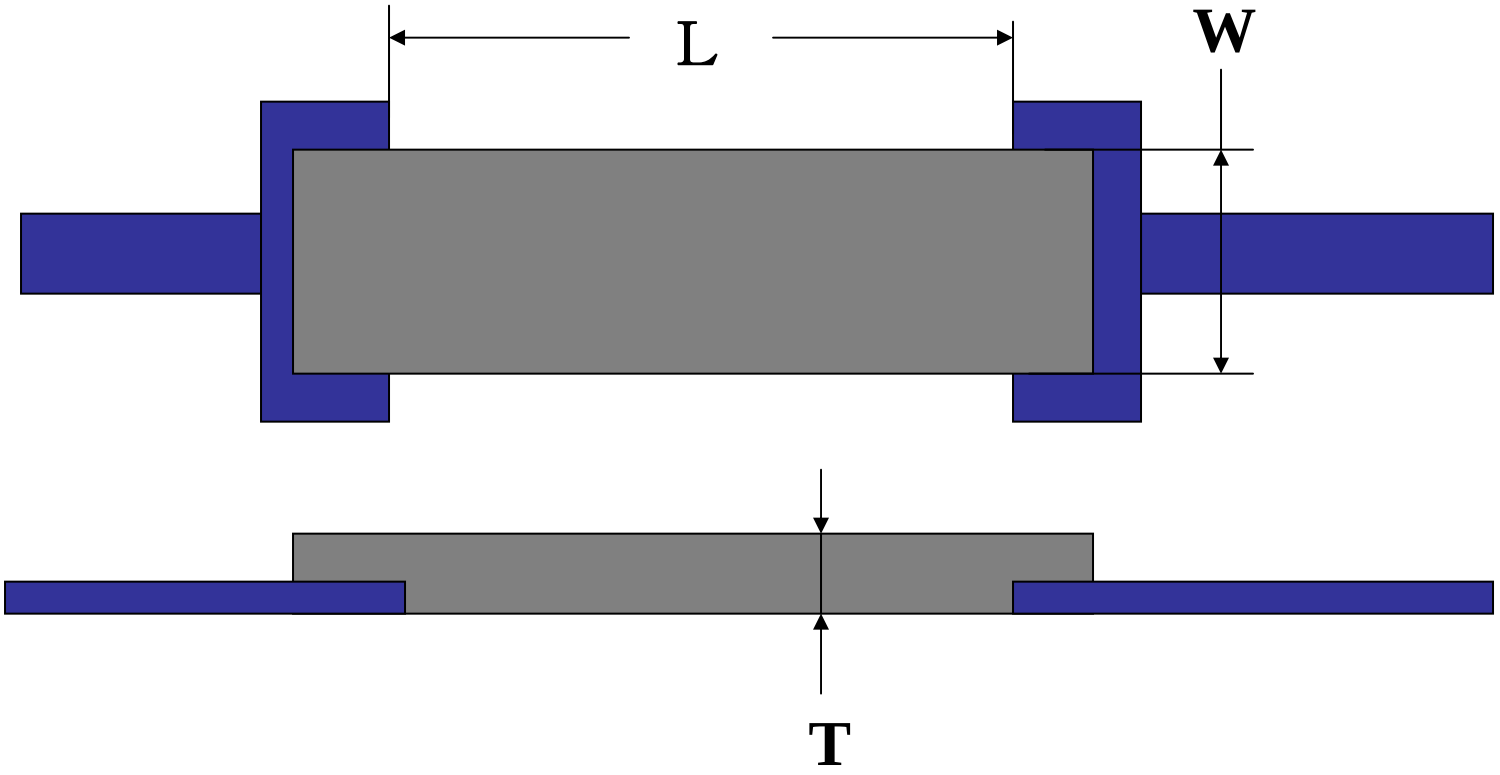
6. Embedded resistor

$$R = a * L / W * T$$



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6. Embedded resistor

Examples with polyimide resin matrix

#Conductivity of conductors: < 3 x $^{-5}$ ohm*cm

#Conductivity of resistors: < 1.5 x $^{-1}$ ohm*cm

#Volume resistivity of insulation layer:
> 2.5 x ^{16} ohm*cm

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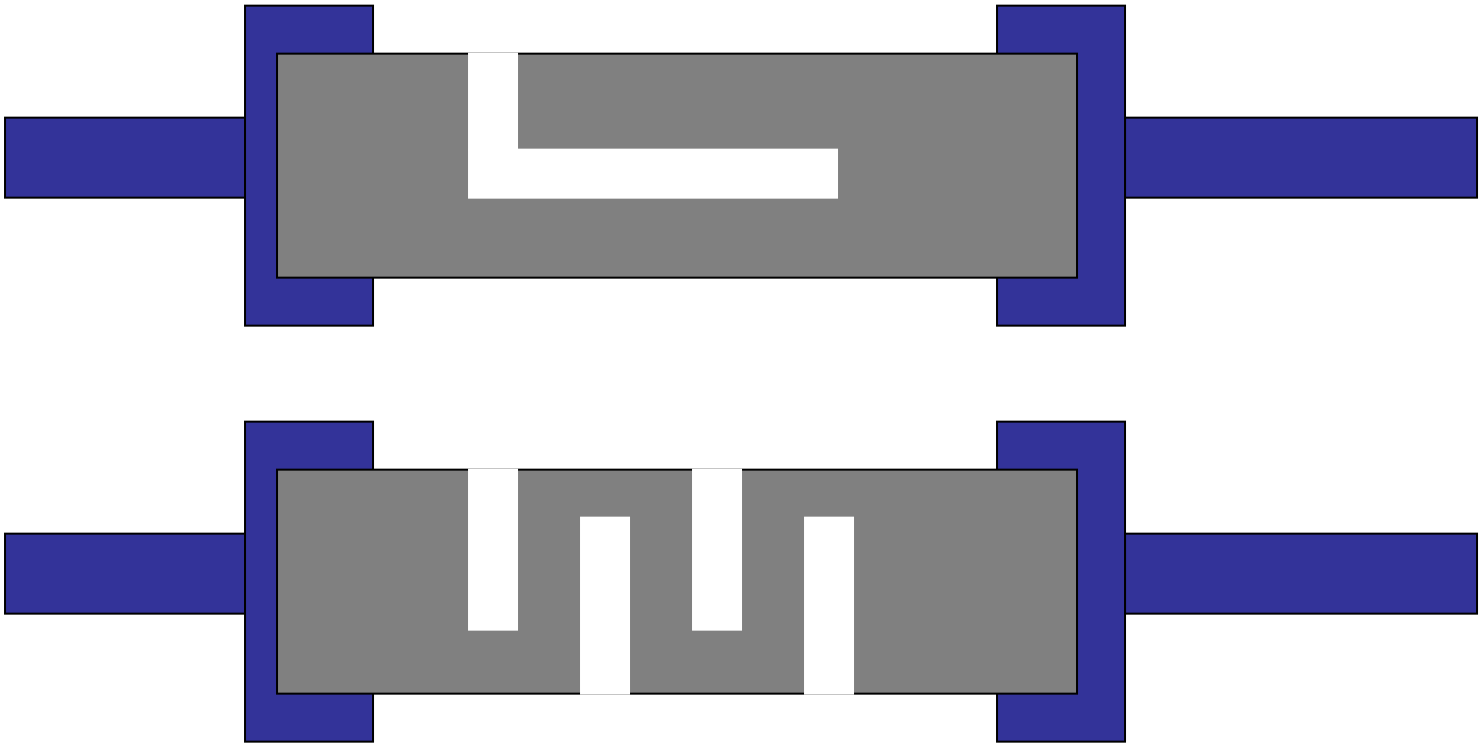
6. Embedded resistor (trimmed)



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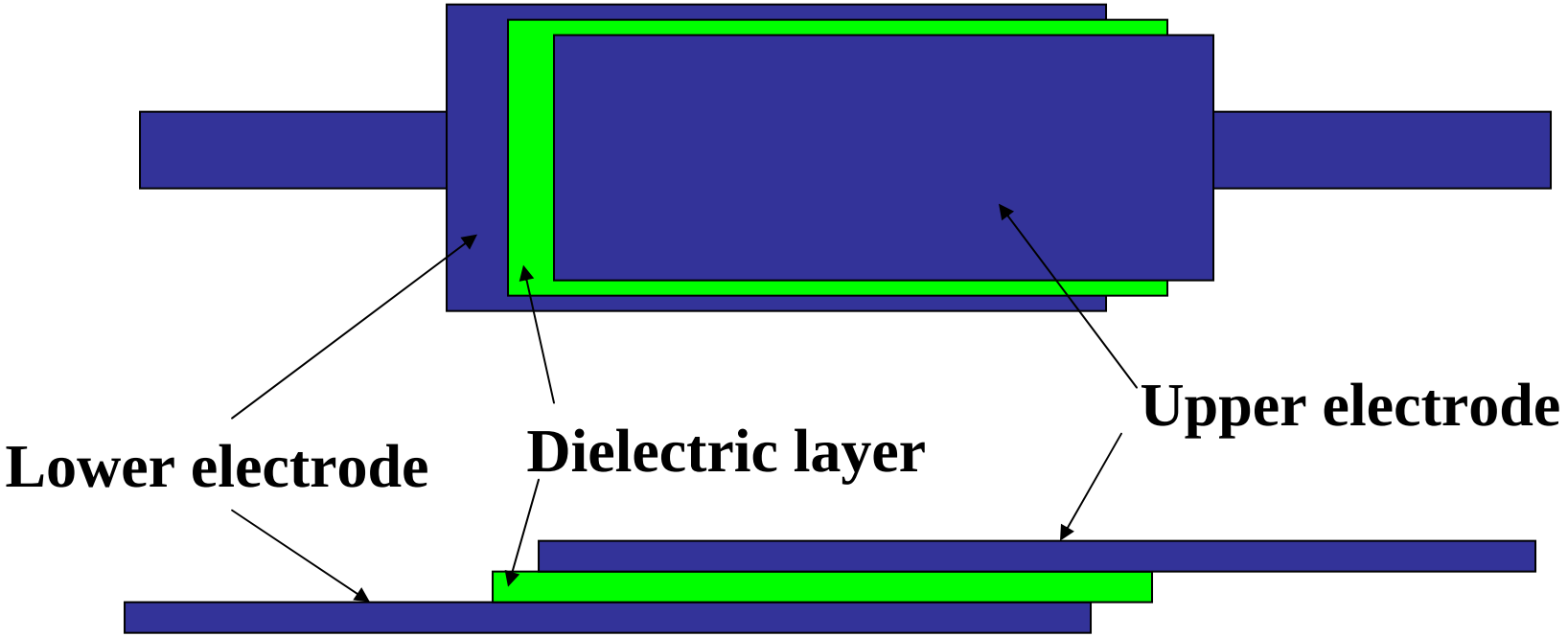
7. Embedded capacitance



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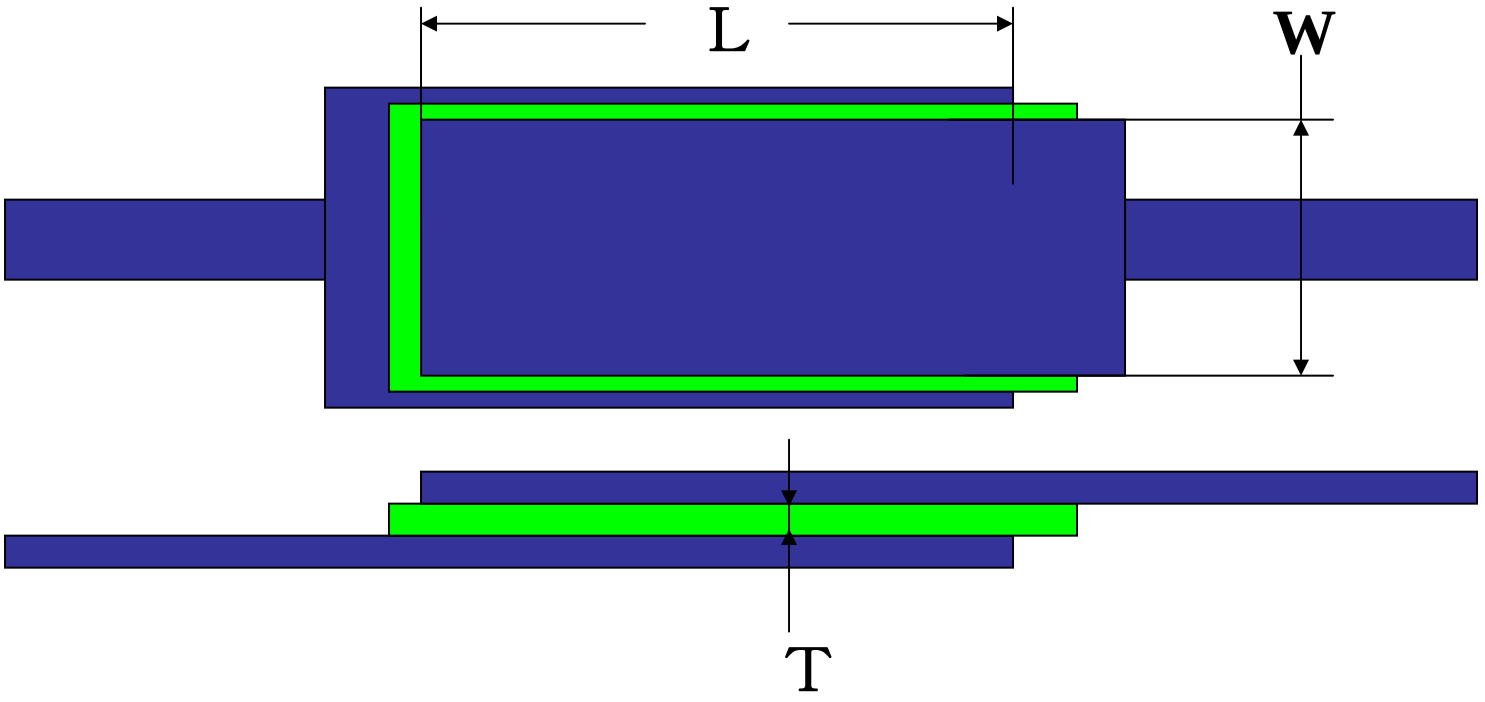
7. Embedded capacitance

$$C = b * \varepsilon * L * W / T$$



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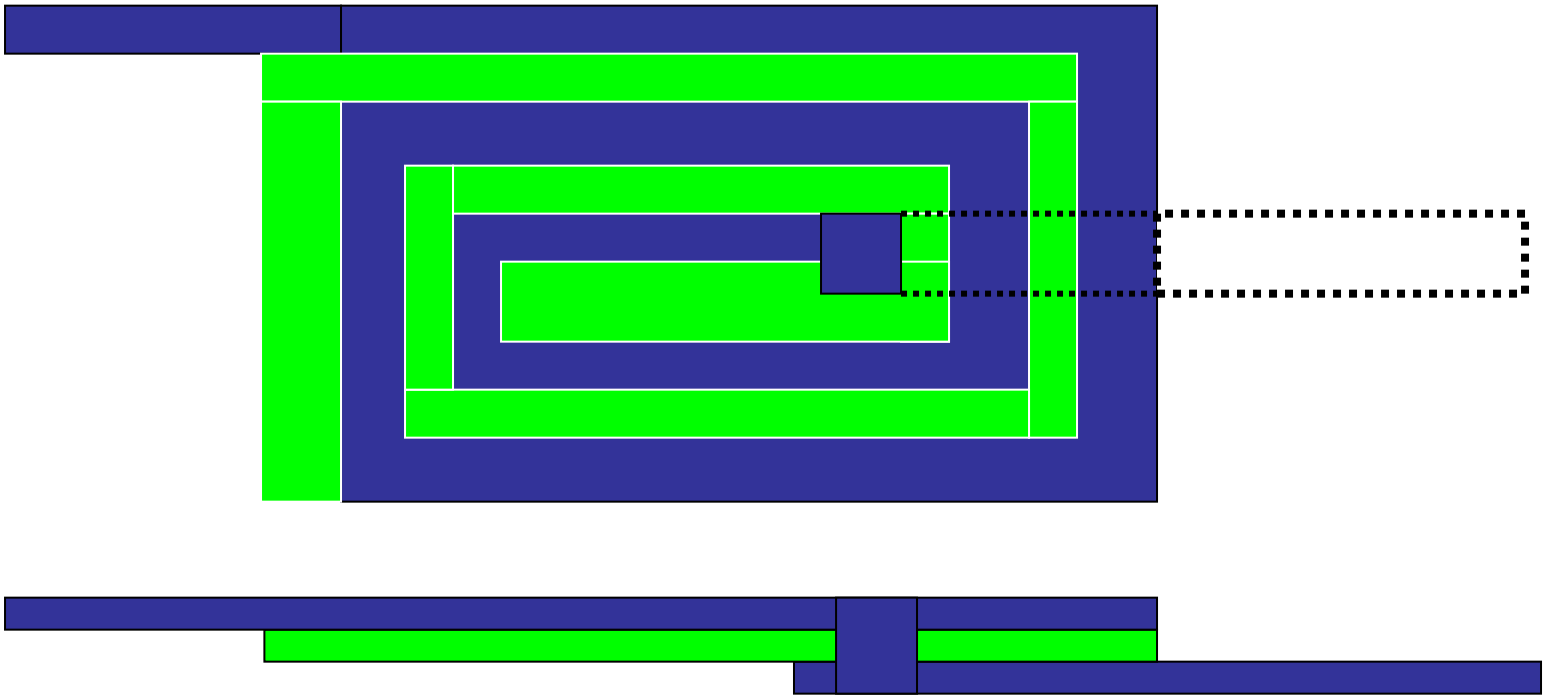
8. Embedded inductance (with drilled via hole)



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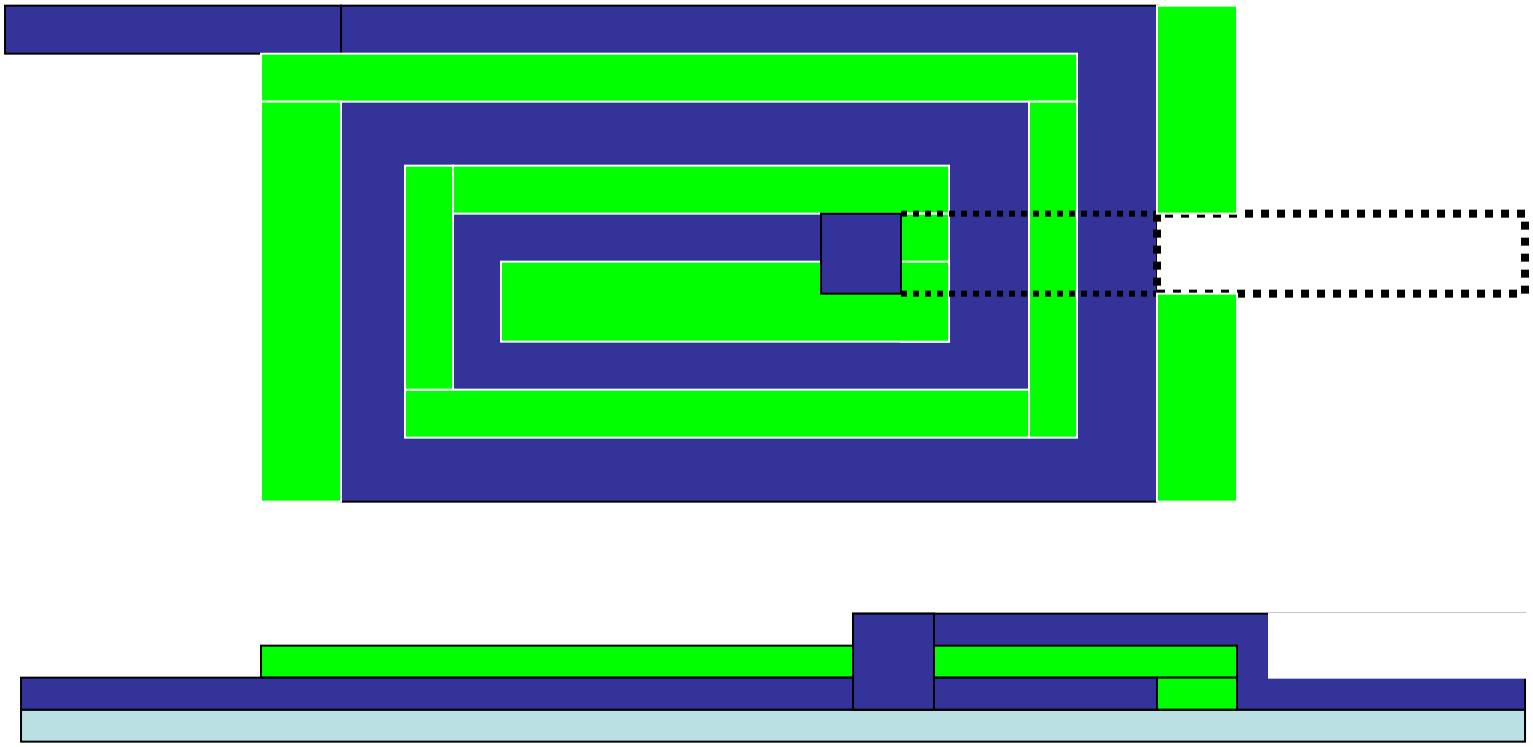
8. Embedded inductance (with printed via holes)



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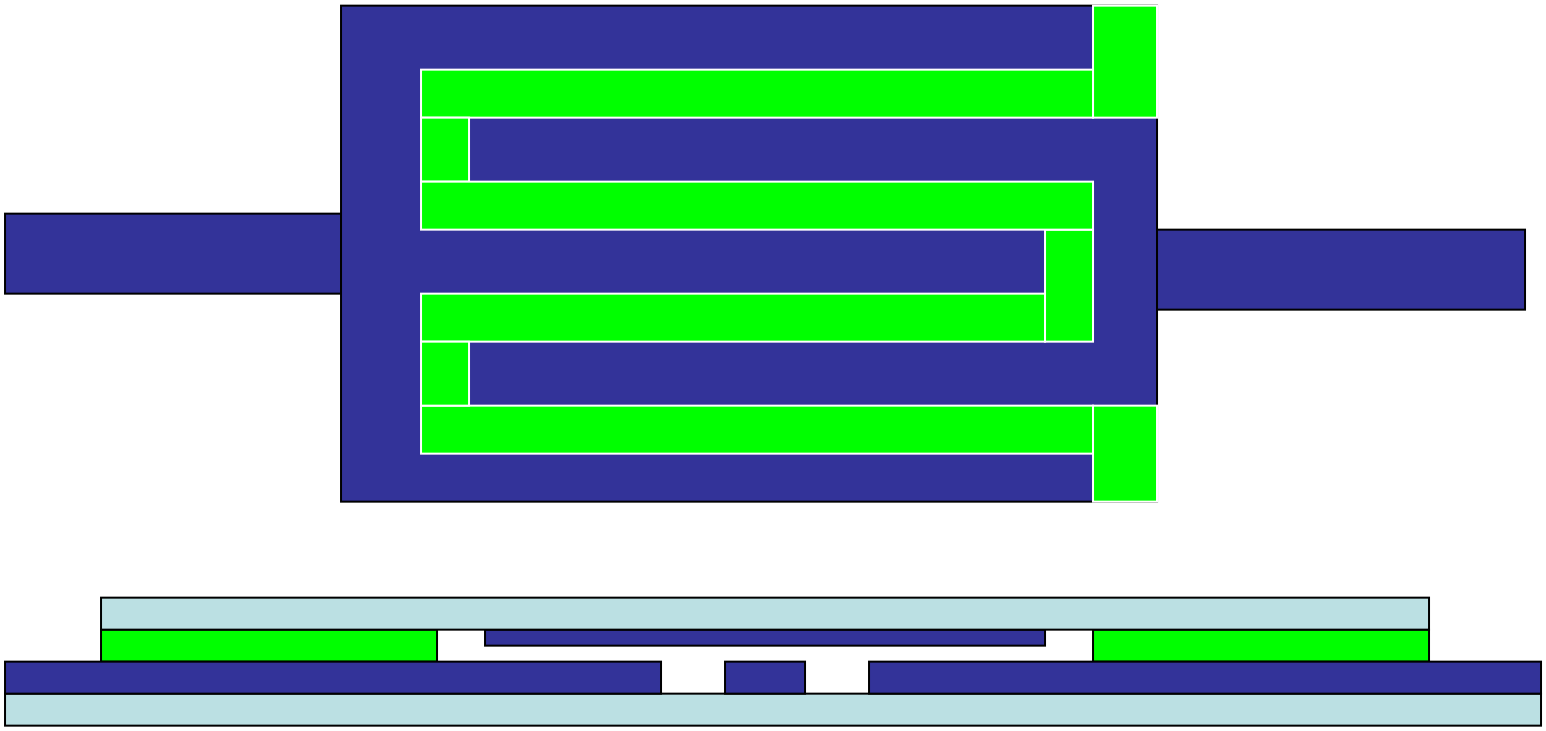
9. Membrane switch



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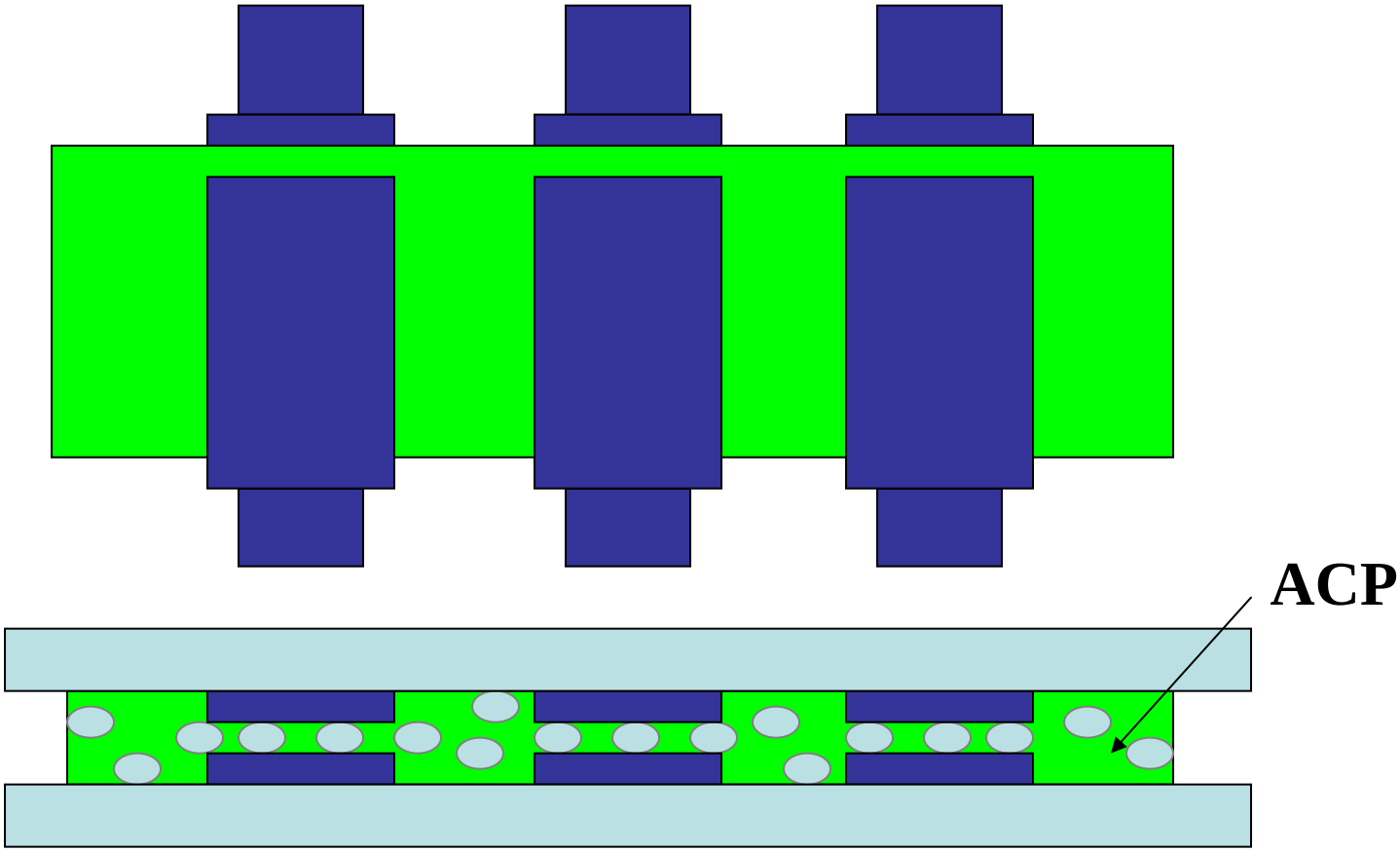
10. Termination with ACP

_____ (ACP: Anisotropic Conductive Paste)



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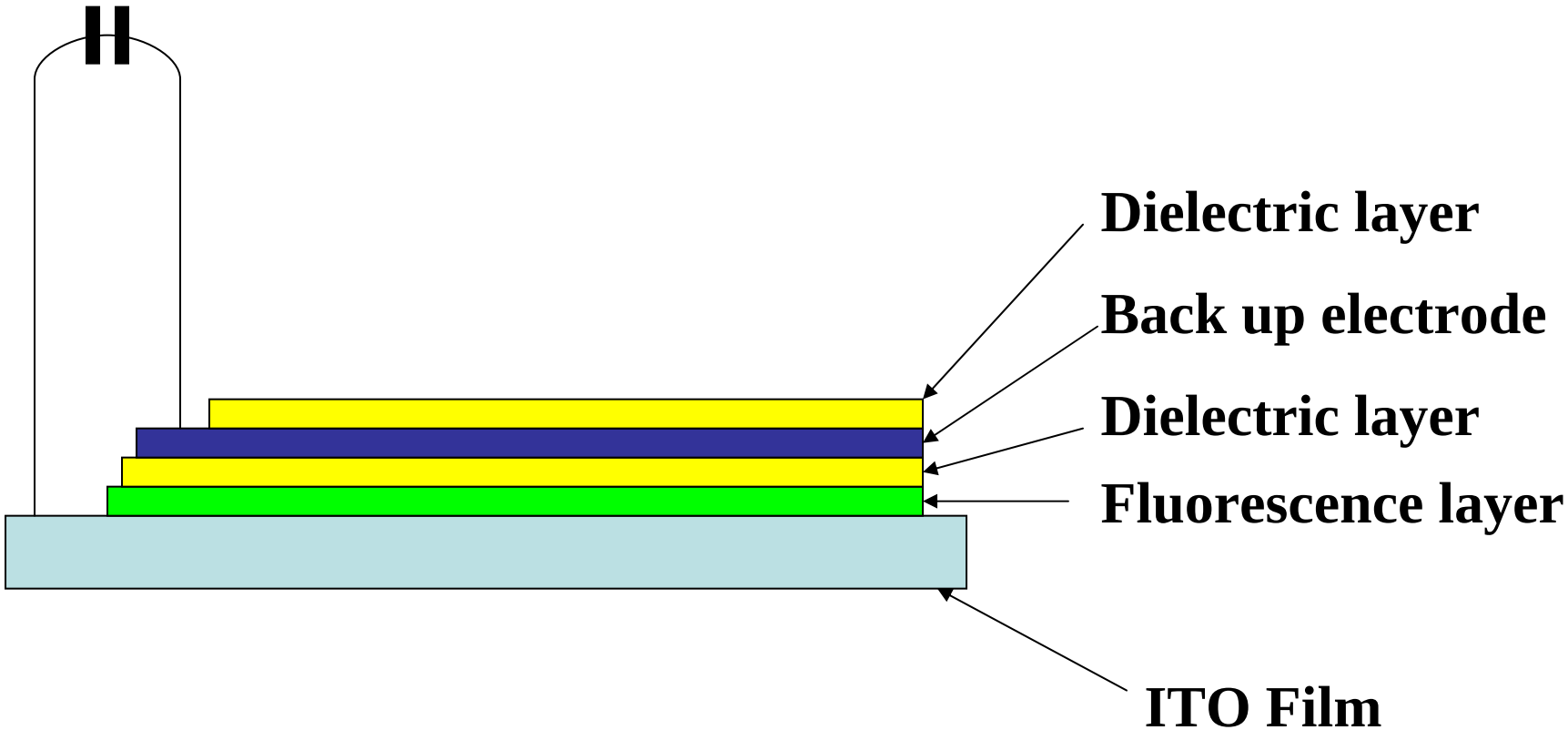
11. Electrolluminecsence device



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12. More functions will be added by your ideas.

**Combinations with the other technologies will generate more value
**New applications are only limited by your ideas

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