

Technologie návrhu a výroby DPS

Pavel Vitvar

Transport Tycoon



Transport Tycoon - rezistor + ledka + zem



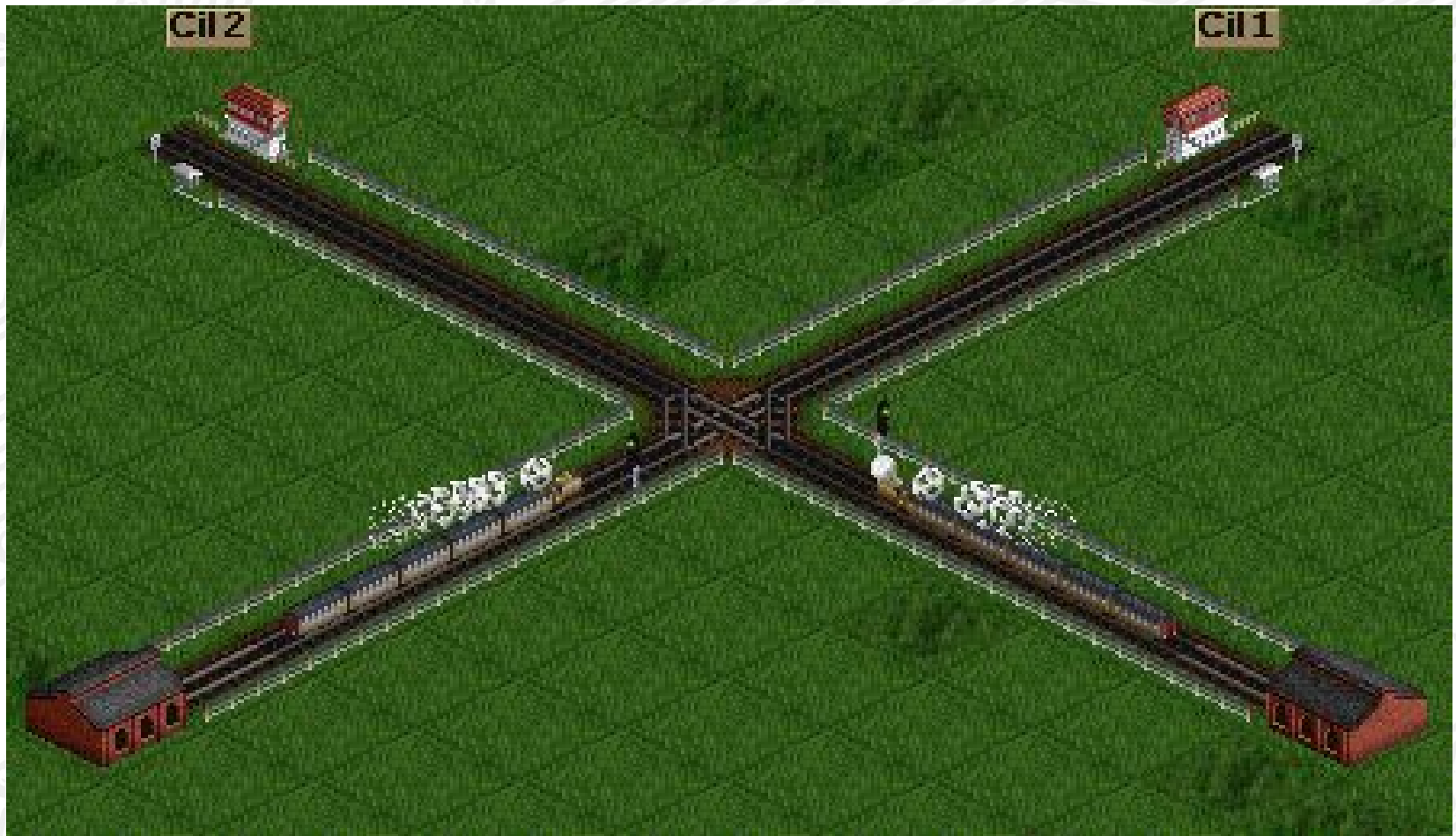
Transport Tycoon



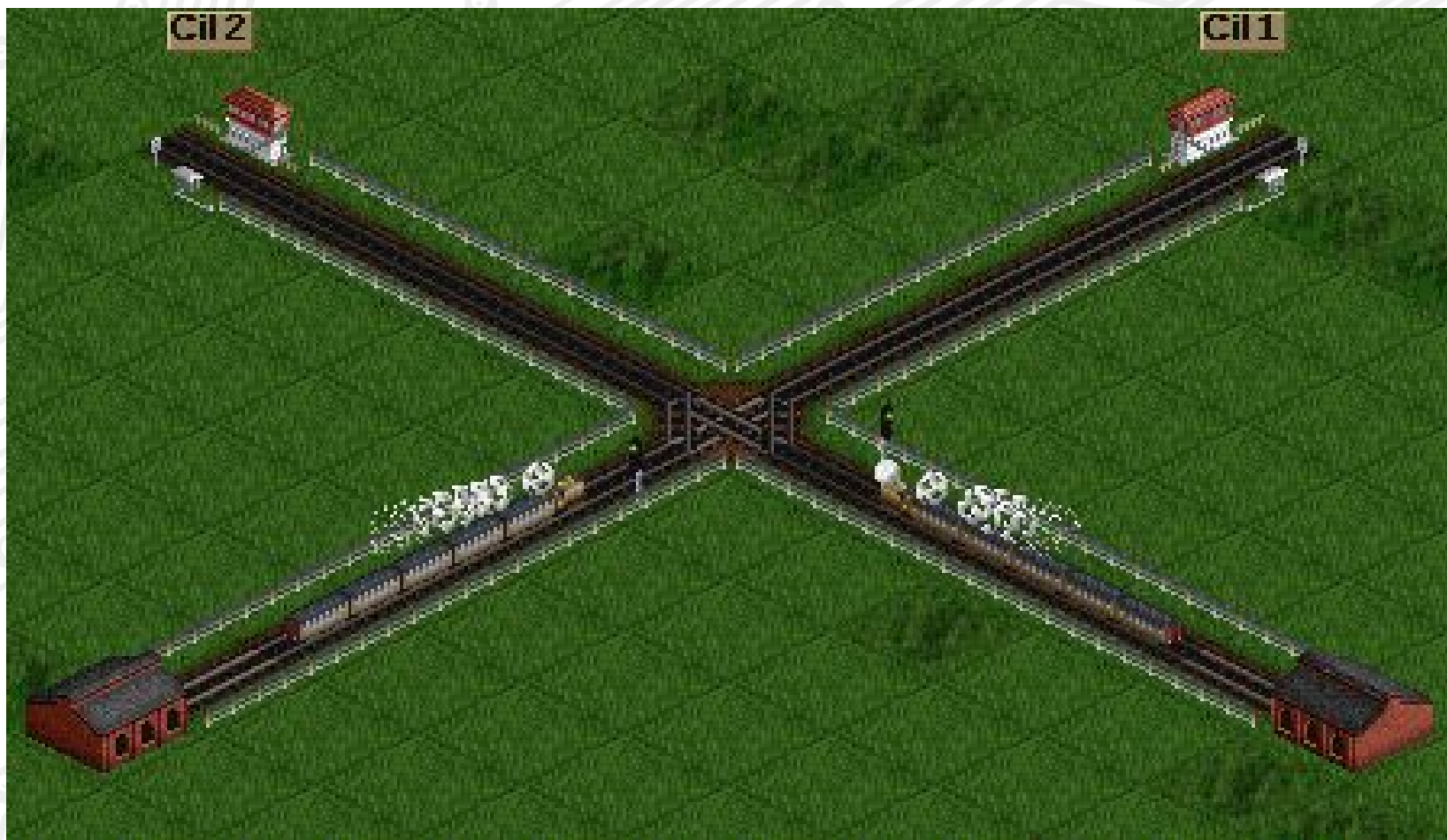
Transport Tycoon - dvě žárovky



Transport Tycoon



Transport Tycoon - zkrat!



Trocha historie

1903 - Albert Hanson návrh propojení součástek tenkou fólií

1913 - Arthur Berry - patent na leptání spojů

1927 - Charles Durcase - patent na galvanické pokovení

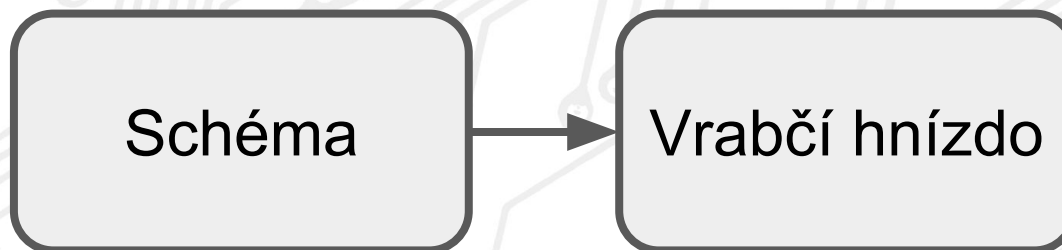
1943 - 2. světová válka - roznětky v protiletadlových střelách

1950 - THT ve spotřební elektronice v USA

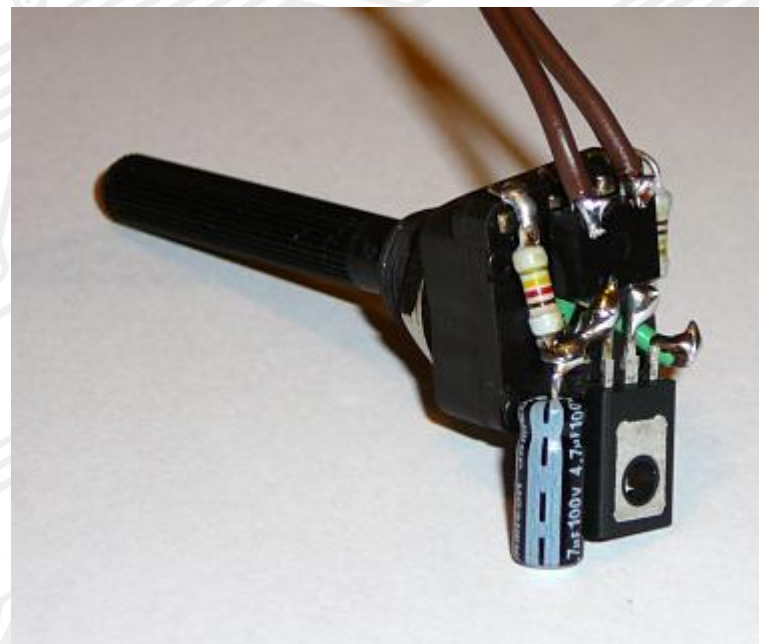
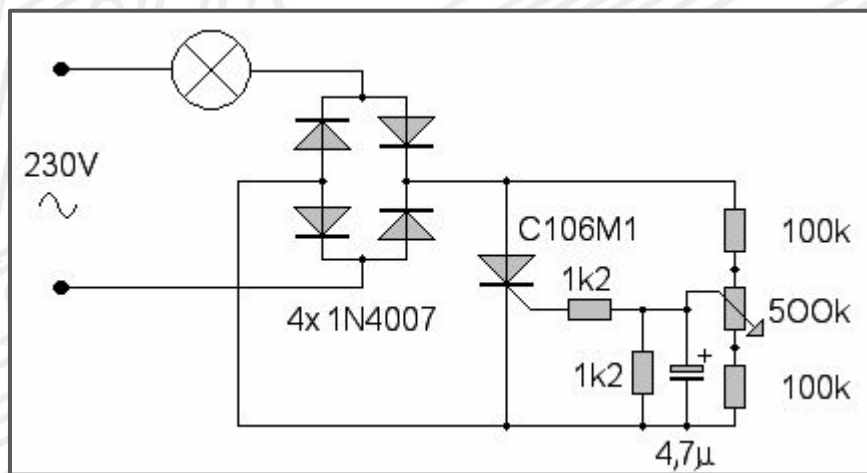
1980 - SMT ve spotřební elektronice v USA

2015 -

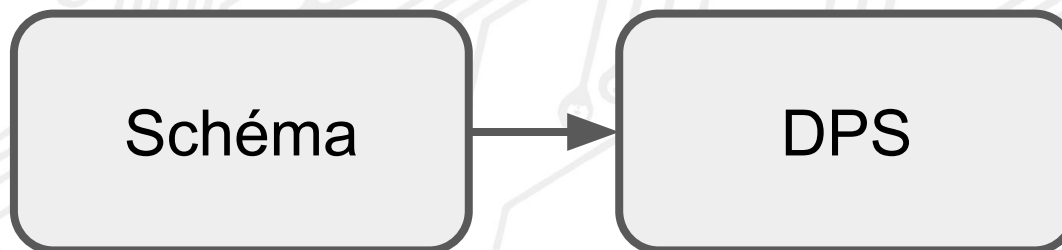
Technologie - bastlíř úroveň 0



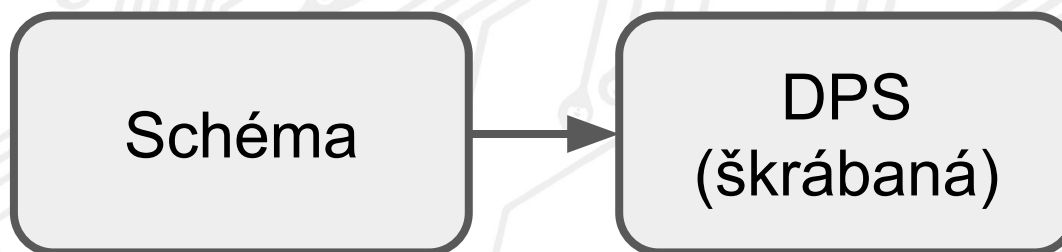
Technologie - bastlíř úroveň 0



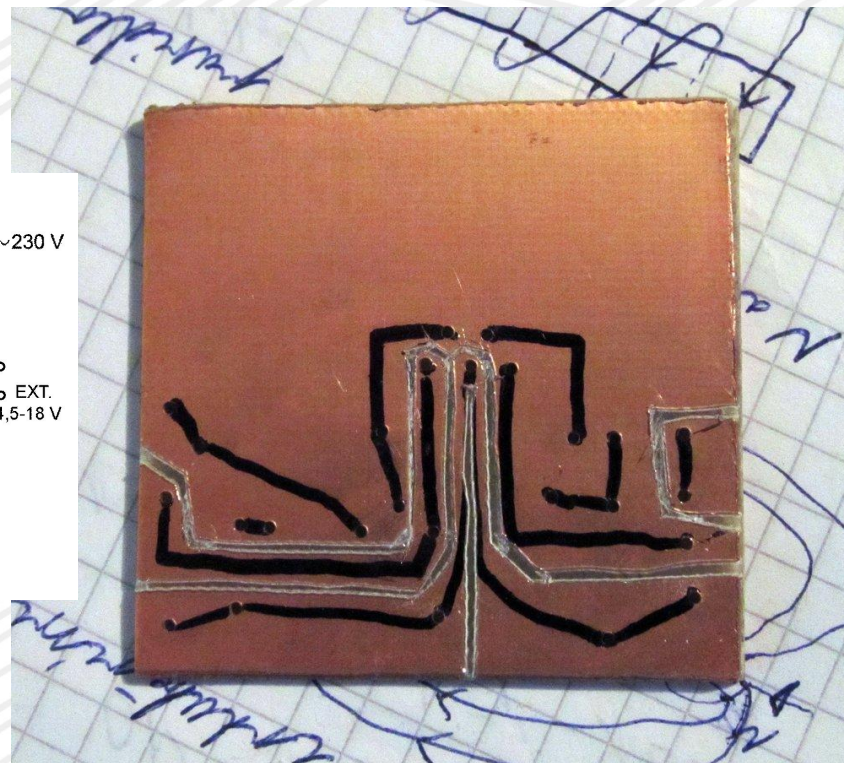
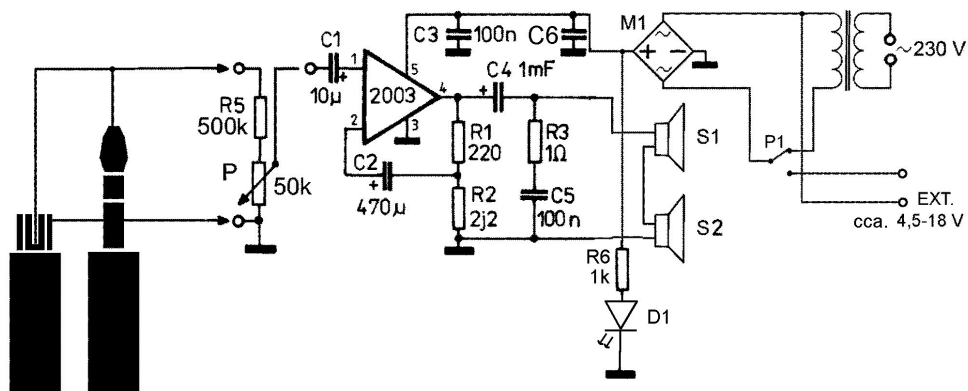
Technologie - bastlíř úroveň 1



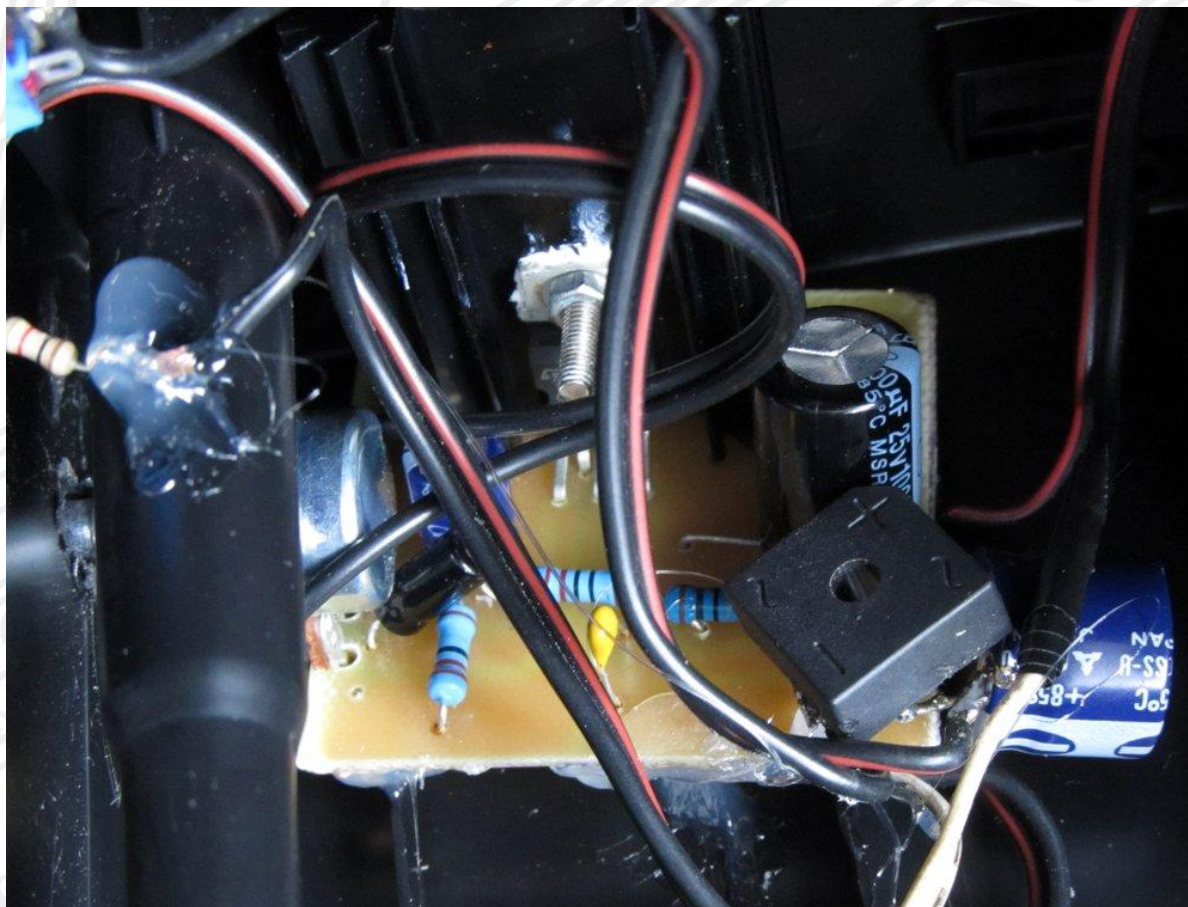
Technologie - bastlíř úroveň 1



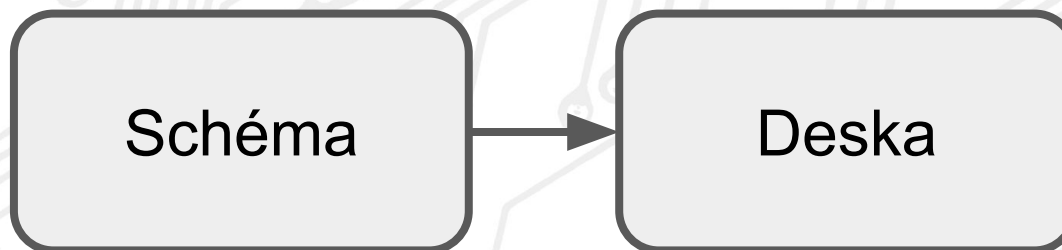
Technologie - bastlíř úroveň 1



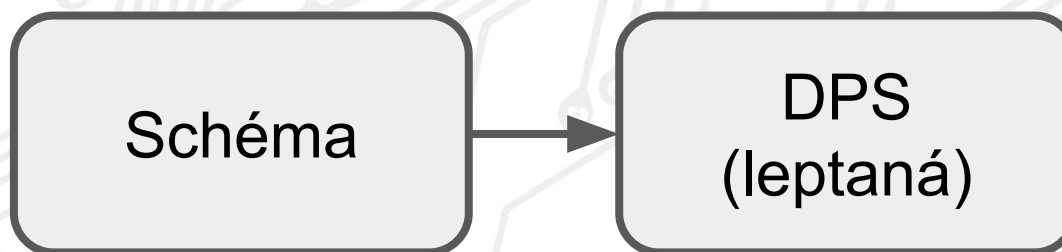
Technologie - bastlíř úroveň 1



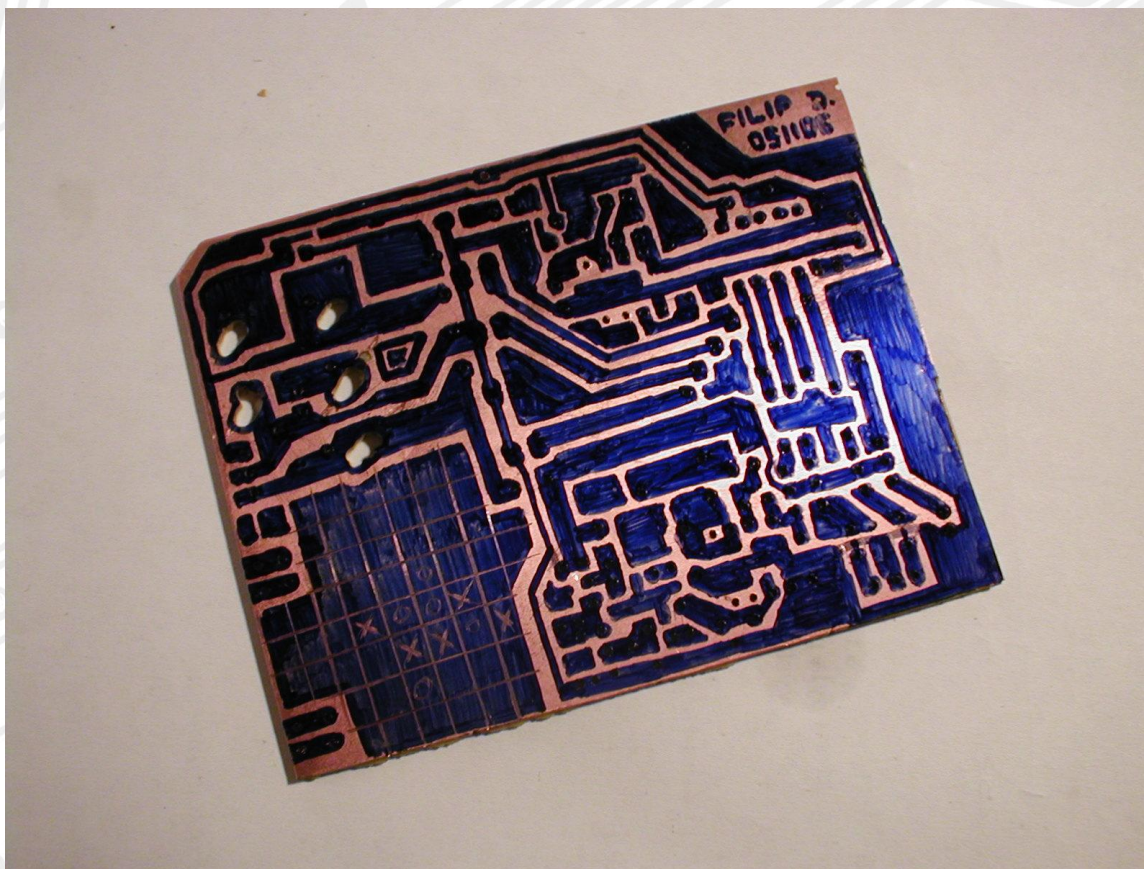
Technologie - bastlíř úroveň 2



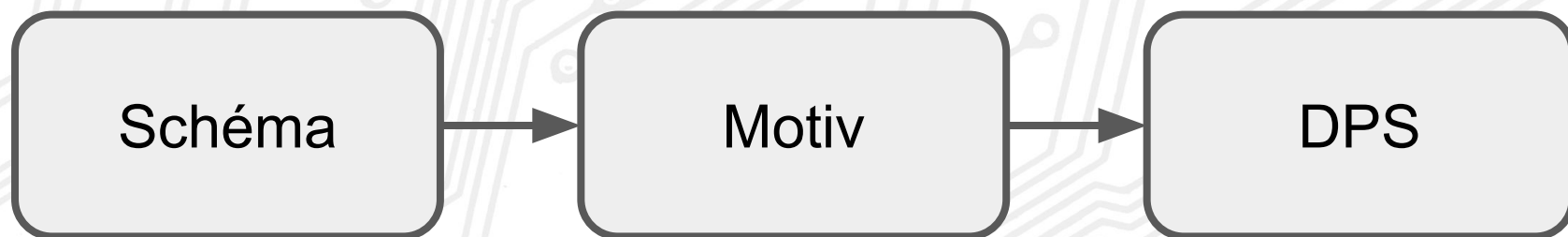
Technologie - bastlíř úroveň 2



Technologie - bastlíř úroveň 2



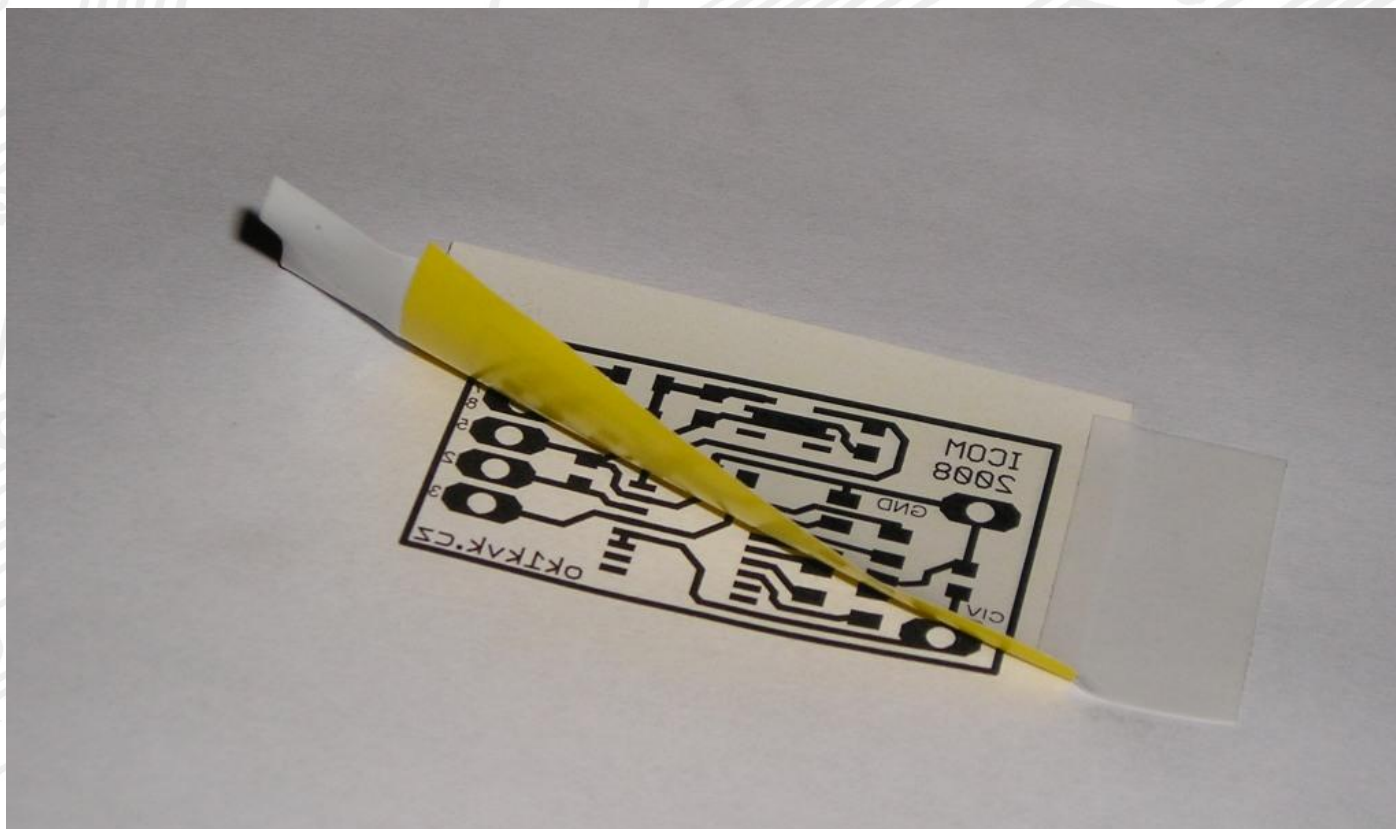
Technologie - bastlíř úroveň 3



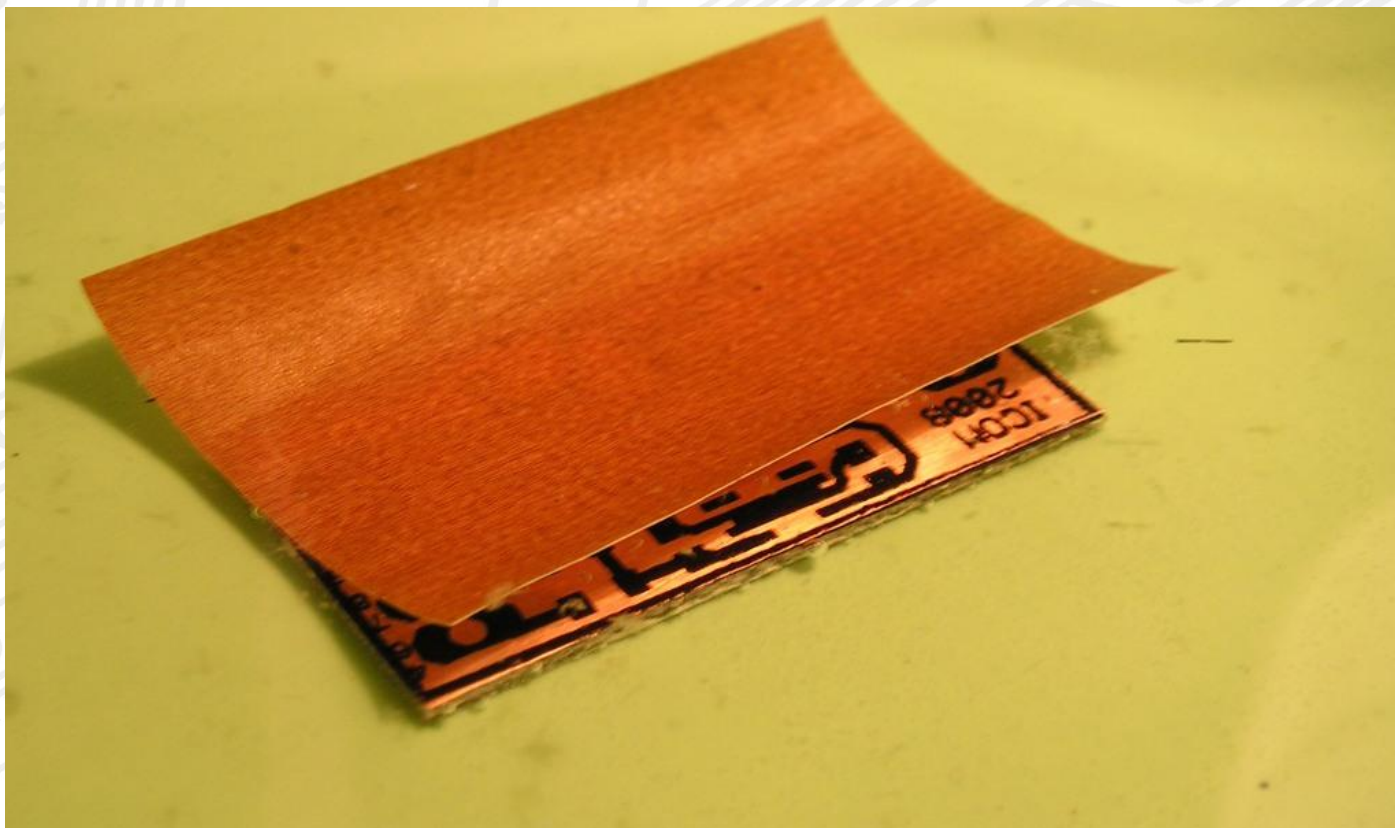
Technologie - bastlíř úroveň 3



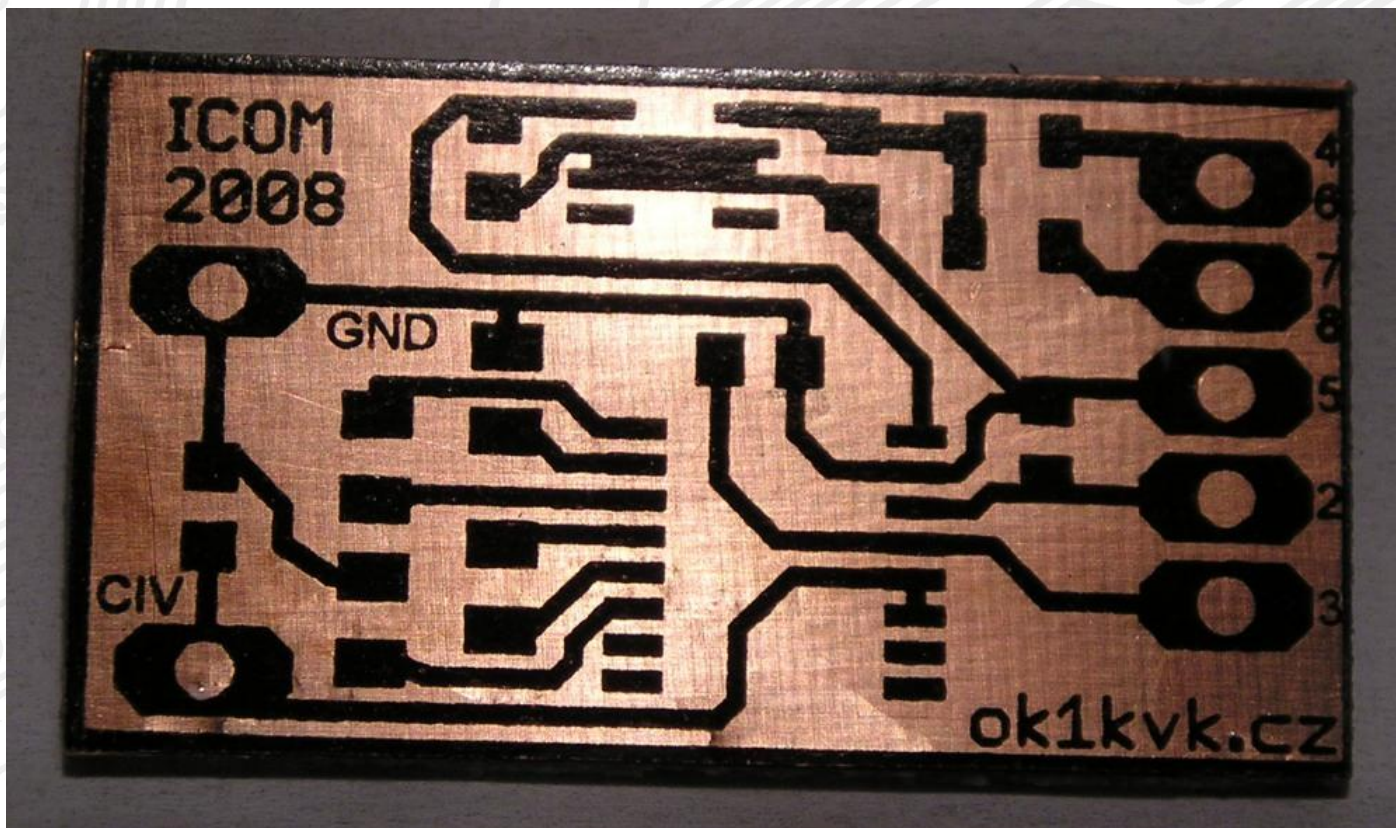
Technologie - bastlíř úroveň 3



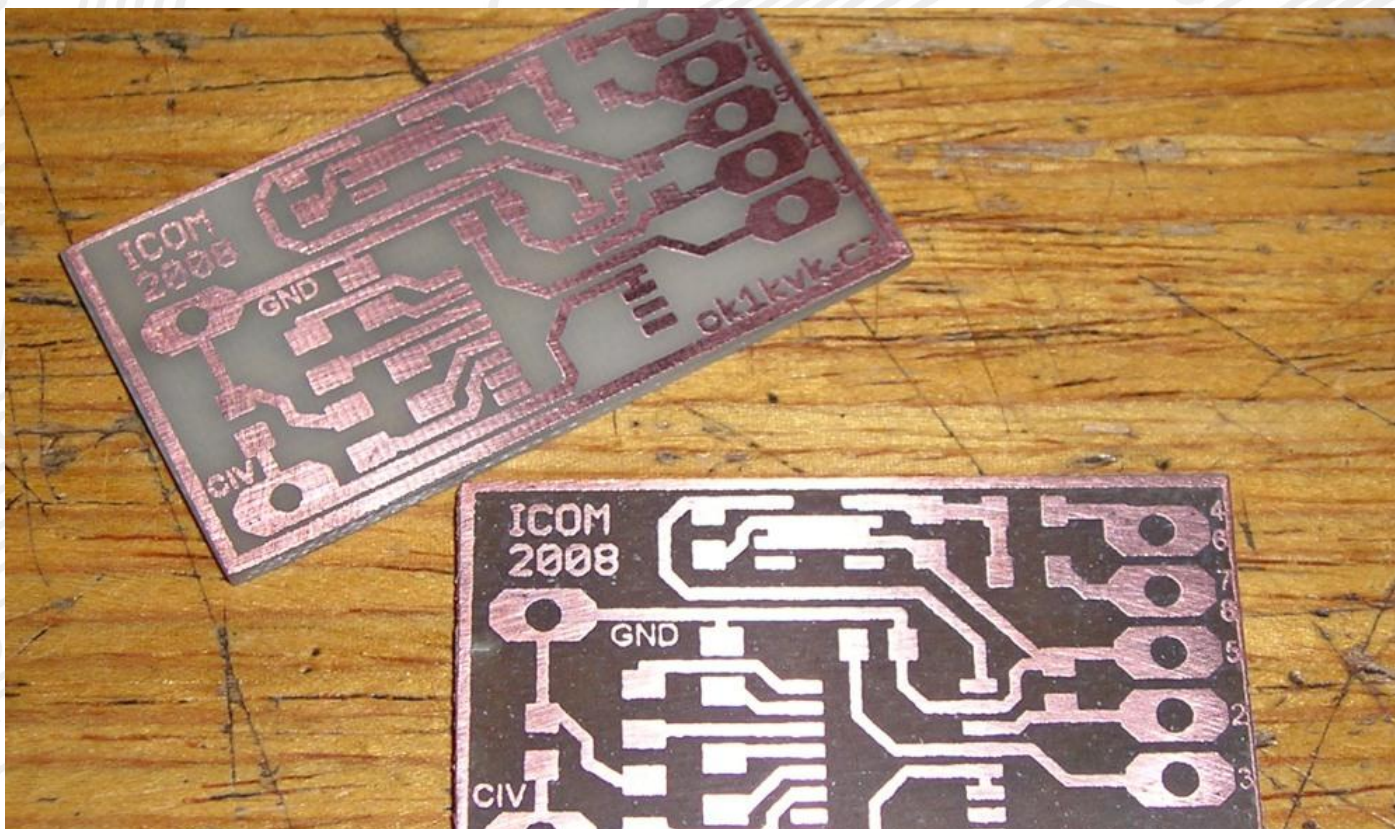
Technologie - bastlíř úroveň 3



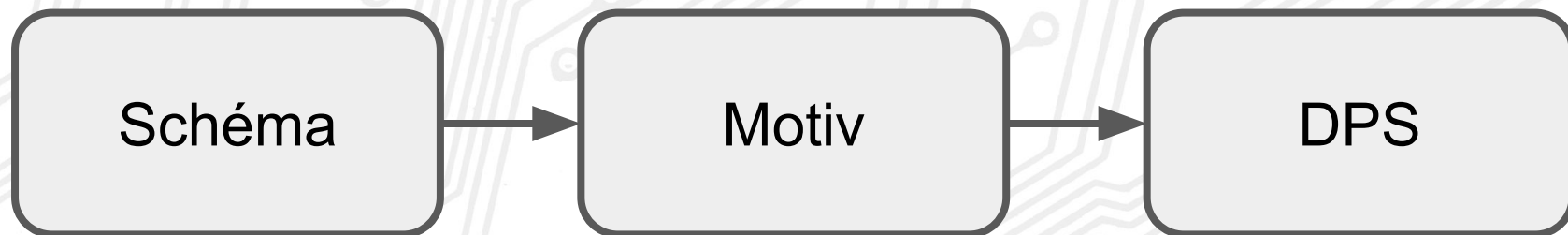
Technologie - bastlíř úroveň 3



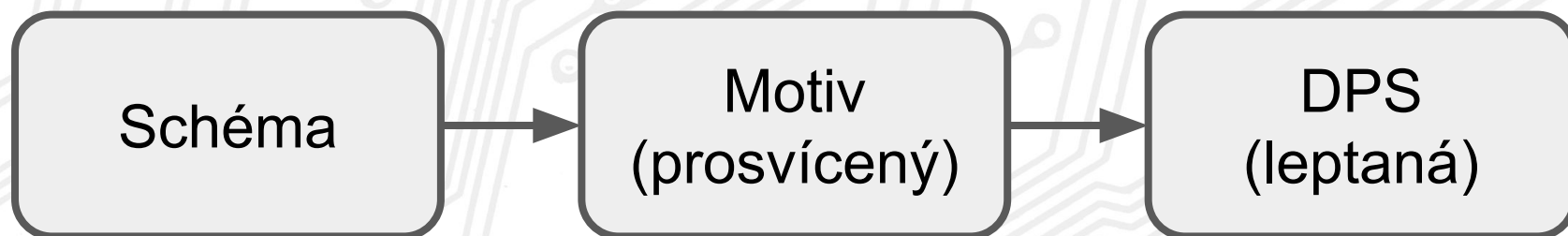
Technologie - bastlíř úroveň 3



Technologie - bastlíř úroveň 4



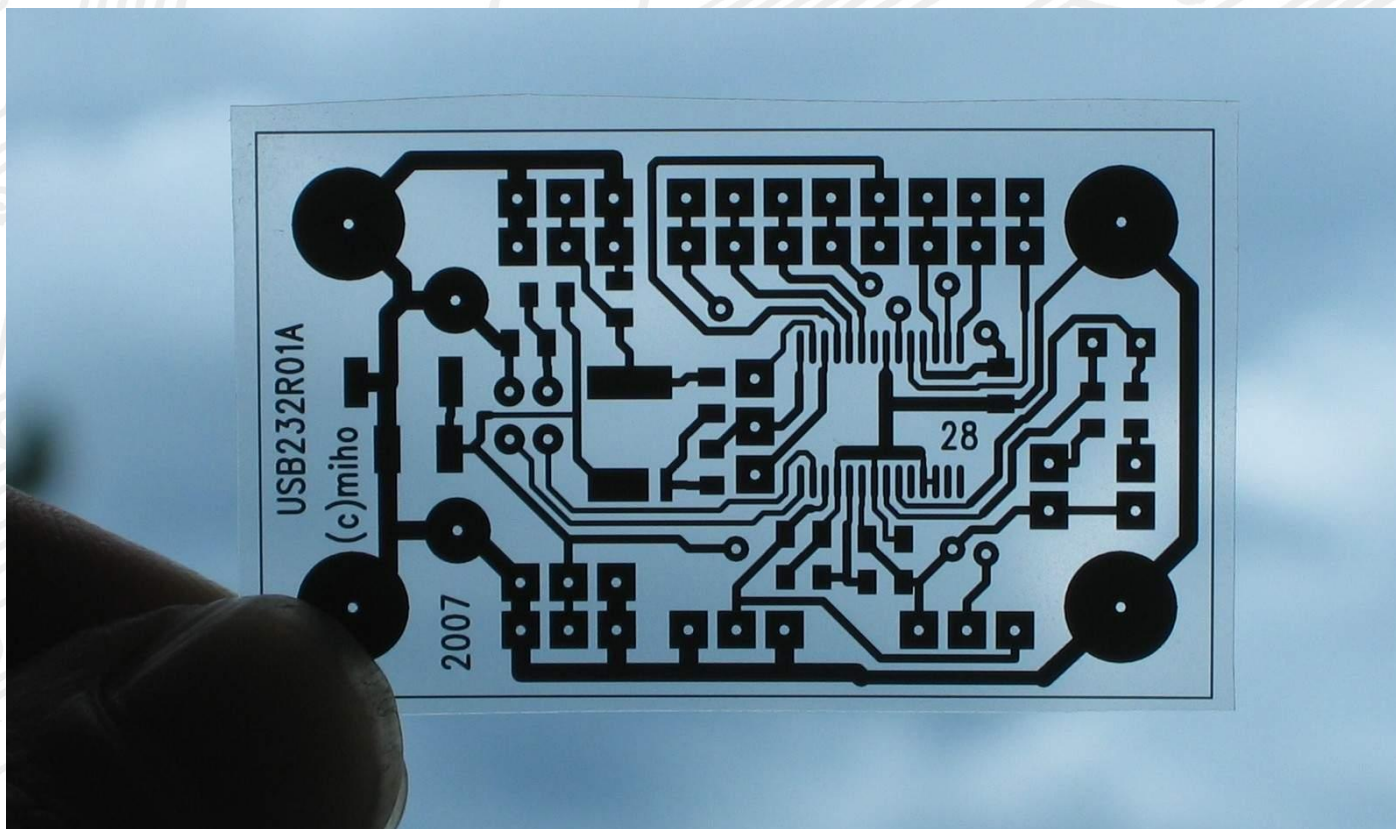
Technologie - bastlíř úroveň 4



Technologie - bastlíř úroveň 4



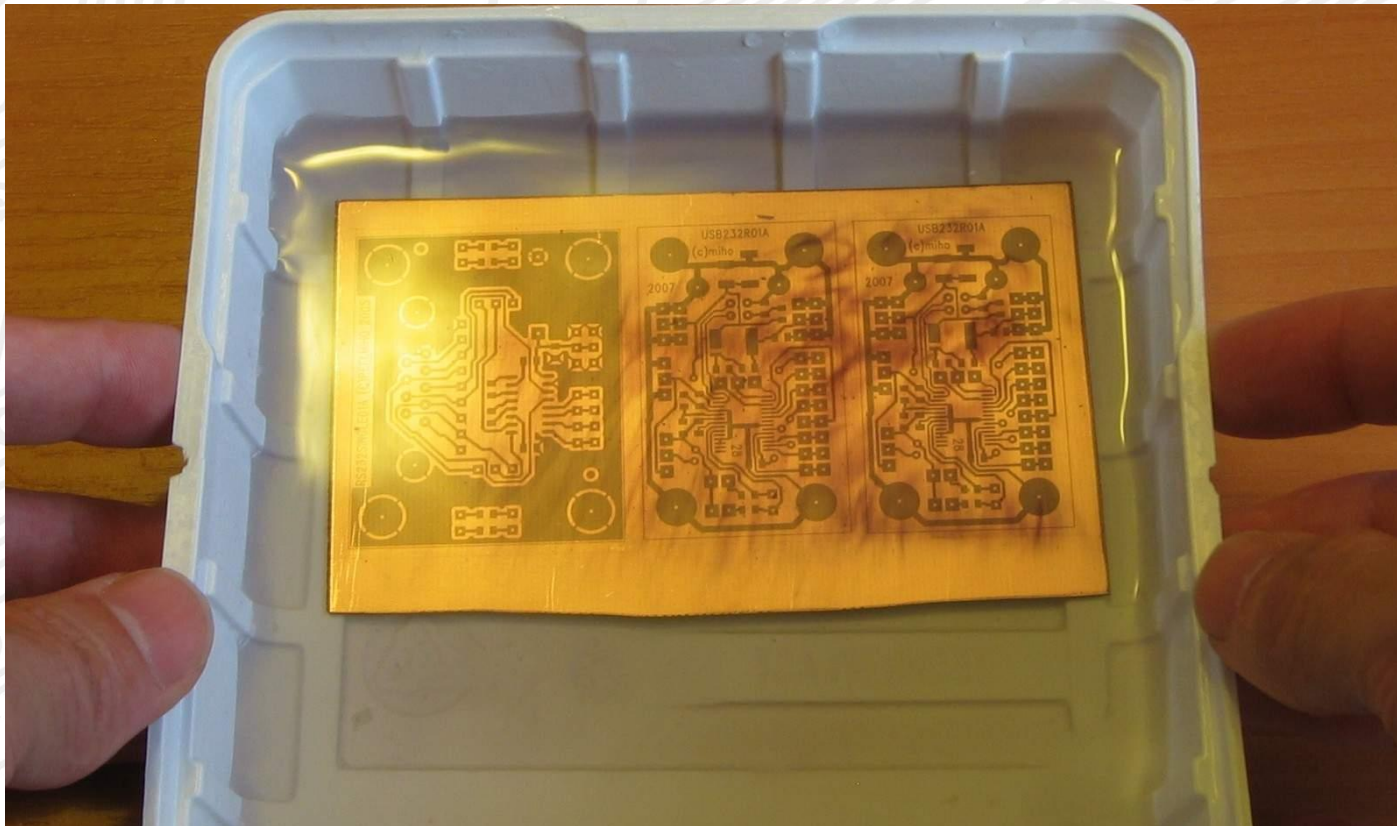
Technologie - bastlíř úroveň 4



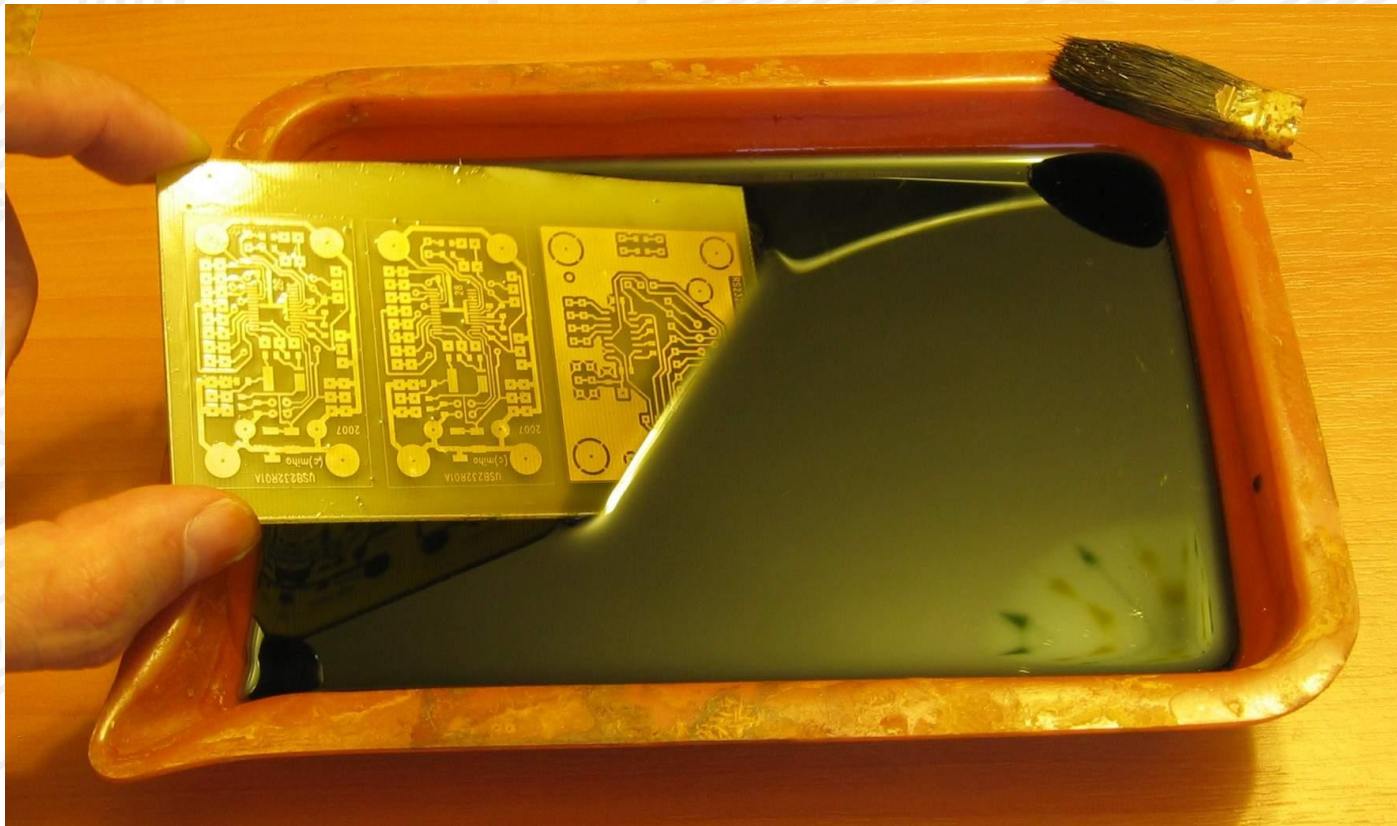
Technologie - bastlíř úroveň 4



Technologie - bastlíř úroveň 4



Technologie - bastlíř úroveň 4



Návrhové programy



EAGLE[®]
www.cadsoft.de

Altium
Designer[®]



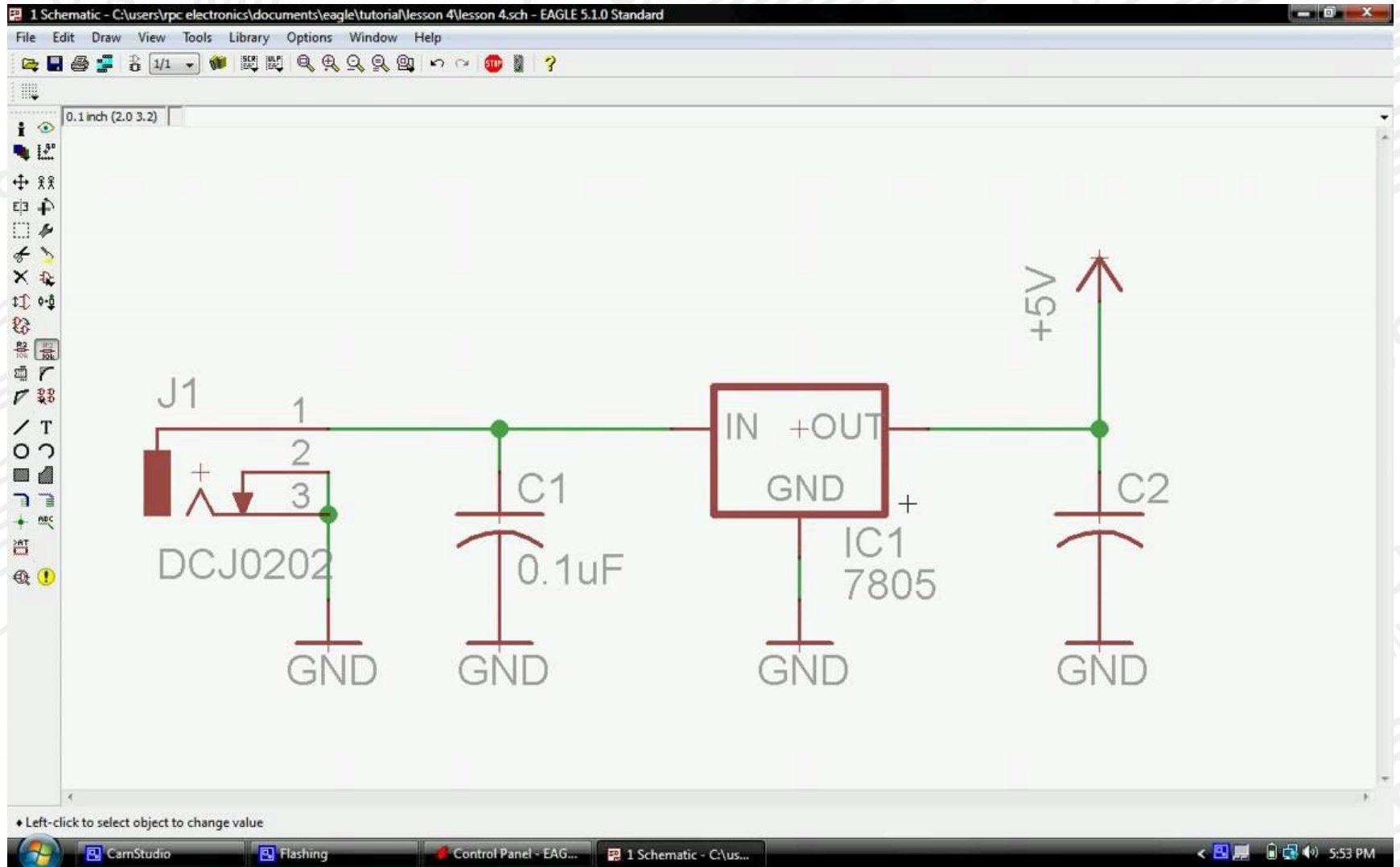
CIRCUITMAKER



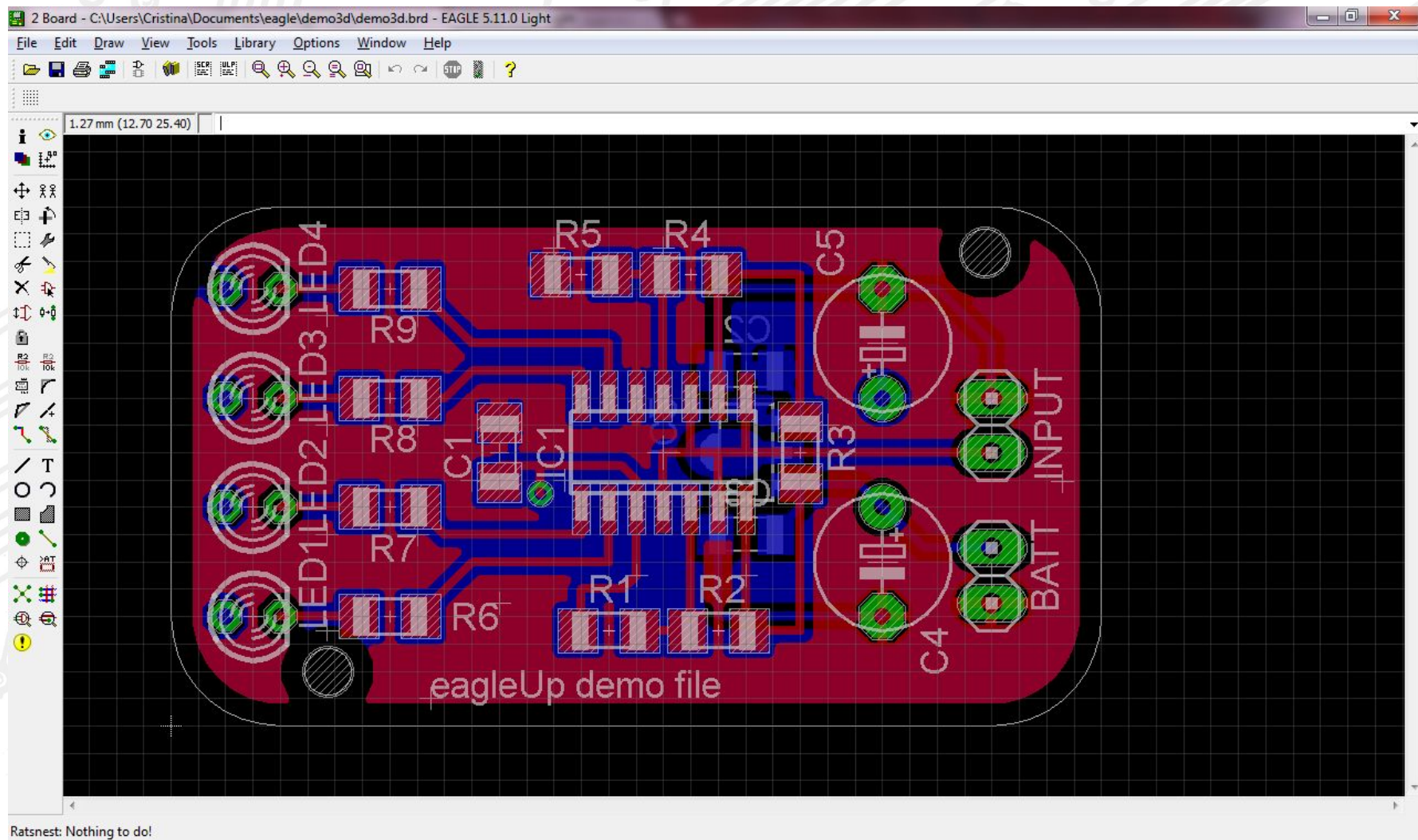
kiCad
kiCad

ver
onhill.cz

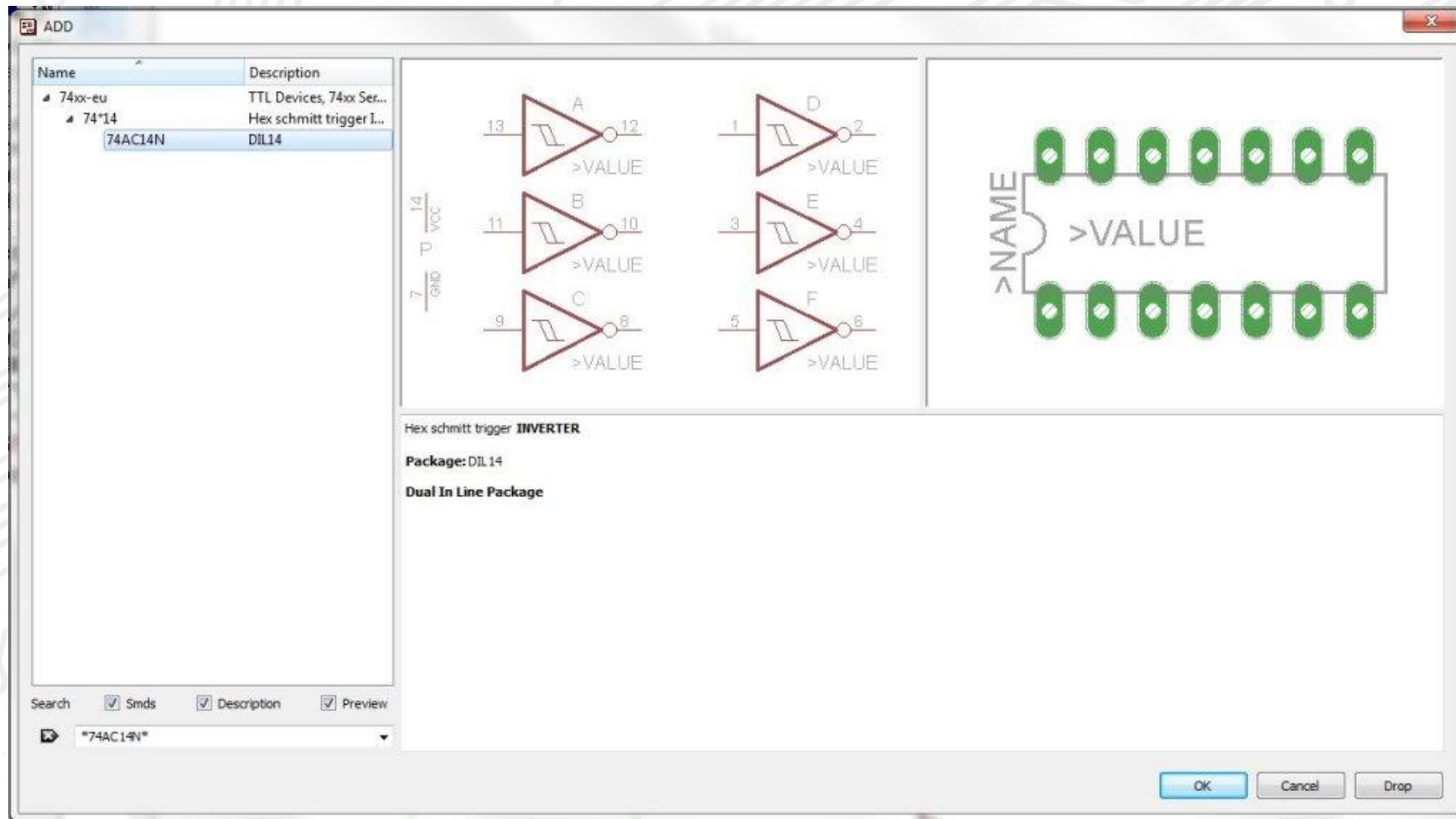
Návrhové systémy - Eagle



Návrhové systémy - Eagle

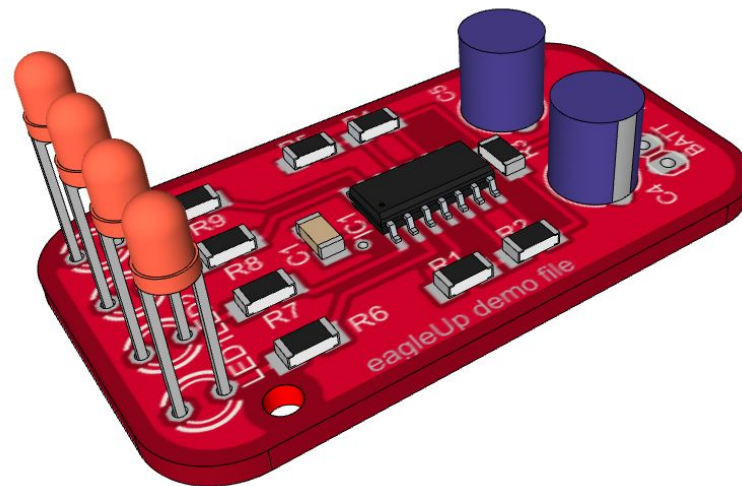


Návrhové systémy - Eagle

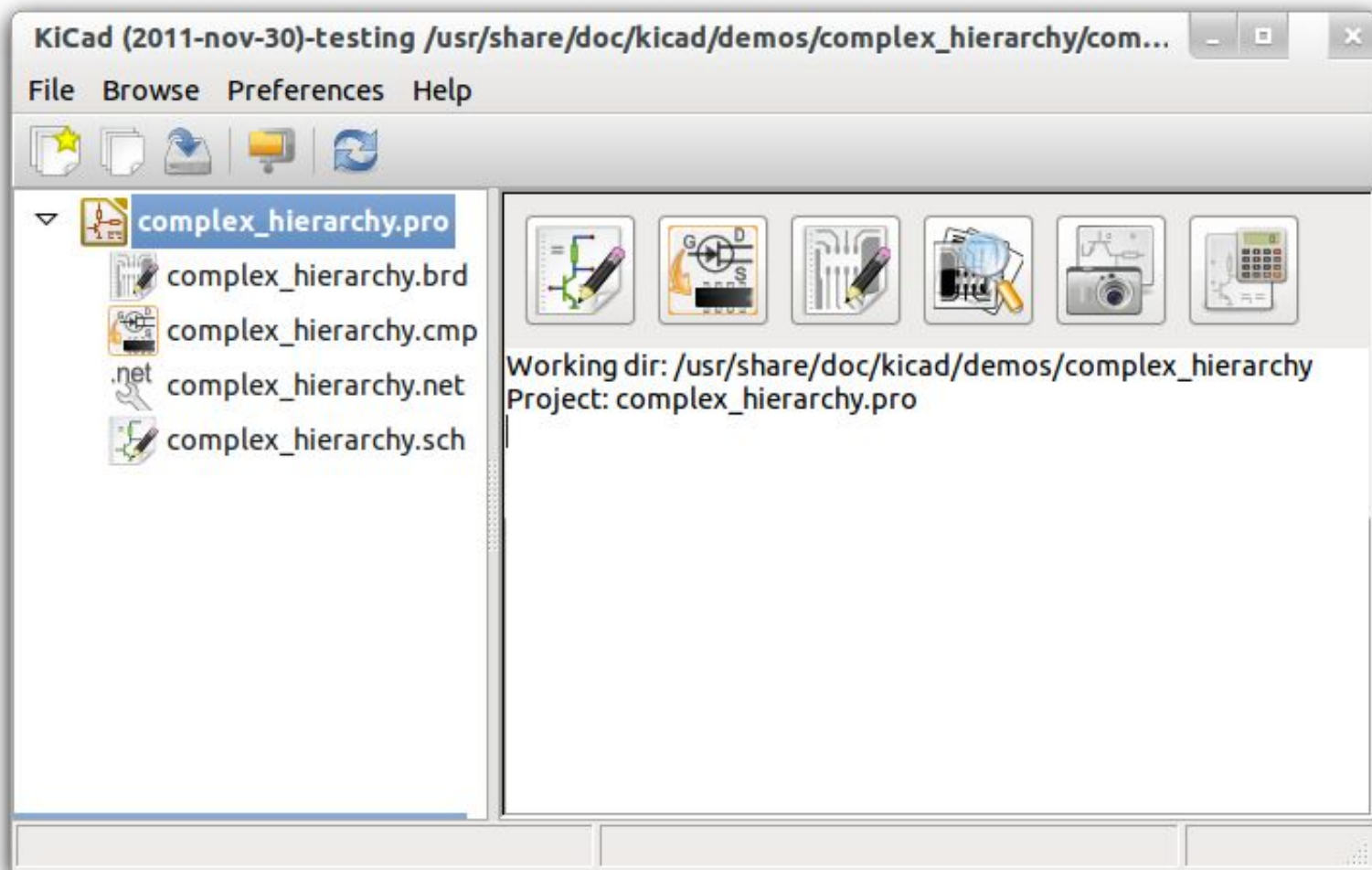


Návrhové systémy - Eagle

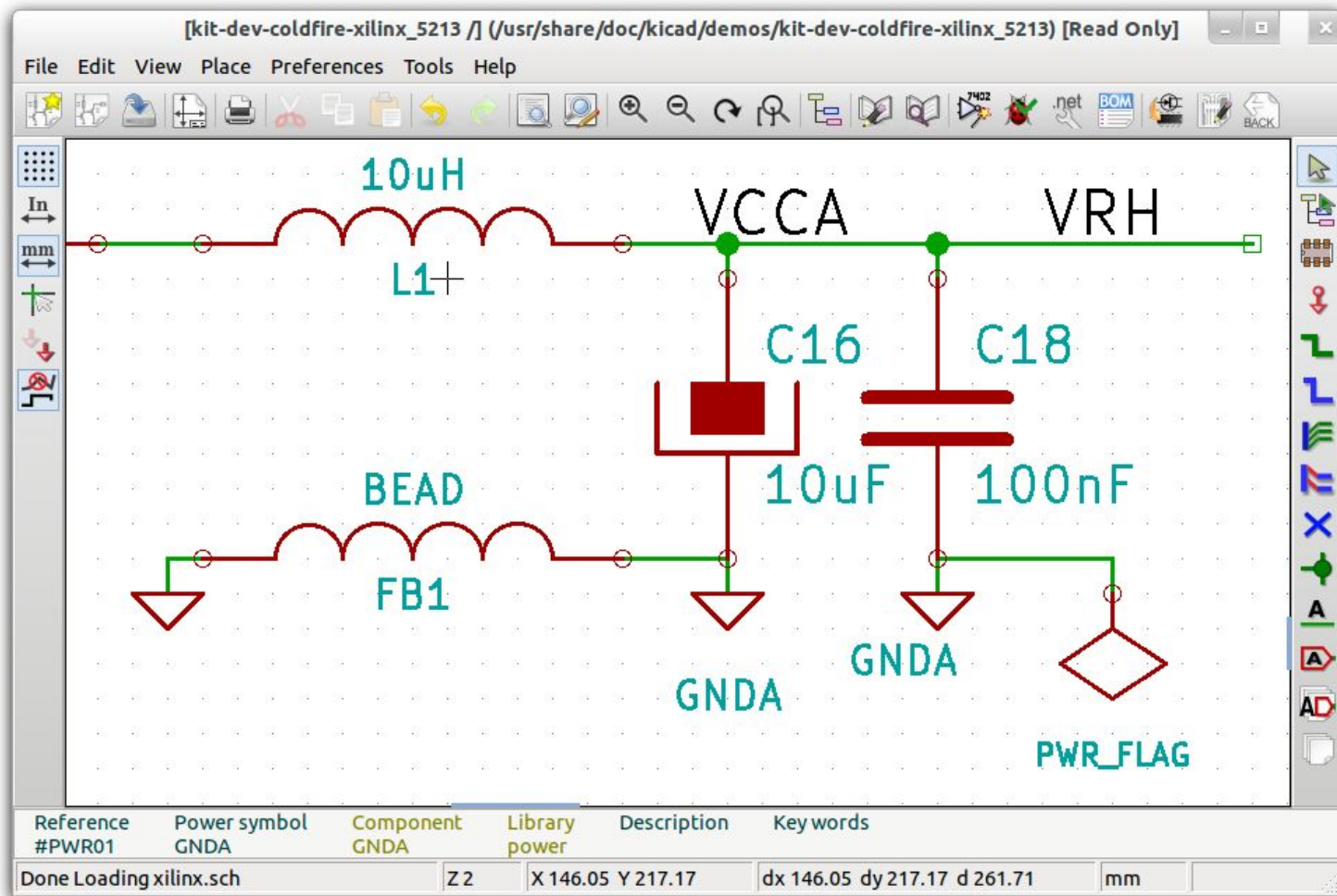
```
1 Text Editor - /Users/julian/Dro...  
string command = "WIRE (0 0) (1 0);";  
exit(command);|  
  
2:15 Ins
```



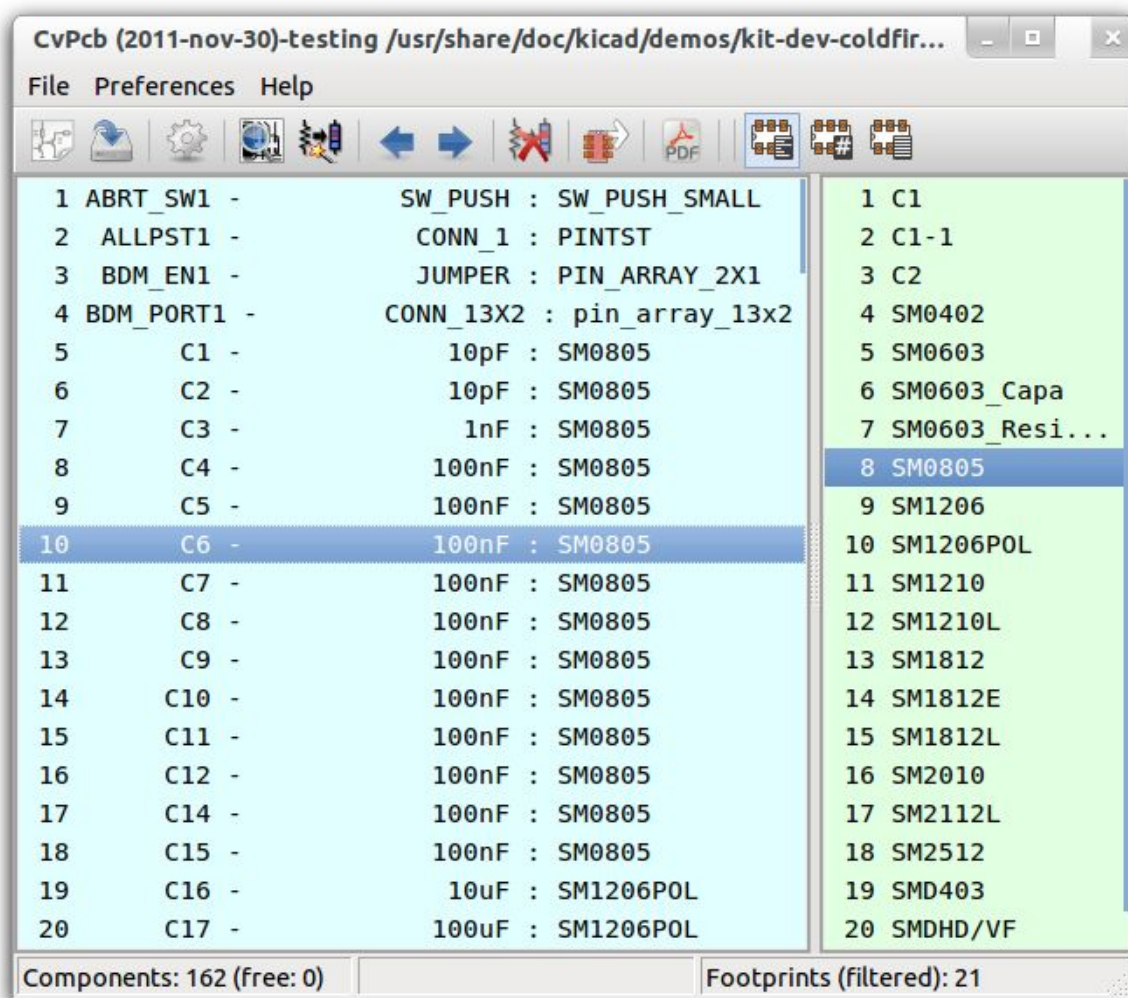
Návrhové systémy - KiCAD



Návrhové systémy - KiCAD



Návrhové systémy - KiCAD



Návrhové systémy - KiCAD

The screenshot displays the KiCAD PCB editor interface. The main window shows a detailed PCB layout with various components, traces, and pads. The interface includes a menu bar (File, Edit, View, Place, Preferences, Tools, Design Rules, Help), a toolbar with various editing tools, and a status bar at the bottom. The status bar shows the following statistics:

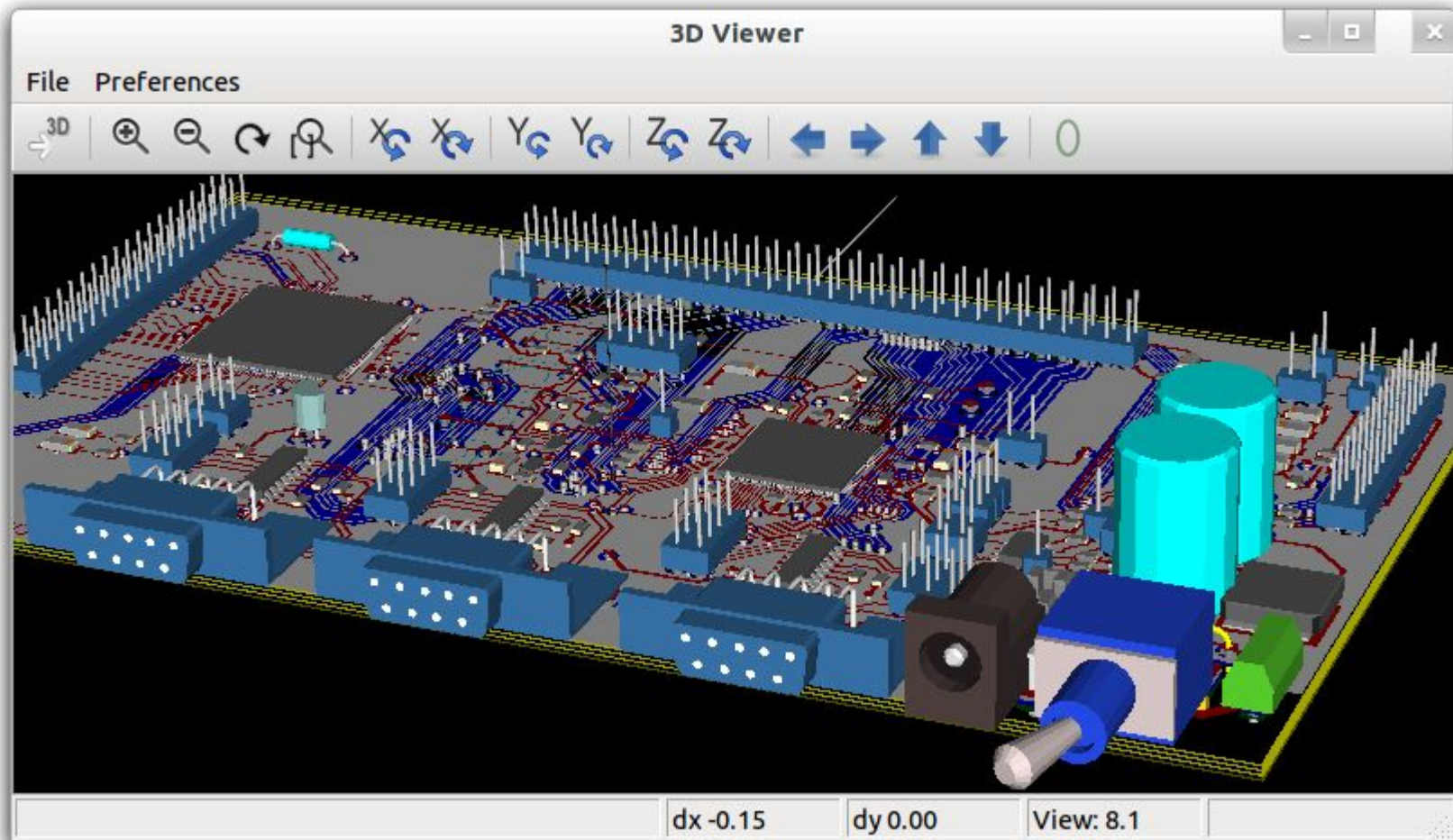
Pads	Vias	trackSegm	Nodes	Nets	Links	Connect	Unconnected
821	253	3275	743	210	534	534	0

The status bar also displays coordinates: Z 93.04C X 190.500 Y 46.990 dx 190.500 dy 46.990 d 196.210 mm.

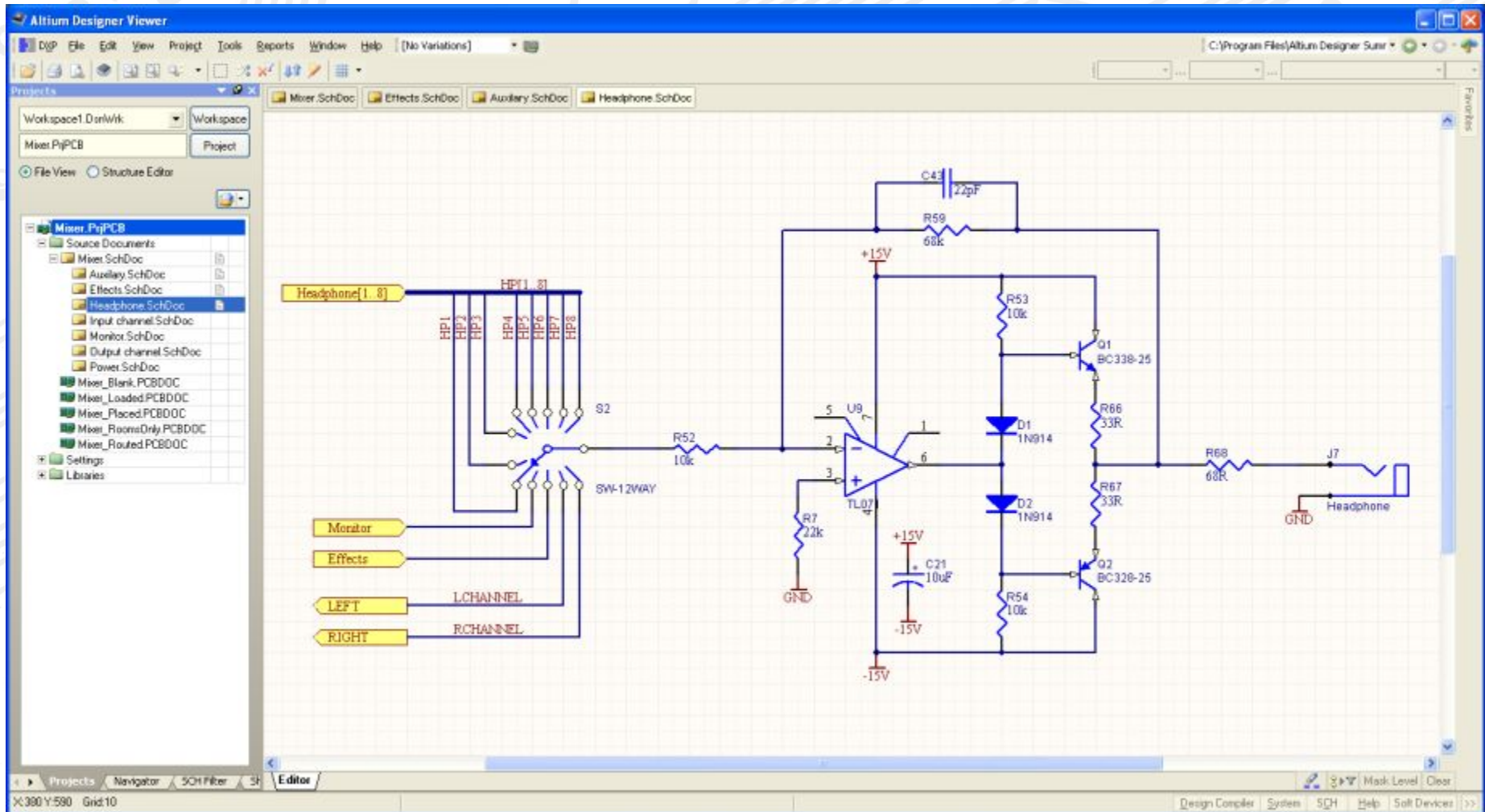
The right sidebar shows the 'Visibles' panel with a list of layers and their visibility status:

Layer	Render
Composant	<input checked="" type="checkbox"/>
GND_layer	<input checked="" type="checkbox"/>
3.3V_layer	<input checked="" type="checkbox"/>
Cuivre	<input checked="" type="checkbox"/>
Adhes_Front	<input checked="" type="checkbox"/>
Adhes_Back	<input checked="" type="checkbox"/>
SoldP_Front	<input checked="" type="checkbox"/>
SoldP_Back	<input checked="" type="checkbox"/>
Silks_Front	<input checked="" type="checkbox"/>
Silks_Back	<input checked="" type="checkbox"/>
Mask_Front	<input checked="" type="checkbox"/>
Mask_Back	<input checked="" type="checkbox"/>
Drawings	<input checked="" type="checkbox"/>
Comments	<input checked="" type="checkbox"/>
Eco1	<input checked="" type="checkbox"/>
Eco2	<input checked="" type="checkbox"/>
PCB_Edges	<input checked="" type="checkbox"/>

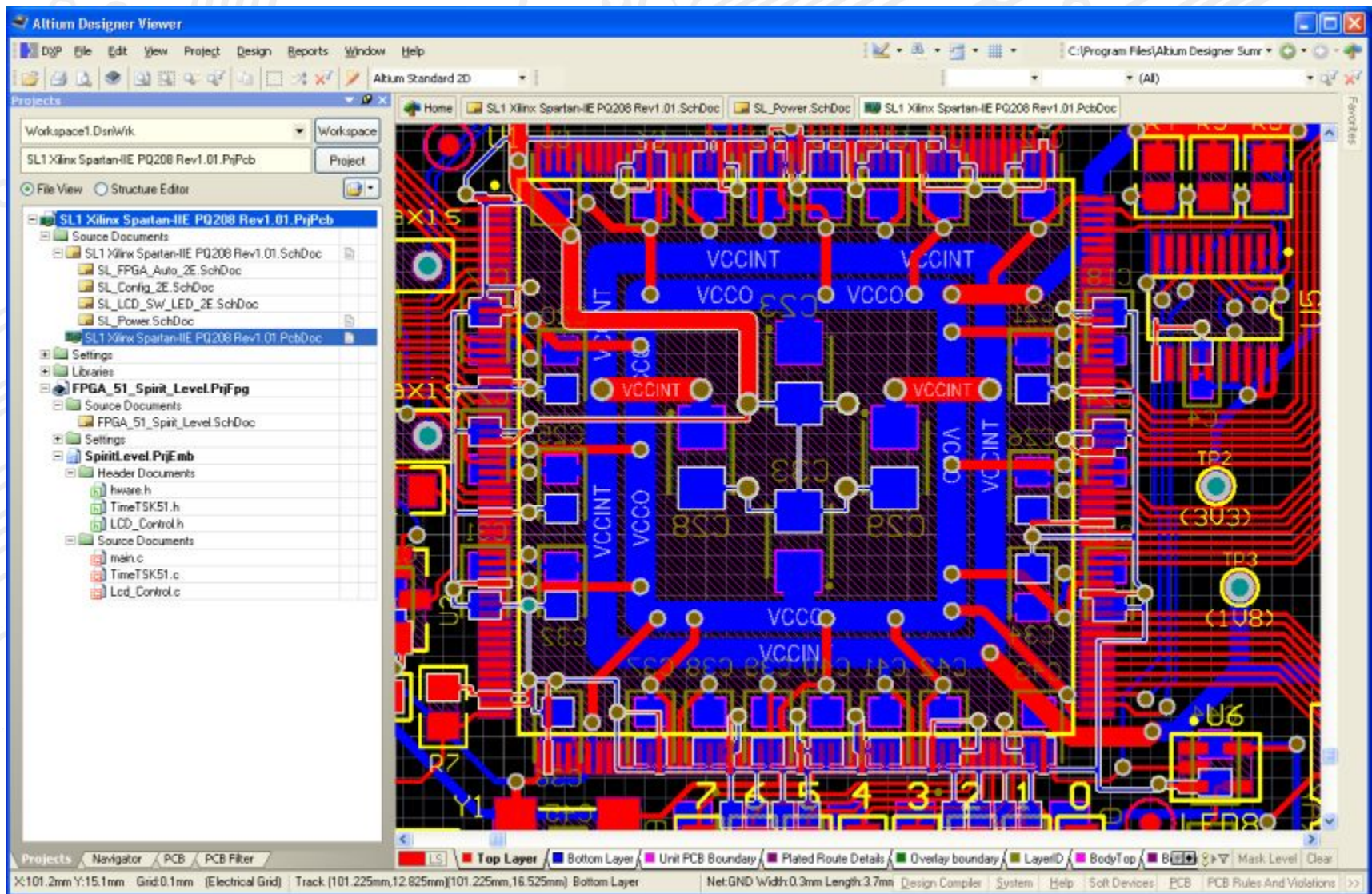
Návrhové systémy - KiCAD



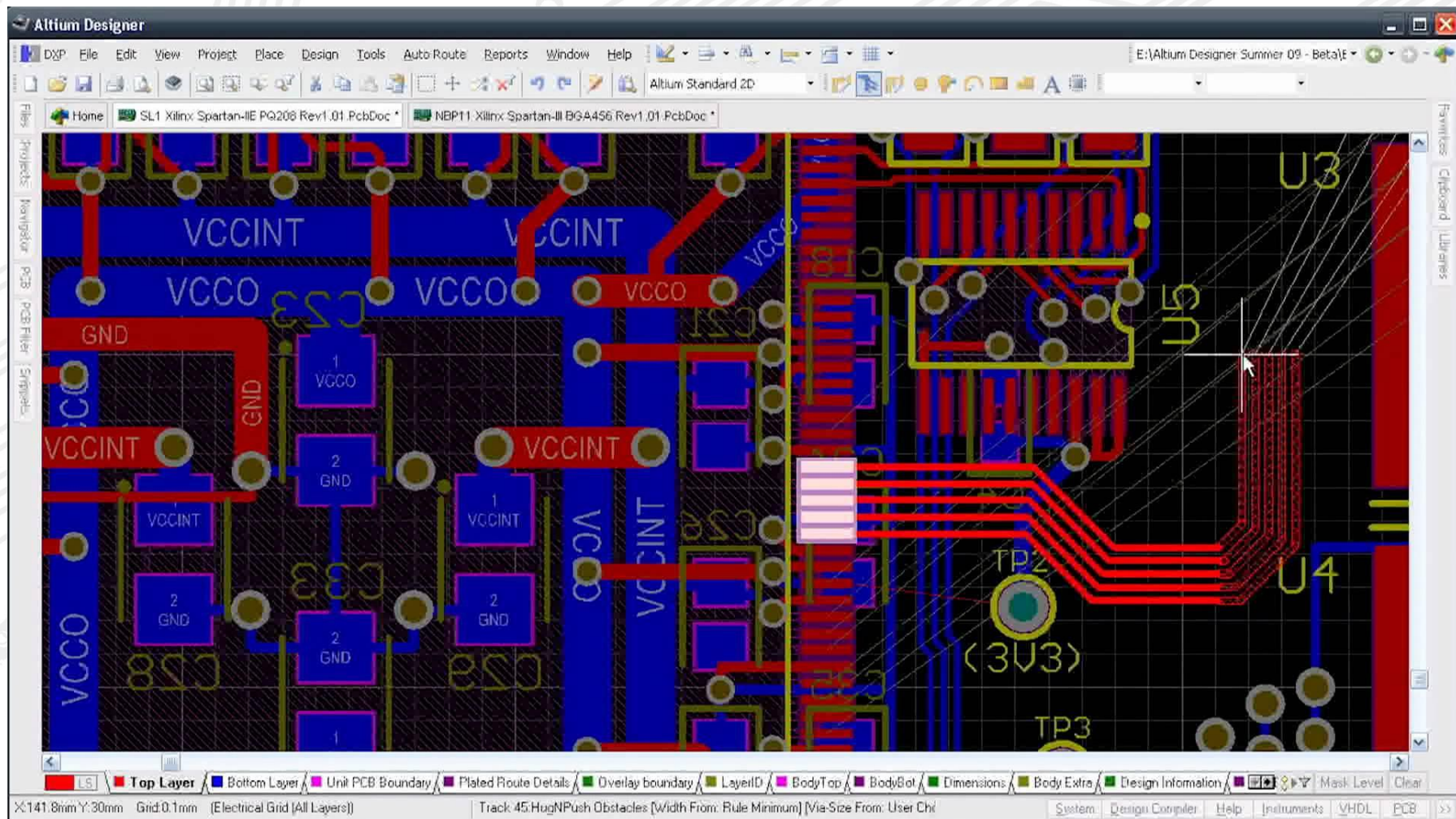
Návrhové systémy - Altium



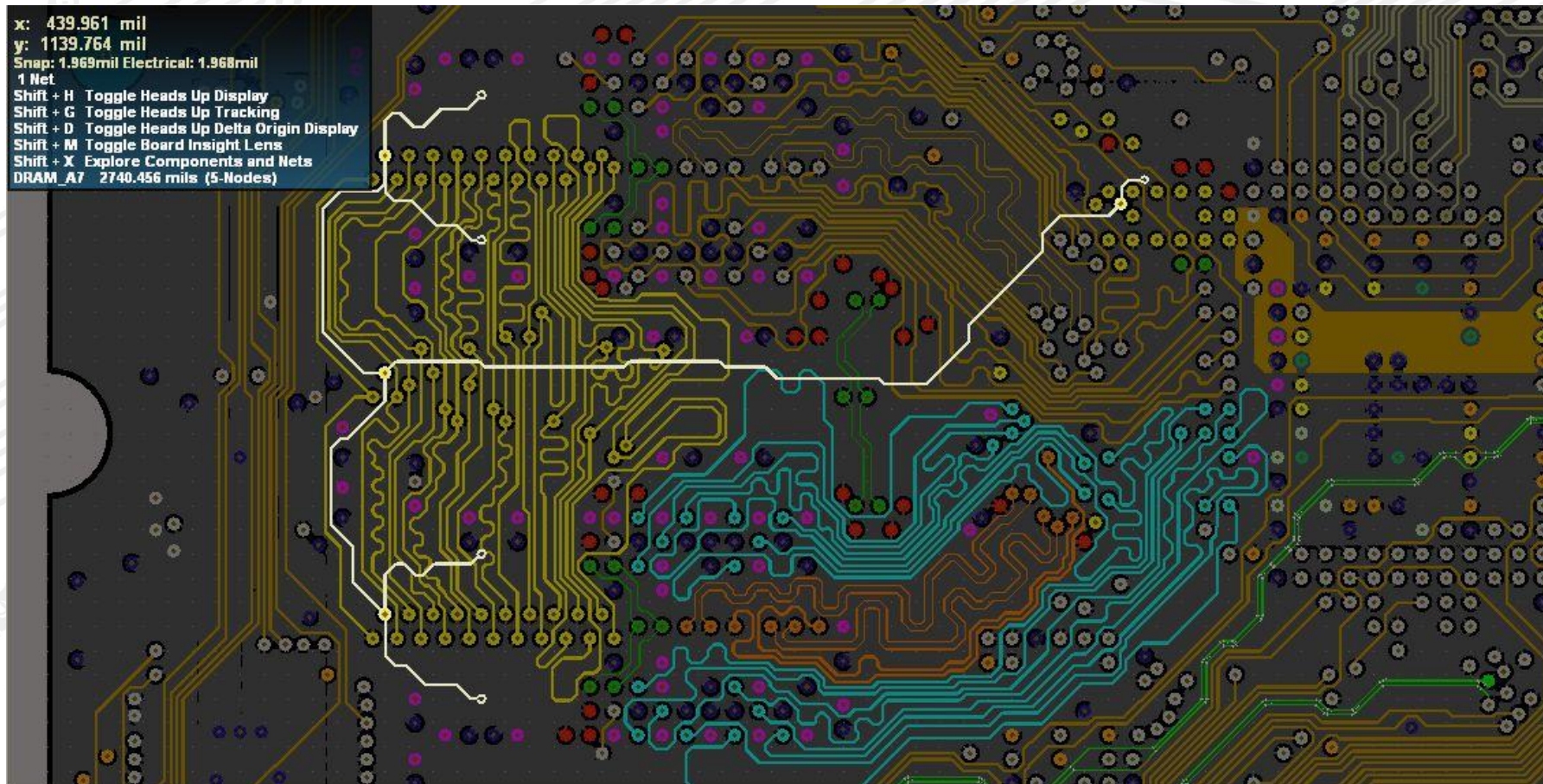
Návrhové systémy - Altium



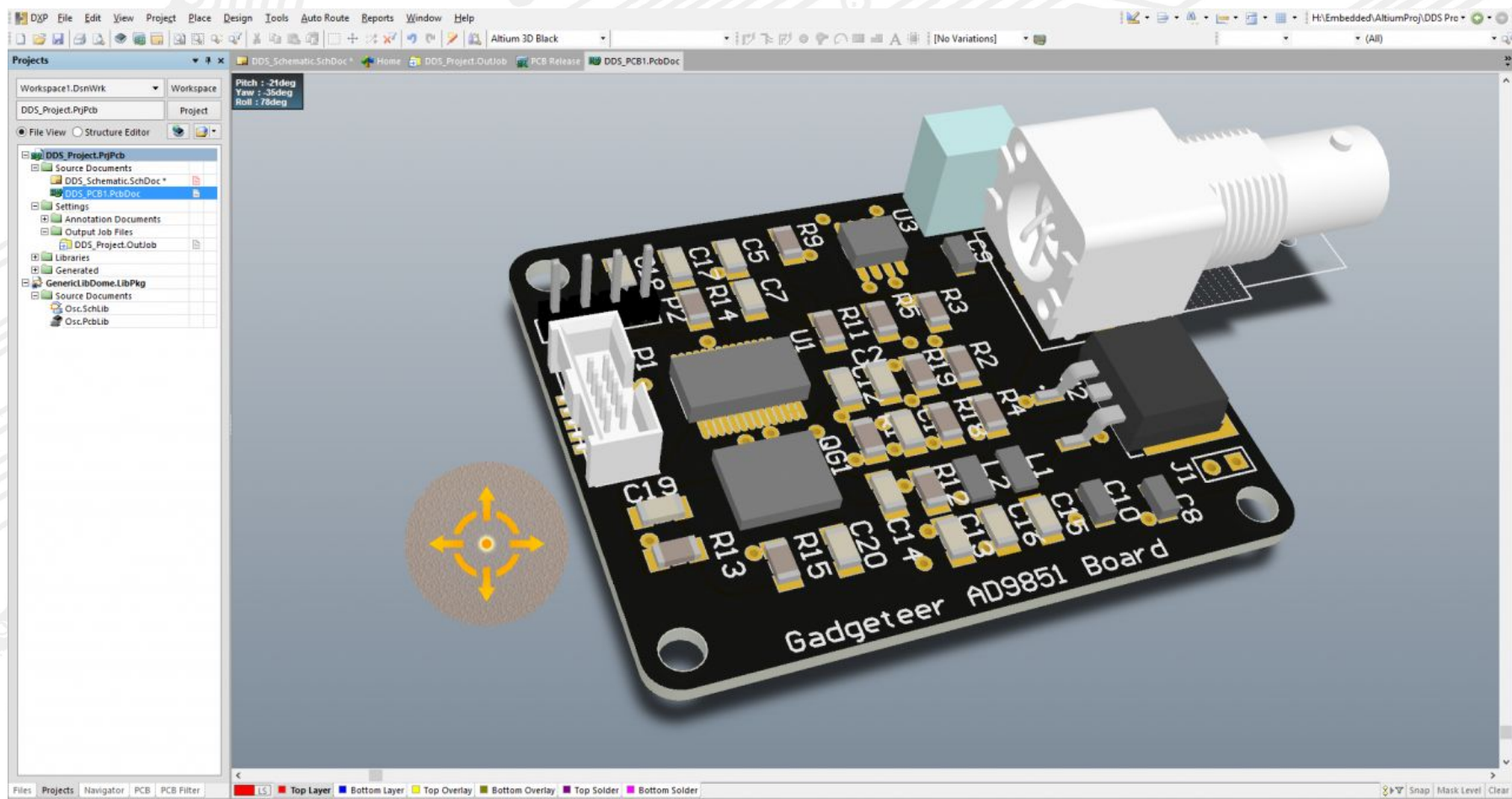
Návrhové systémy - Altium



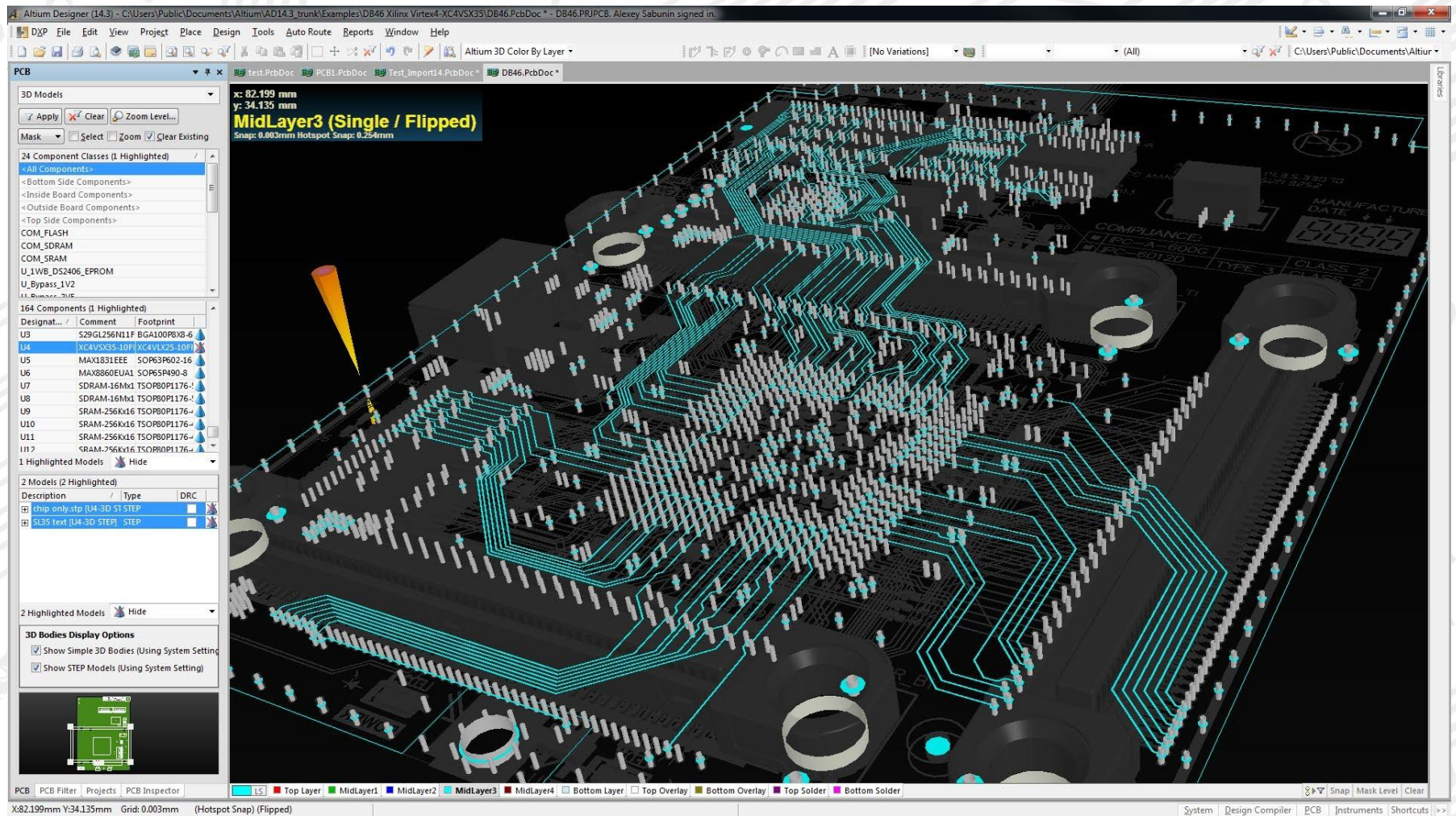
Návrhové systémy - Altium



Návrhové systémy - Altium



Návrhové systémy - Altium



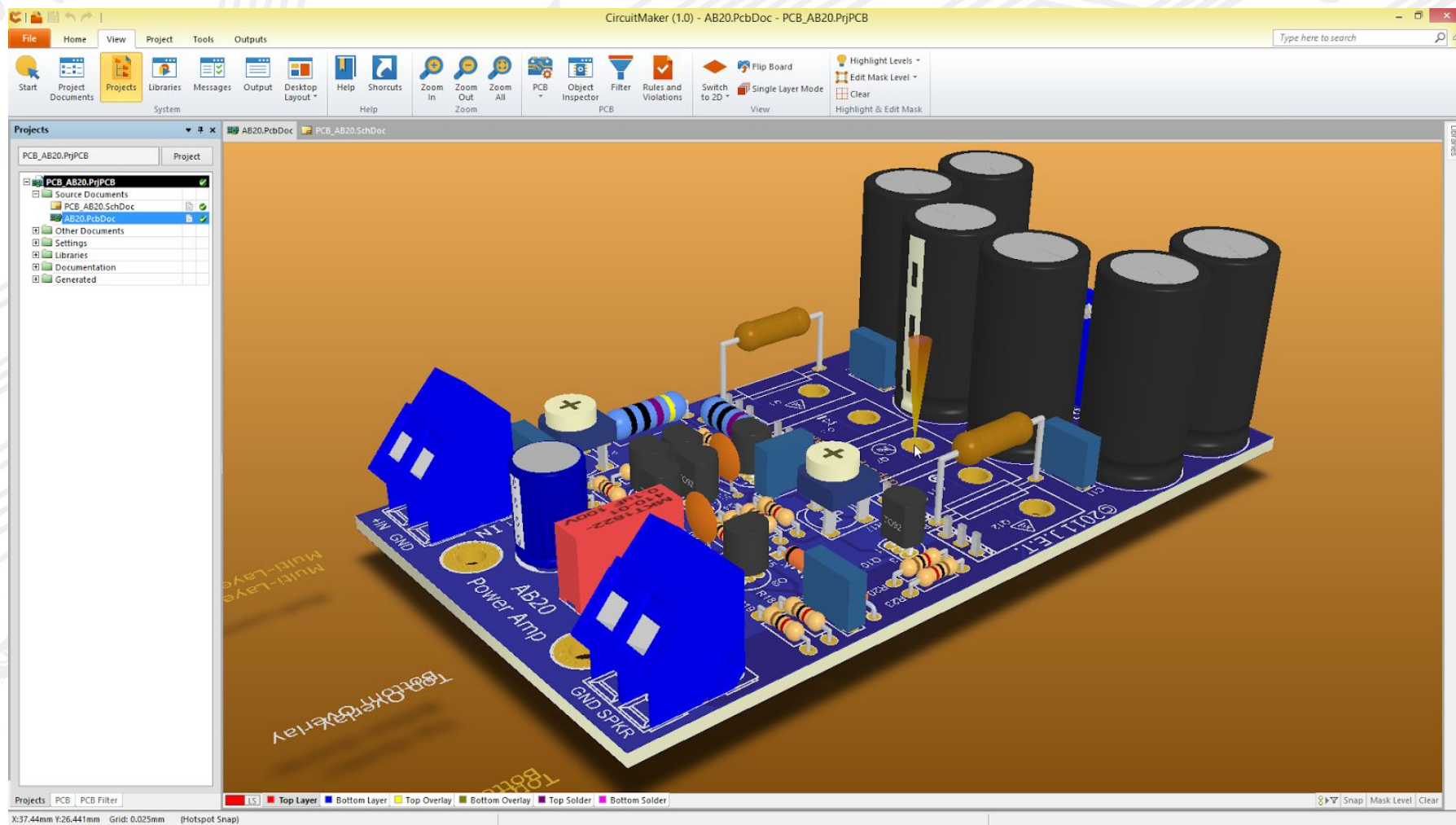
Návrhové systémy - Circuit Maker

Can you tell me where to find the material safety datasheet?

Design would run if you added an capacitor here.

Distributor	SKU	Stock	MOQ	Pkg
Newark	98K9423	2,269	1	USC
Digi-Key	PCE3852CT-ND	27,525	1	Tape USC
Amet Express	EEE-0JA101SP	13,000	1,000	USC
Onlinecomponents.com	EEE0JA101SP	26,580	1	USC
Arrow	EEE-0JA101SP	16,000	1,000	USC

Návrhové systémy - Circuit Maker



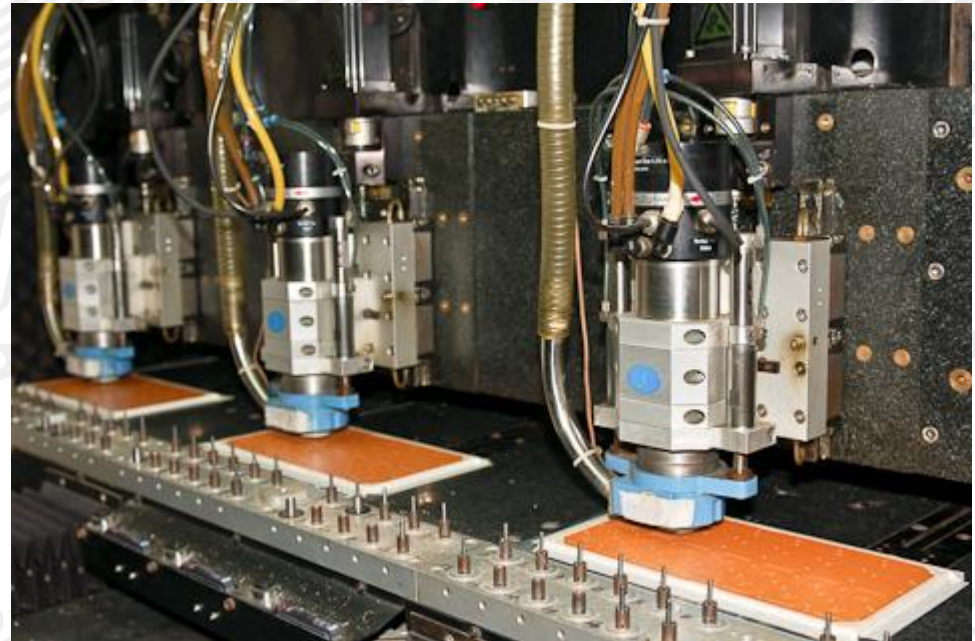
Výroba DPS profesionálně

Místní

- Pragoboard
- Gatema
- Printed
- Jablo PCB

Čína

- Seedstudio



Technologie - profesionál

Vrtání

Základní plátování - měď

Nosný materiál



Prokovení otvorů

Galvanická měď 1

Palladium

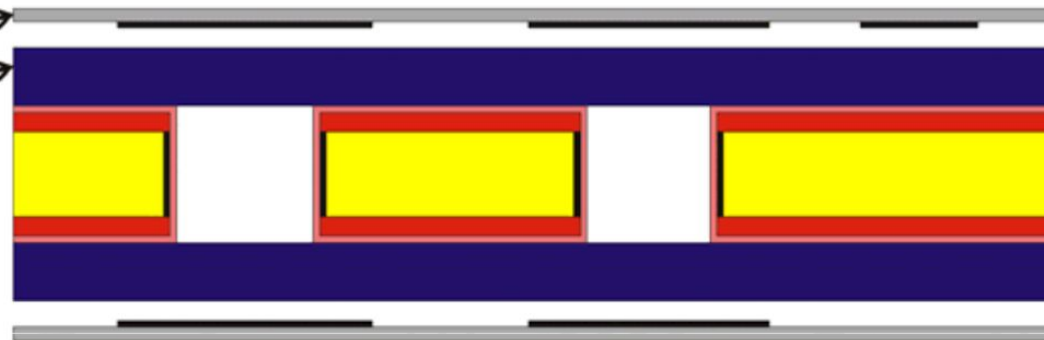


Technologie - profesionál

Laminace fotorezistu a osvit

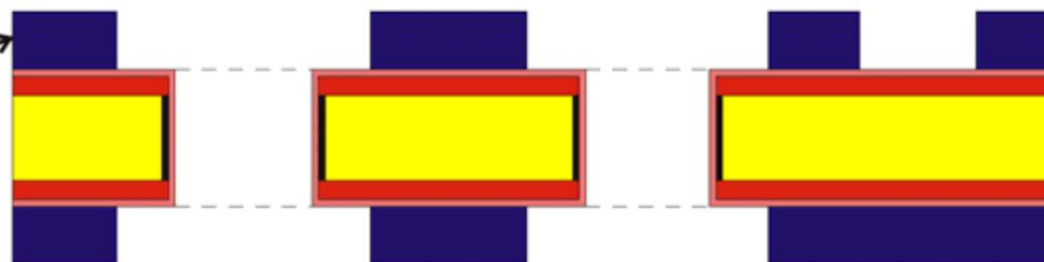
Film s motivem spojů

Fotorezist



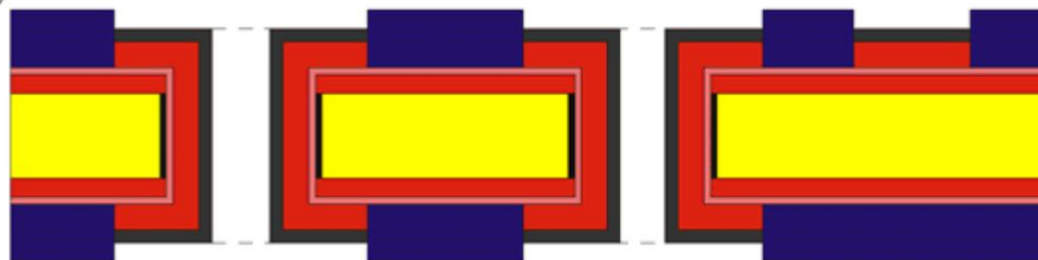
Vyvolání negativního motivu

Fotorezist - negativní motiv



Technologie - profesionál

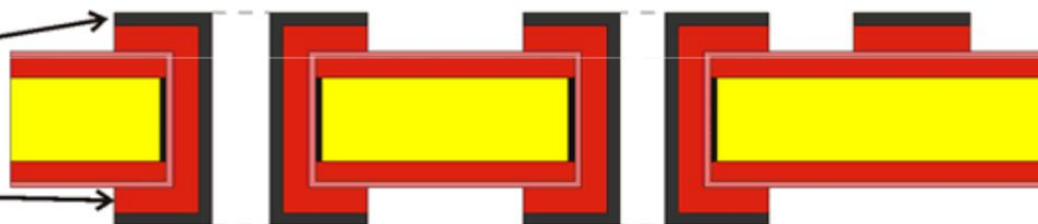
Galvanické zesílení mědi a leptuvzdorný rezist



Odstranění negativního fotorezistu

Galvanický rezist - cín

Galvanické zesílení - měď 2

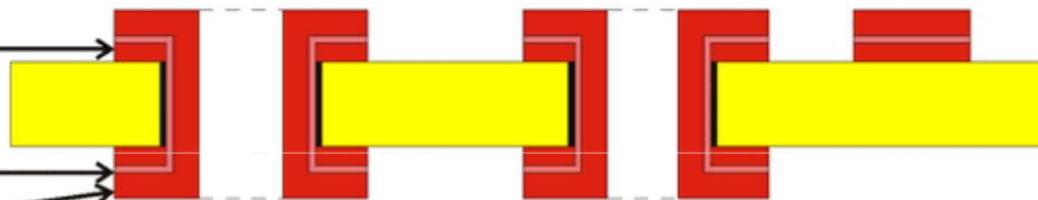


Leptání a odstranění Sn rezistu

Základní plátování - měď

Galvanická měď 1

Galvanické zesílení - měď 2

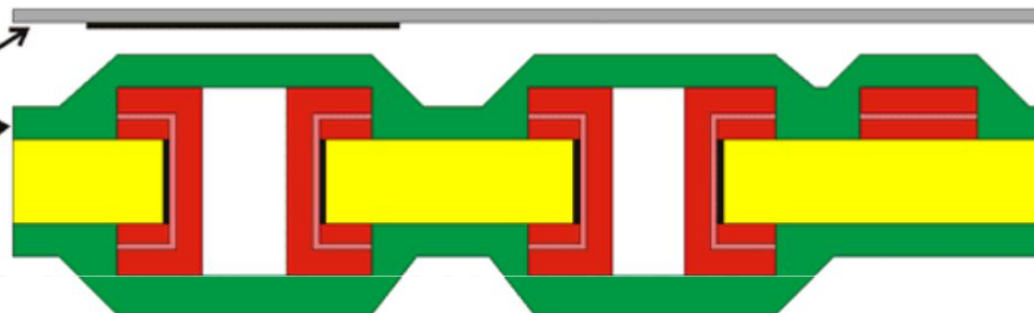


Technologie - profesionál

) Fotocitlivivá nepájivá maska a osvit

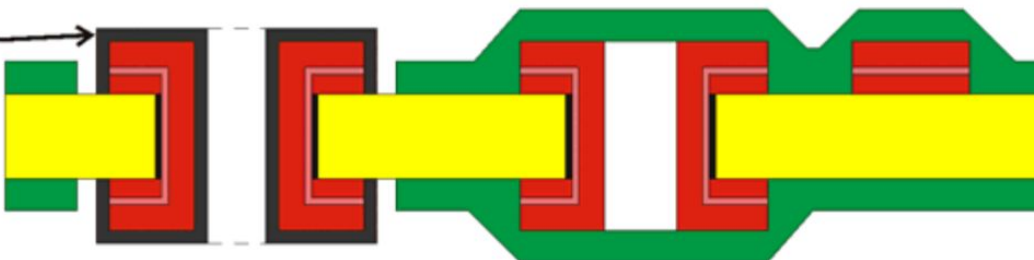
Film s motivem nepájivé masky

Nepájivá maska

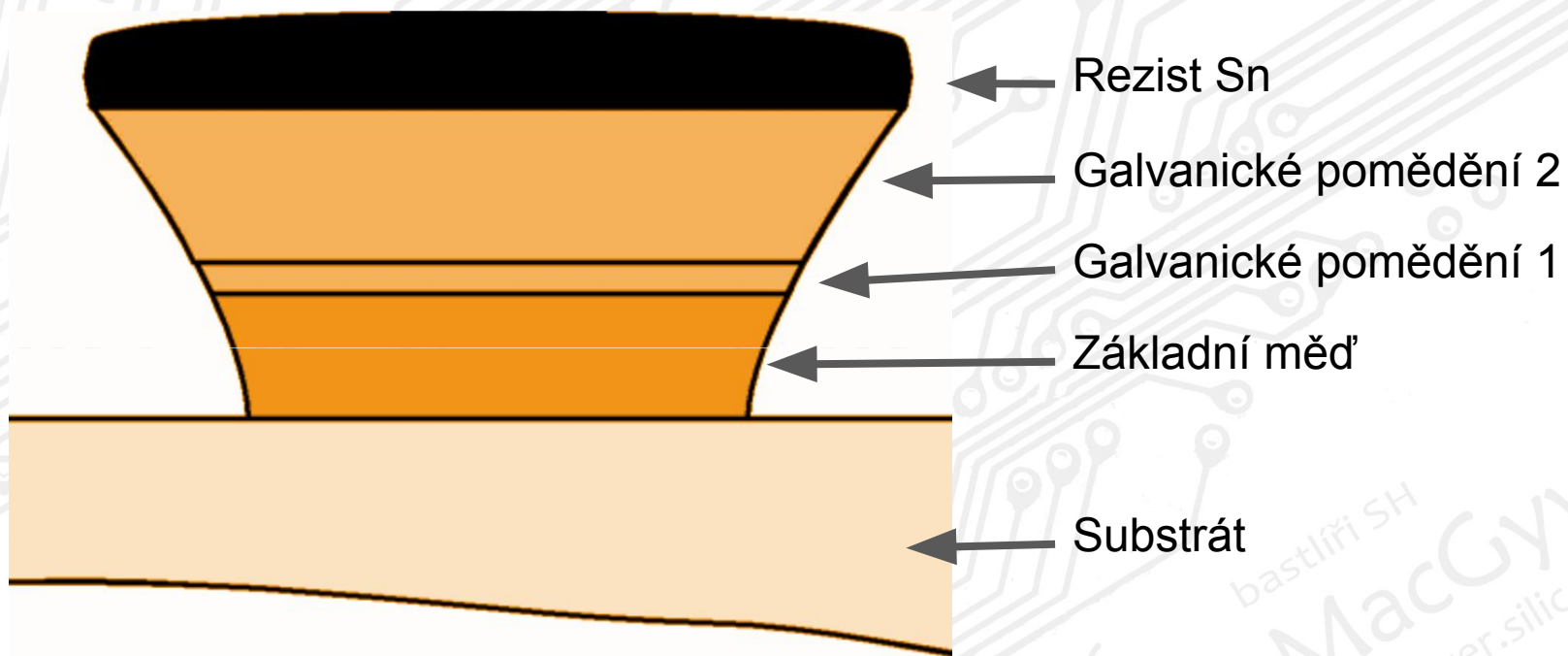


Žárové nanesení pájky (HAL)

Pájka (HAL)



Technologie - profil vodiče

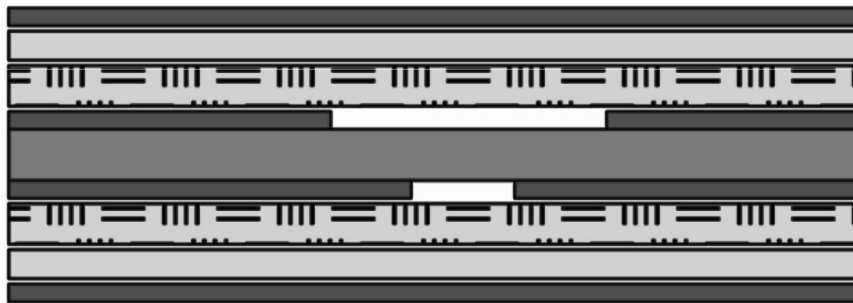


Technologie - 4 vrstvy

Oboustranně vyleptané jádro



Vrstvení fólií nevytvrzených laminátů a mědí



Měď

Jádro

Měď

Měď

Prepreg

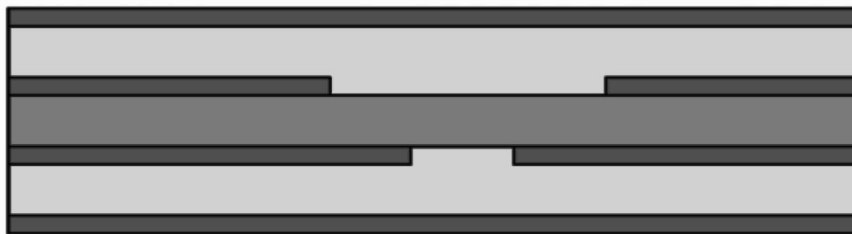
Leptané jádro

Prepreg

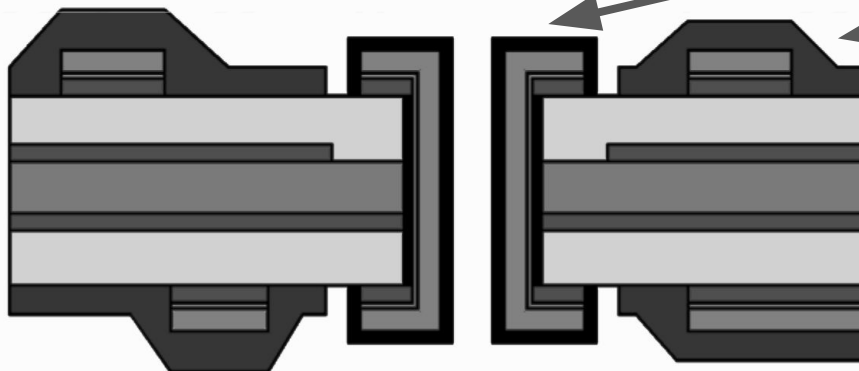
Měď

Technologie - 4 vrstvy

Laminace



Finální výrobek



Rezist Sn

Maska

Měď 1,2,3

Zdroje

- Wikipedia
 - https://en.wikipedia.org/wiki/Printed_circuit_board
- Skriptum
 - Principy a pravidla elektronického návrhu - Vít Záhlava
- Web
 - Altium.com
 - CircuitMaker.com
 - Cadsoftusa.com

Děkuji za pozornost

bastlíři SH
MacGyver
macgyver.siliconhill.cz

