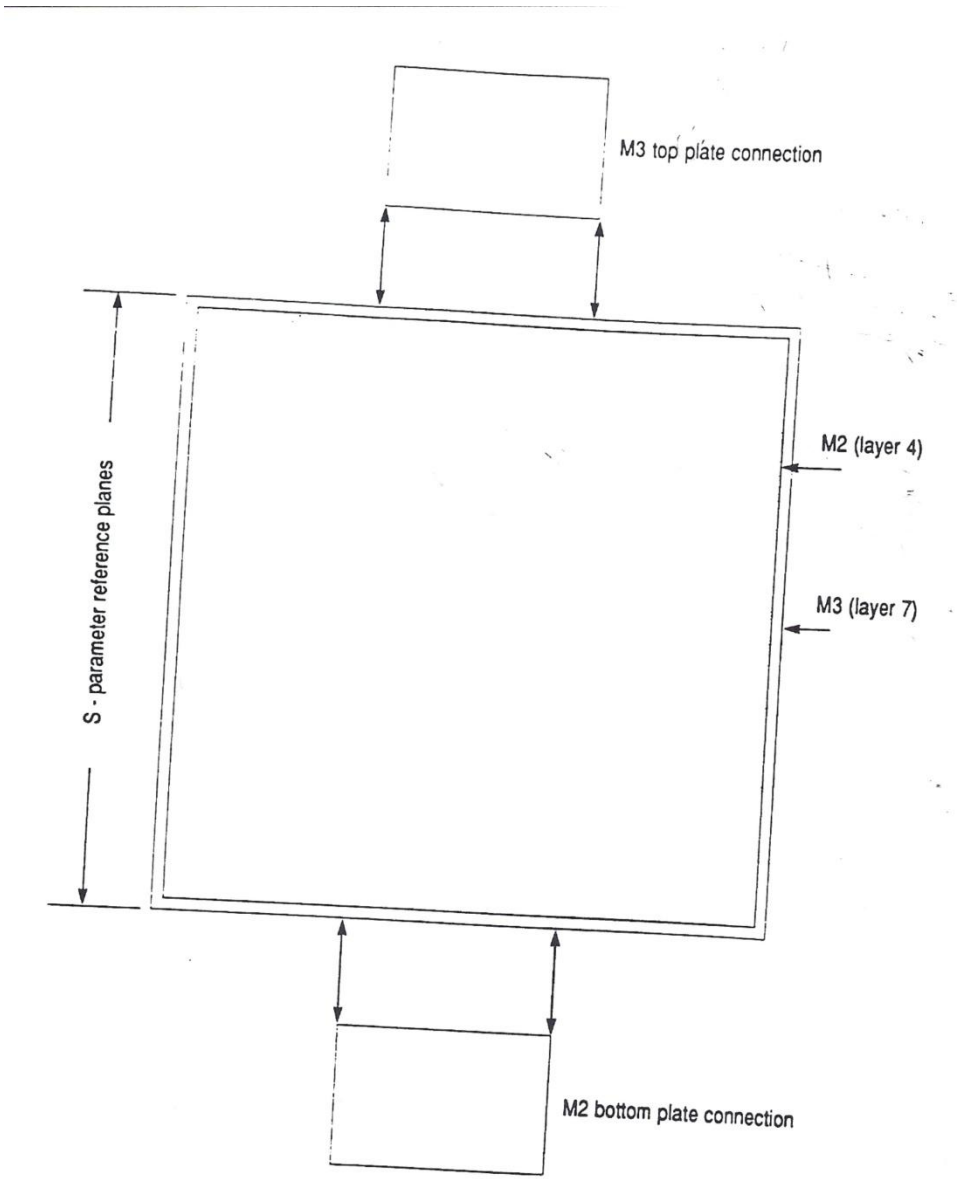
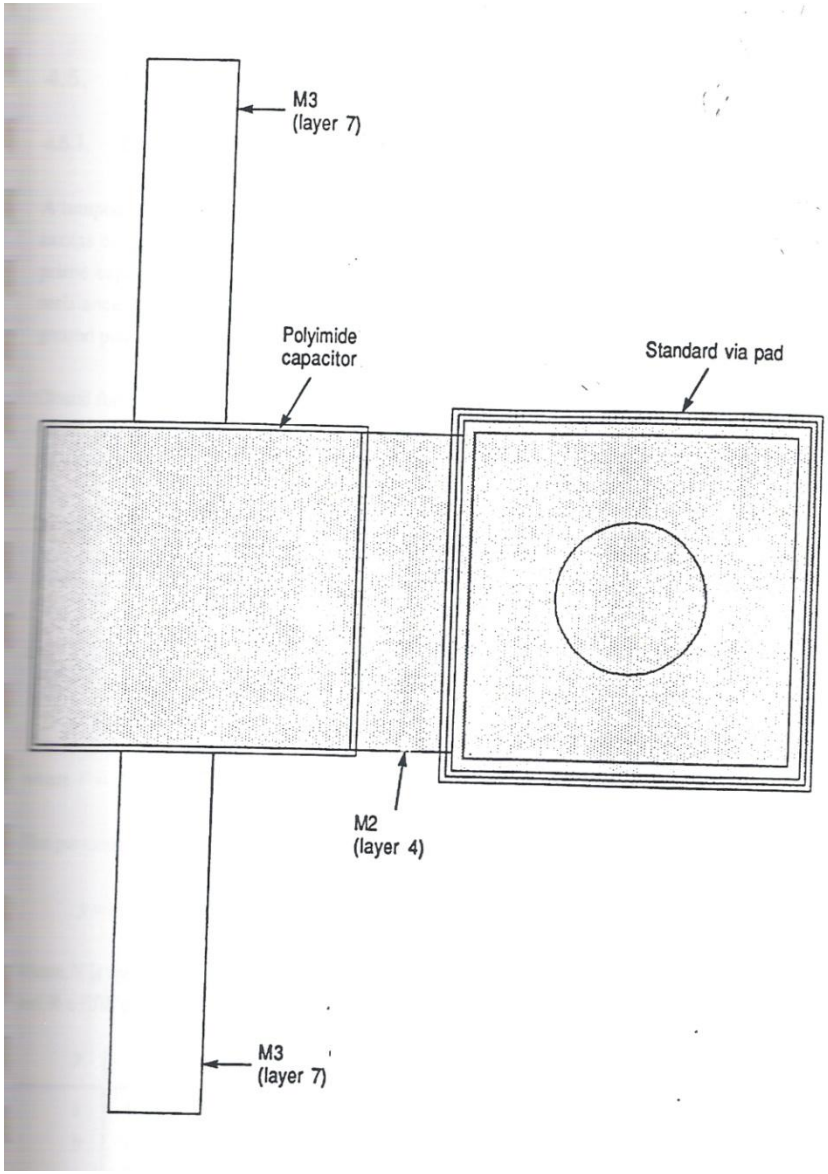
CONDENSATOARE MMIC

MMIC 4

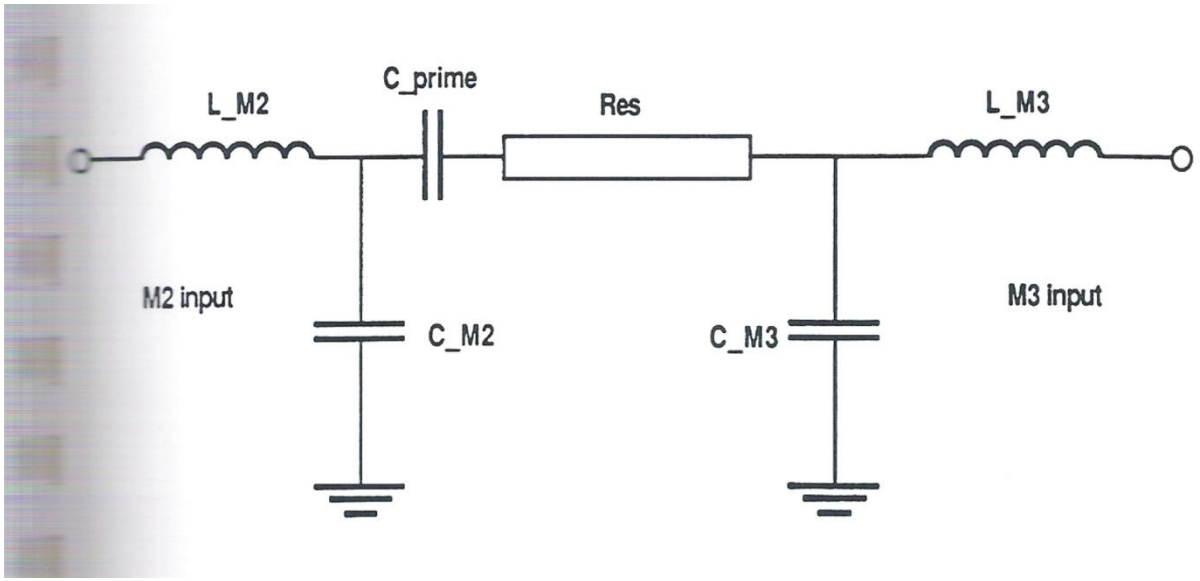
CONDENSATOR SANDWICH CU POLIIMID



Condensator de decuplare



MODEL DE CIRCUIT



MODEL ANALITIC

$$y = ax^n + b$$

y	C_Prime(pF)	RES(Ω)	C_M2(pF)	C_M3(pF)
a	2.81417×10^{-5}	310156	1.982851×10^{-5}	3.262996×10^{-7}
n	1.943606	-2.424696	1.521669	1.884238
b	0.010967	0.724728	4.343976×10^{-3}	2.981967×10^{-3}

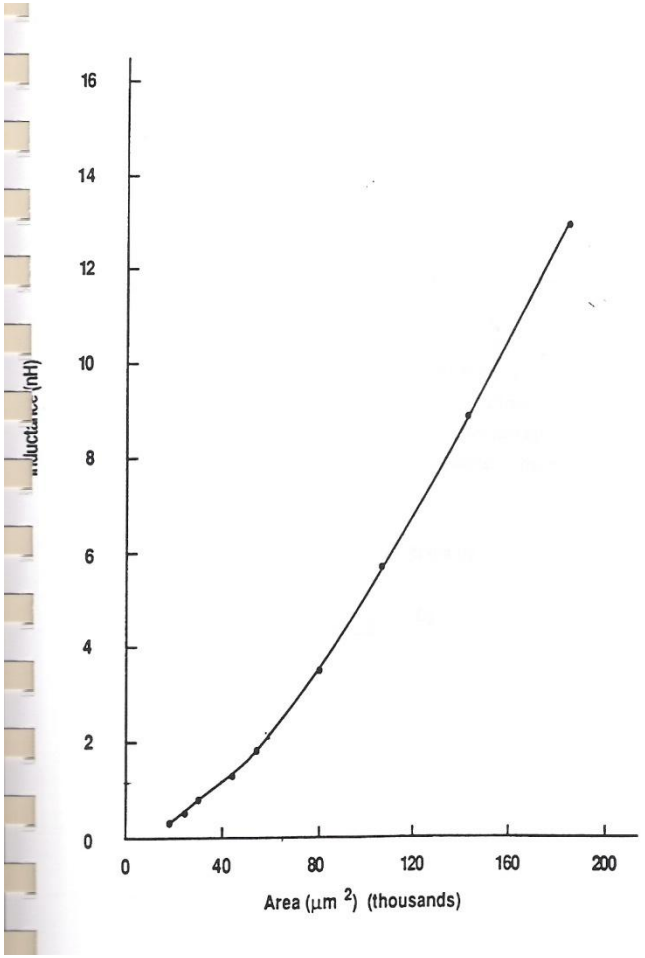
$$y = ax^5 + bx^4 + cx^3 + dx^2 + ex + f$$

y	L_M2(nH)	L_M3(nH)
a	1.199327×10^{-13}	7.223189×10^{-14}
b	$-1.425209 \times 10^{-10}$	$-1.086451 \times 10^{-10}$
c	5.925084×10^{-8}	5.791041×10^{-8}
d	-9.977216×10^{-6}	-1.352713×10^{-5}
e	7.61417×10^{-4}	1.548175×10^{-3}
f	-0.018913	-0.043643

Sinteza

$$x = \left(\frac{C\_PRIME - 0.010967}{2.81417 \times 10^{-5}} \right)^{\frac{1}{1.943606}}$$

Inductanța bobinei planare MMIC în funcție de aria ocupată



Tabelul 2

Calcul analitic

$$y = ax^8 + bx^7 + cx^6 + dx^5 + ex^4 + fx^3 + gx^2 + hx + i$$

x y	L(nH) NT	NT L(nH)
a	0	0
b	0	0
c	-1.244773×10^{-5}	0
d	6.601764×10^{-4}	0
e	-0.013458	3.568872×10^{-3}
f	0.134896	-3.8747×10^{-2}
g	-0.717619	4.36441×10^{-1}
h	2.378735	-5.96717×10^{-1}
i	0.34576	5.48464×10^{-1}

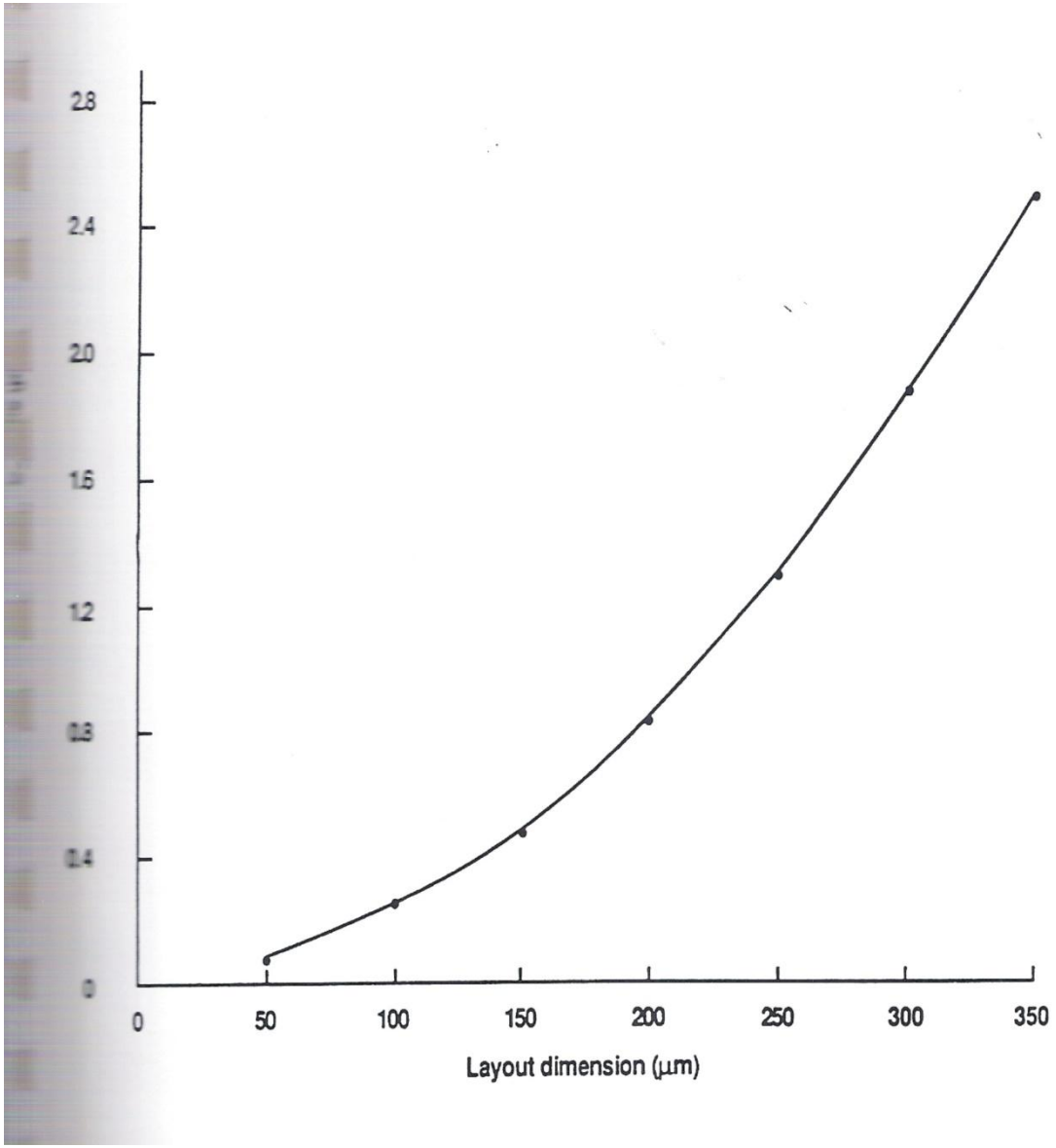
$C_{M2} = CA_2/1000(pF)$ $C_{M3} = CA_3/1000(pF)$

x y	NT R(Ω)	NT CA2(pF)	NT CA3(pF)
a	0	0	0
b	0	0	0
c	0	0	0
d	0	0	0
e	-8.715679×10^{-3}	1.7183×10^{-2}	7.7091×10^{-2}
f	1.17006×10^{-1}	-2.9383×10^{-1}	-1.319712
g	-4.14503×10^{-1}	2.482252	9.310673
h	1.540988	-4.46438×10^{-1}	-12.427652
i	-4.90493×10^{-1}	14.271271	16.686414

$C_{FB} = C_F/1000(pF)$

x y	NT CF(pF)
a	5.291501×10^{-3}
b	-1.91888×10^{-1}
c	2.936406
d	-24.65102
e	1.23379191×10^{2}
f	$-3.73563243 \times 10^{2}$
g	6.58330576×10^{2}
h	$-5.96458929 \times 10^{2}$
i	2.11078589×10^{2}

C_PRIME vs. Layout

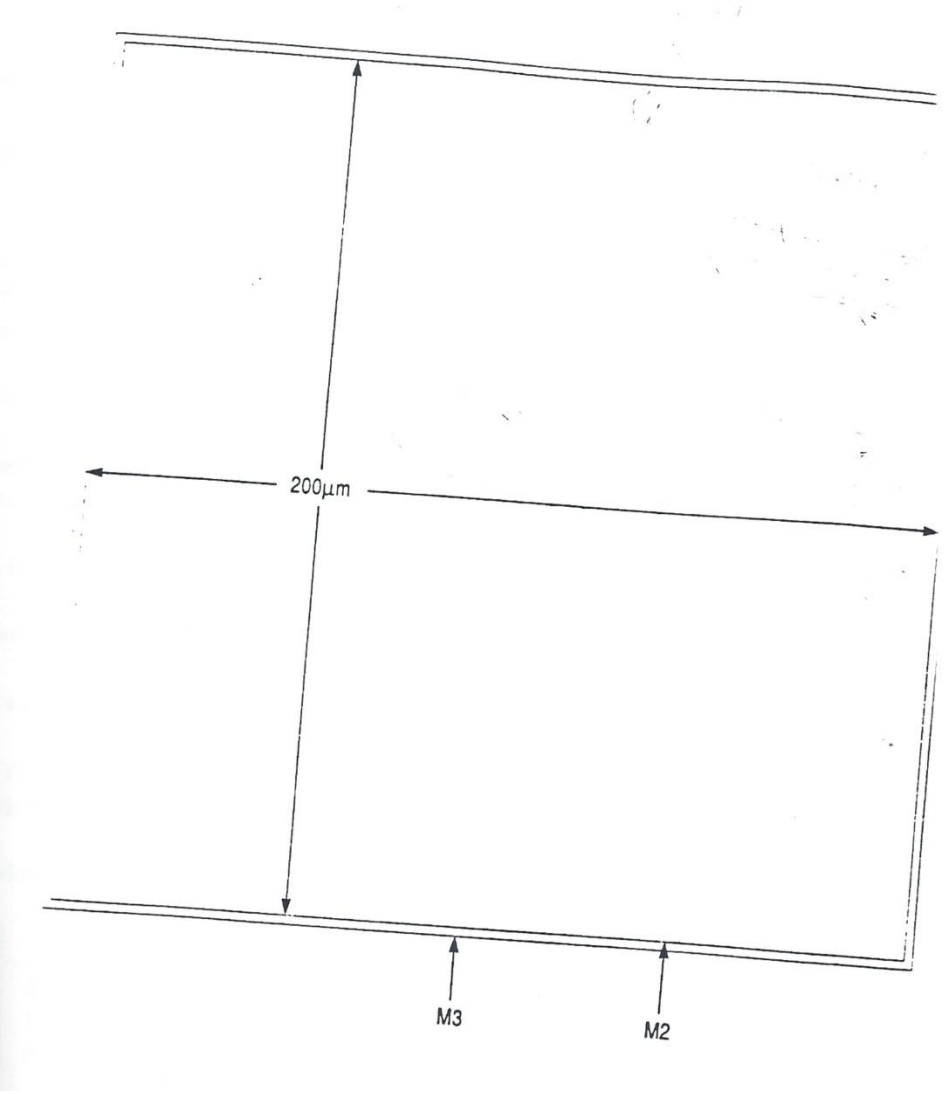


EXEMPLU DE PROIECTARE

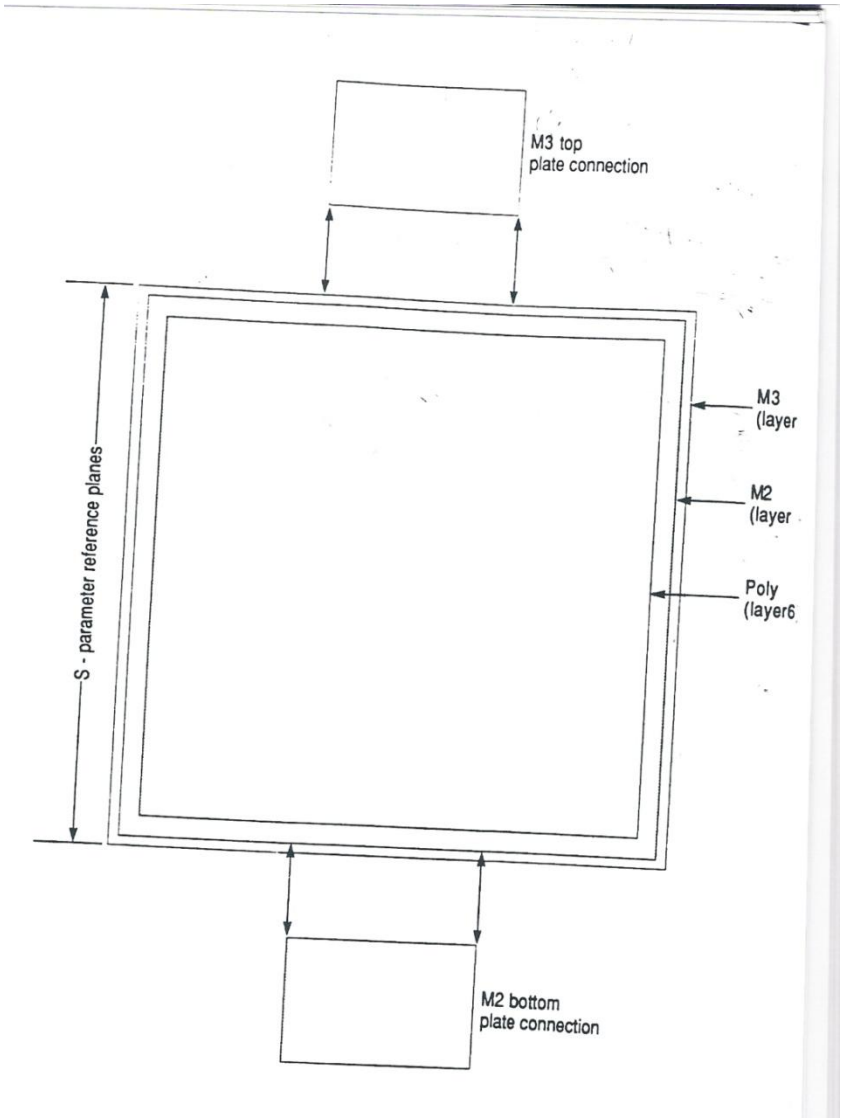
Care este dimensiunea armăturii M2 pentru un condensator poliimid de o.85 pF.

SOLUTIE

$$x = \left(\frac{0.85 - 0.010967}{2.81417 \times 10^{-5}} \right)^{\frac{1}{1.943606}} = 200$$



Condensator cu nitrura de siliciu



Relatii de calcul

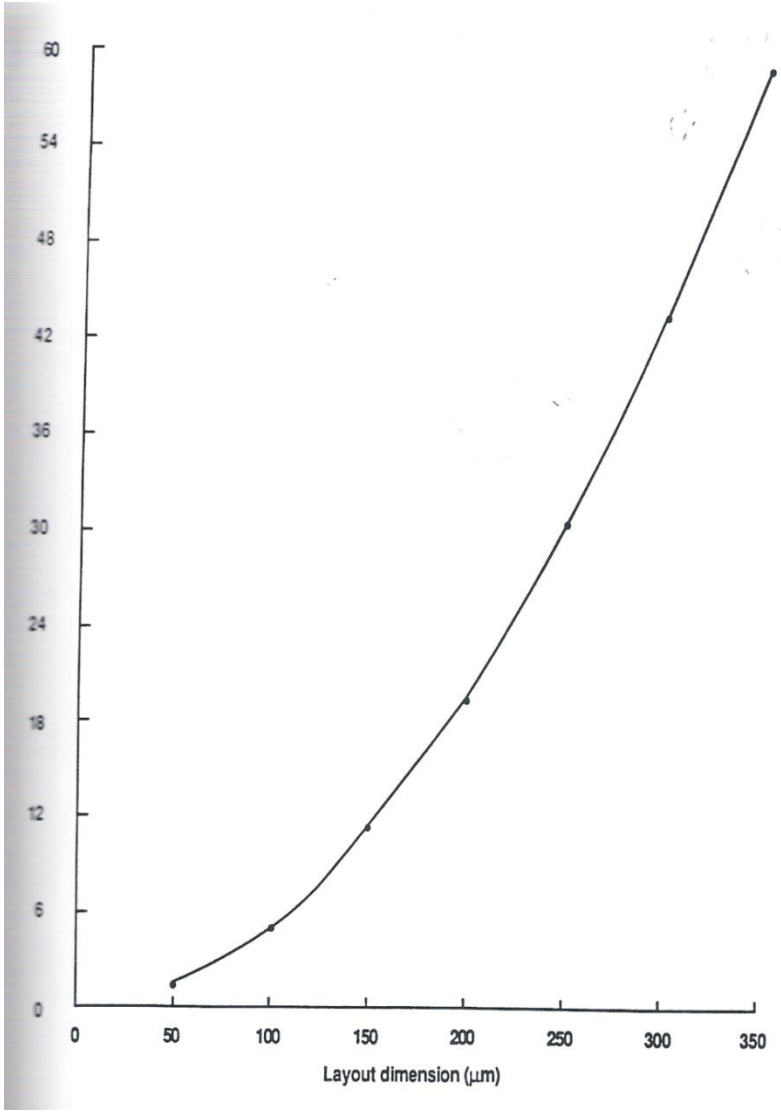
y	C_PRIME(pF)	C_M2=C_M3
`a	5.789419×10^{-4}	3.068702×10^{-6}
n	1.968719	1.719218
b	0.010062	9.886438×10^{-3}

y	L_M2=L_M3 (nH)
a	1.008265x10-13
B	-1.028124x10-10
c	4.04525x10-8
d	-7.805765x10-6
e	8.906675x10-4
f	-0.028514

SINTEZA

$$x = \left(\frac{C\_PRIME - 0.010062}{5.789419 \times 10^{-4}} \right)^{\frac{1}{1.968719}}$$

Dimensiune layout vs. C_PRIME



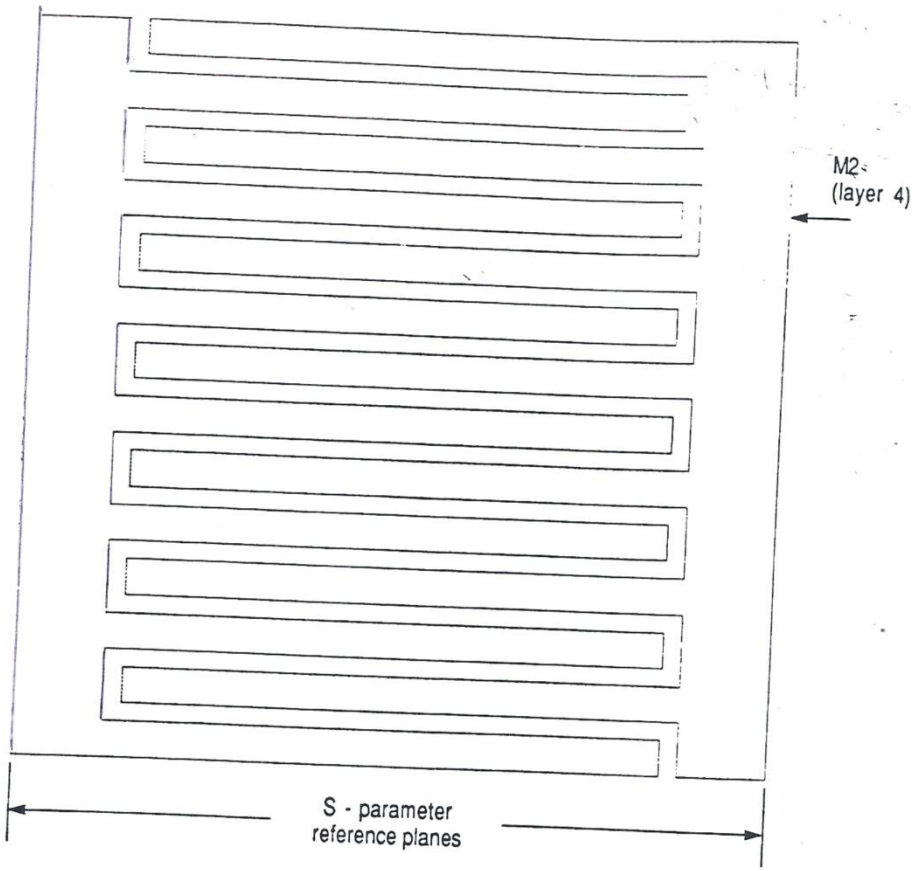
EXEMPLU DE PROIECTARE

Care este dimensiunea unui condensator cu nitrid de siliciu avînd capacitatea de 59 pF

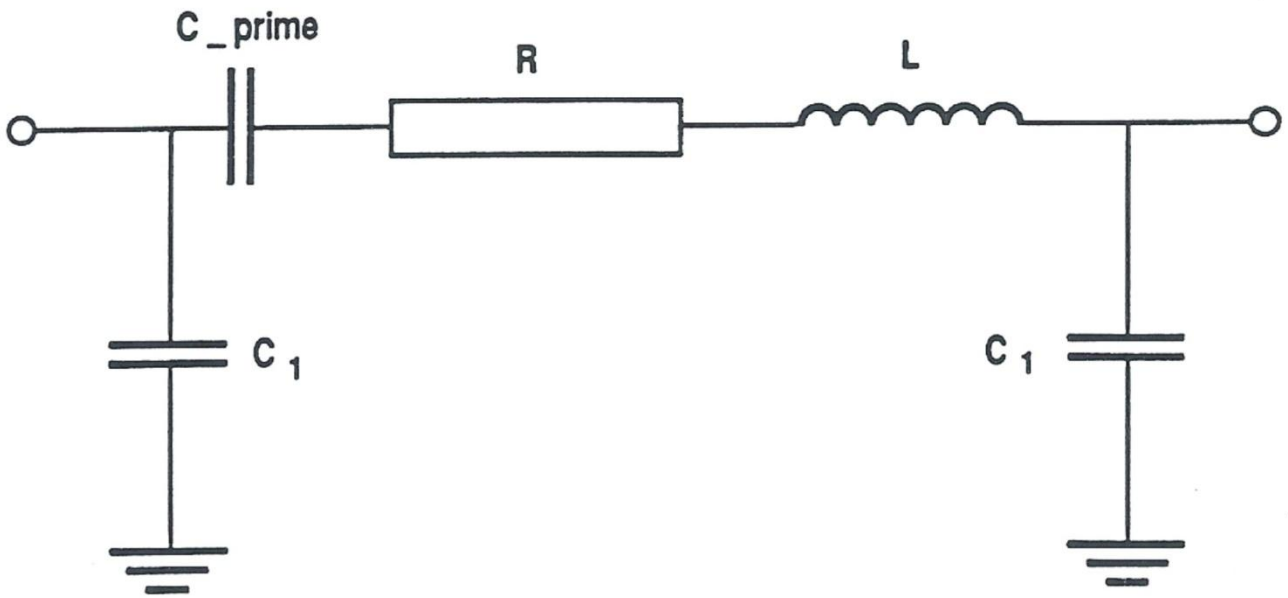
Solutie

$$x = \left(\frac{59 - 0.010062}{5.789419 \times 10^{-4}} \right)^{\frac{1}{1.968719}} = 350\,\mu m$$

Condensator pieptene



Modelul de circuit



RELATII DE CALCUL

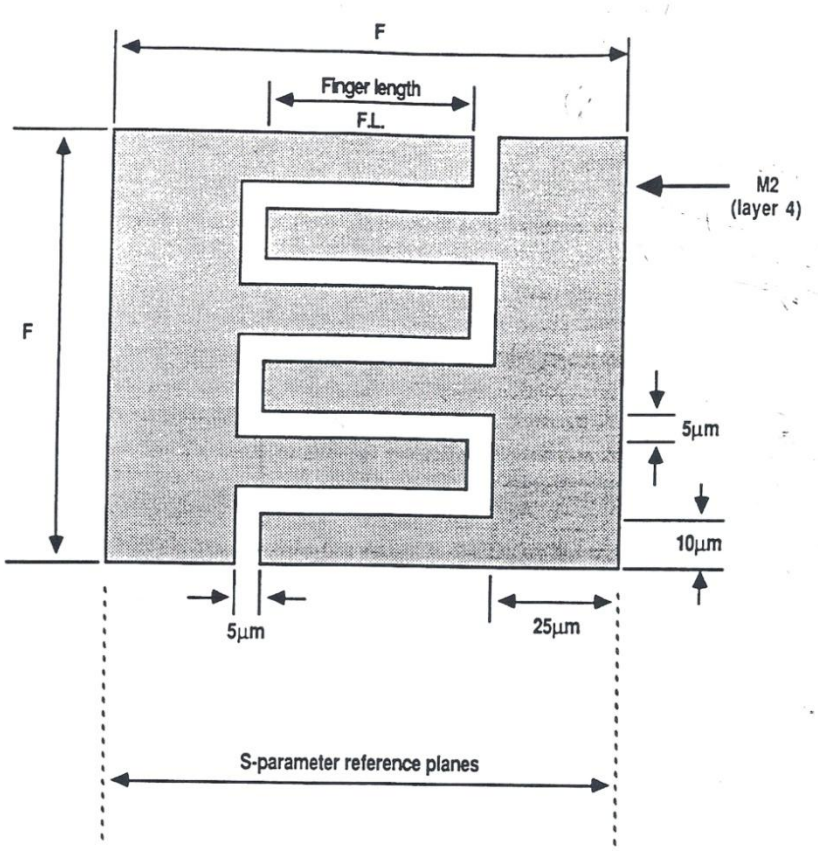
$$N = 1.999482 + \sqrt{\left(744.0775 C\_PRIME - 0.15125\right)}$$

$$C\_PRIME = \left(\left((N-1)(F-55)+F\right)8.96\times10^{-5}\right)+6.59\times10^{-4}$$

$$F = 10N + 5(N-1)$$

$$y = aN^5 + bN^4 + cN^3 + dN^2 + eN + f$$

y	C1(pf)	L(nH)	R(Ω)
a	0	0	-2.22583×10^{-3}
b	0	0	0.163427
c	0	-3.026908×10^{-4}	-4.72975
d	4.132143×10^{-5}	0.014089	67.48168
e	2.831357×10^{-3}	-0.208423	-475.724
f	-0.011336	1.063872	1337.138



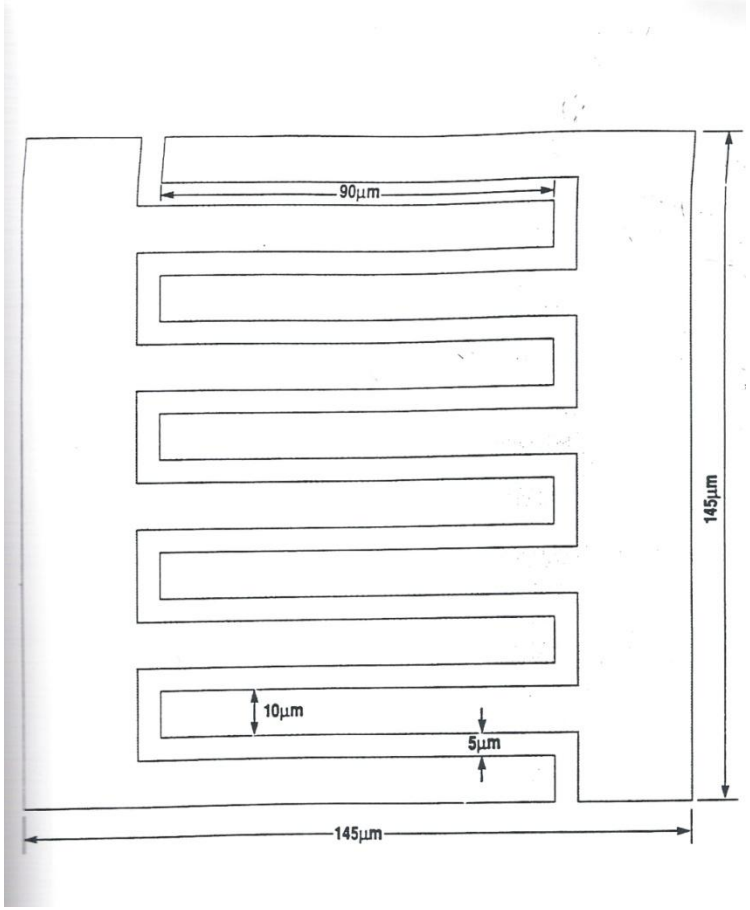
EXEMPLU DE PROIECTARE

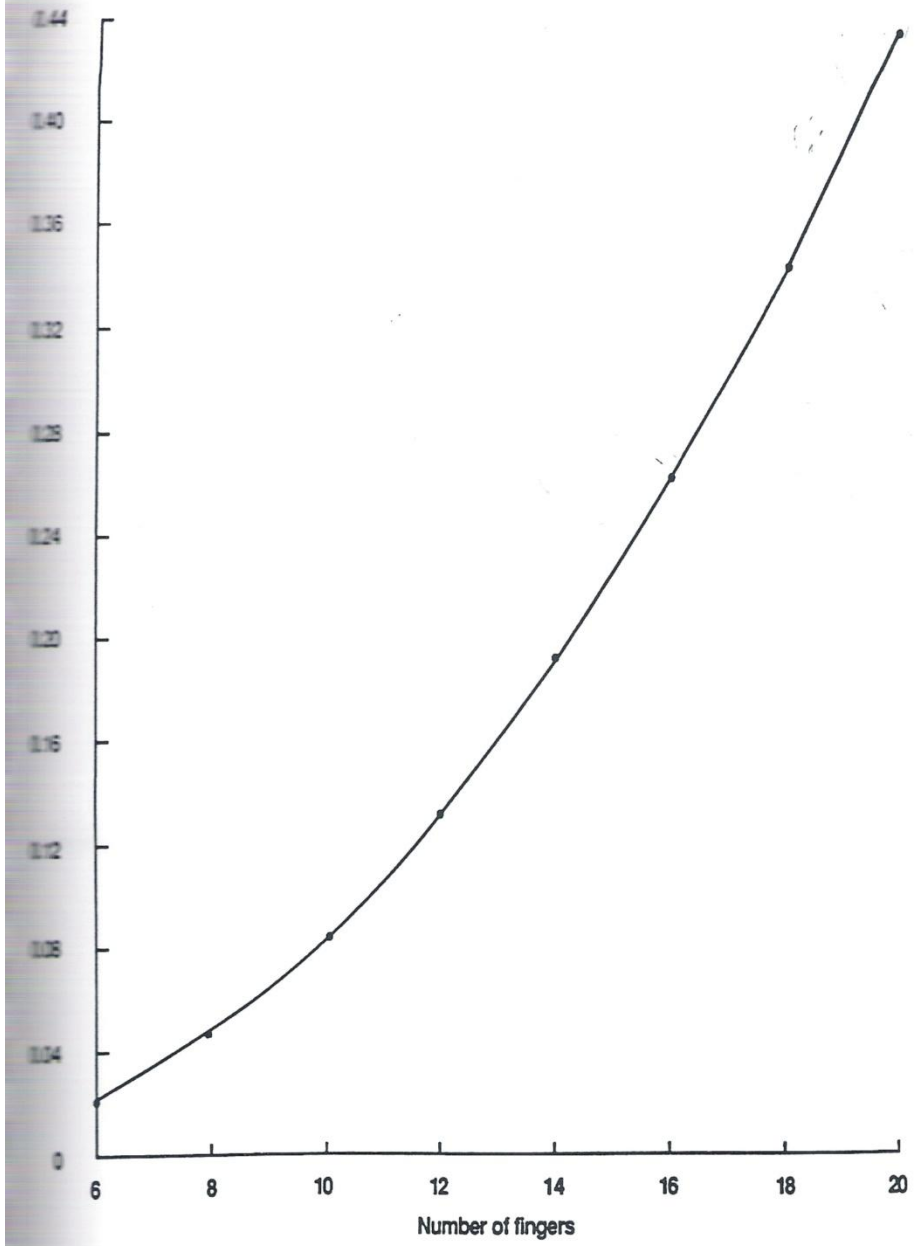
Care este dimensiunea unui condensator interdigital de 0.086 pF.

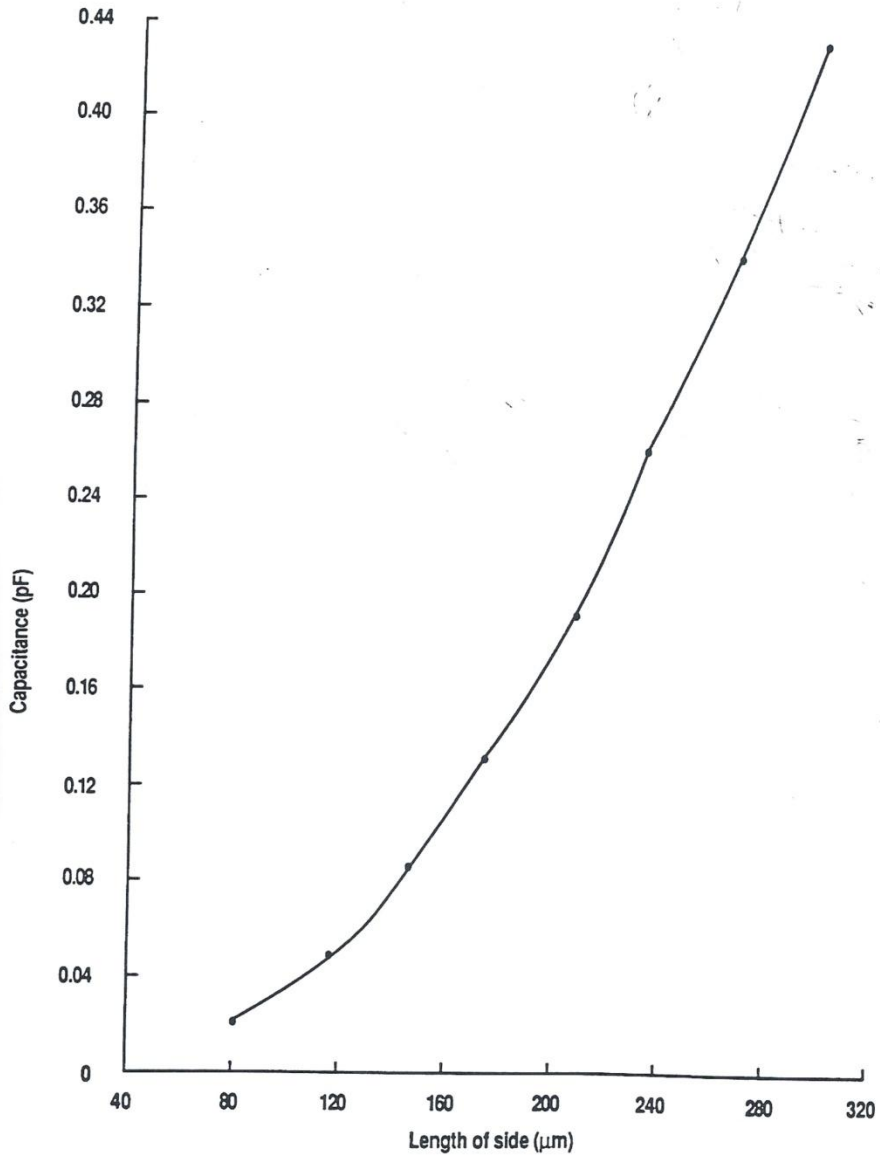
$$N = 1.999482 + \sqrt{\left(744.0775x0.086 - 0.15125\right)} = 10$$

$$F = 10 \times 10 - 5\left(10 - 1\right) = 145\mu m$$

$$F.L. = 145 - 50 - 5 = 90\mu m$$




0.44
0.40
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0
6
8
10
12
14
16
18
20
Number of fingers


0.44
0.40
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0
Capacitance (pF)
40
80
120
160
200
240
280
320
Length of side (μm)