## Analog IC Design

## Exercise 2

Solutions January 2004, problem 1 and 2:

1.

Resistance:

Count squares (band = 2,11 sq.) $\Rightarrow$ 98,5 squares

$R_{poly} = R_{sp} \cdot \#\text{squares} = 9 \cdot 98,5 = 886,5\ \Omega$

There is 5 contacts in each end $\Rightarrow$

$R_{contact} = \underbrace{2}_{\text{2 ends}} \cdot \frac{R_{cp}}{\underbrace{5}_{\text{5 in parallell}}} = \frac{2}{5} \cdot 3,0 = 1,2\ \Omega$

$R = R_{poly} + R_{contact} = 886,5 + 1,2\ \Omega = \underline{888\ \Omega}$

Capacitance:

Calculate area $\Rightarrow A = 2560\ (\mu m)^2$

Calculate perimeter $\Rightarrow P = 1034\ \mu m$

$C = C_{pl} \cdot A + C_{pp} \cdot P = 0,119 \cdot 2560 + 0,049 \cdot 1034\ fF =$

$= \underline{355\ fF}$

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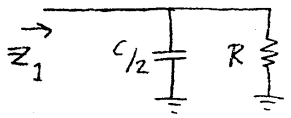
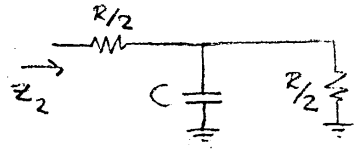
2. With model 1:




$$Z_1 = \frac{1}{\frac{1}{R} + sC/2} = \frac{R}{1 + sRC/2}$$

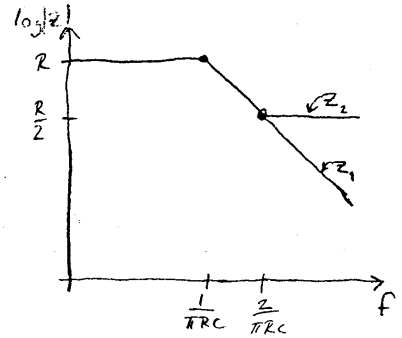
With model 2:




$$Z_2 = \frac{R}{2} + \frac{1}{\frac{2}{R} + sC} = \frac{R}{2} + \frac{R}{2 + sRC} =$$

$$= \frac{R}{2}\left(1 + \frac{1}{1 + sRC/2}\right) = \frac{R}{2}\left(\frac{1 + sRC/2 + 1}{1 + sRC/2}\right) =$$

$$= R\,\frac{1 + sRC/4}{1 + sRC/2}$$




- Resistive to $\frac{1}{\pi RC} = 1GHz$
- Significant difference after

$\frac{2}{\pi RC} = 2GHz$

Solution January 2005, problem 1:

1. a $R_1$ has 2 contacts 15 regular squares & 4 corners

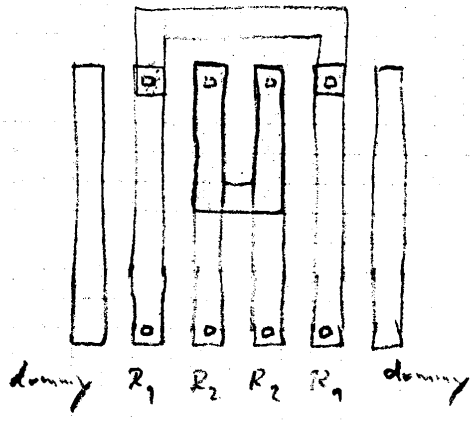
$R_2$ —— —— ——

$\Rightarrow R_1 = R_2 = 15 \cdot 6 + 2 \cdot (3+5) + 4 \cdot 0{,}56 \cdot 6 = 120\,\Omega$

b. They have different shape.

—— —— center of gravity.

There are no dummy structures




To improve the matching wider fingers should be used, if possible.