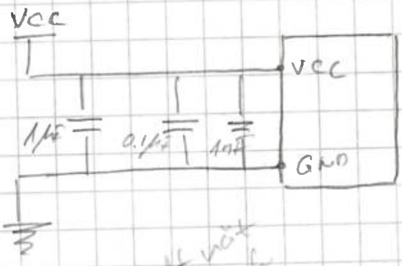
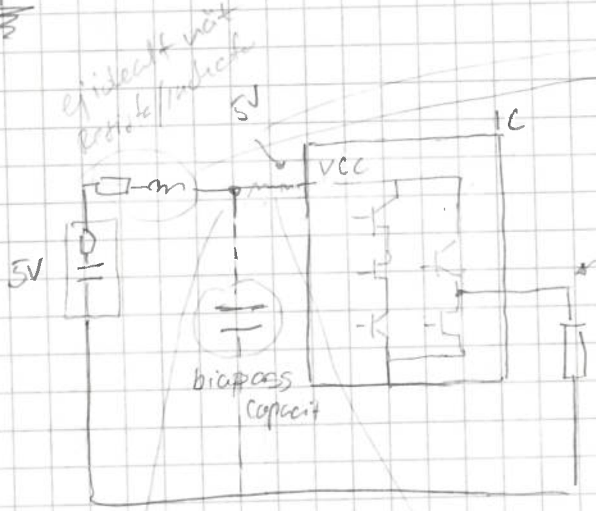
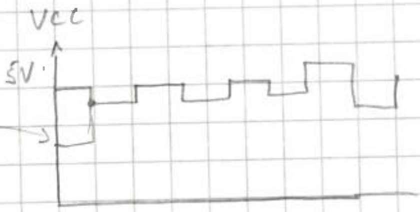
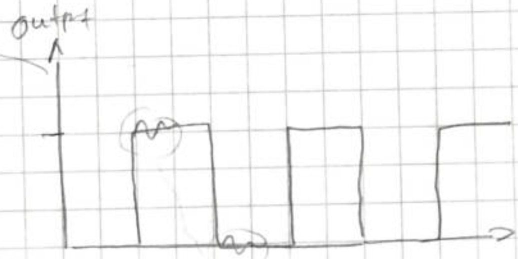
WHAY MULTIPLE CAPACITORS







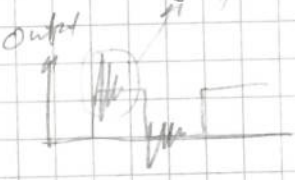


Så nära som möjligt
Till IC
Låg impedance
Låg conductivit

små inductance

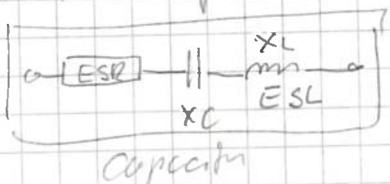
1kHz signal (låg Frekvens)

Högt frekvens



Varför vi behöver different
värde på kapacitor (inte bara en)

A Real Capacitor

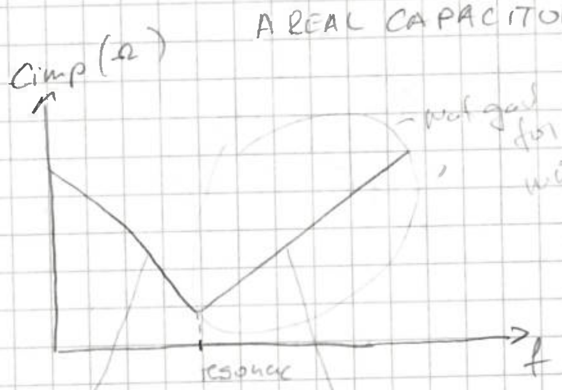


$$X_C = \frac{1}{2\pi f C}$$

$$X_L = 2\pi f L$$

$$C_{imp} = ESR + X_C + X_L$$

A REAL CAPACITOR



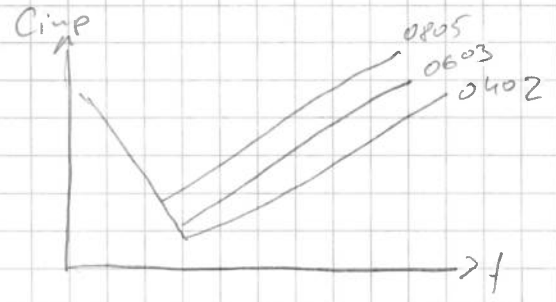
- not good for IC
högre impedance

Impedance drop due to capacitor

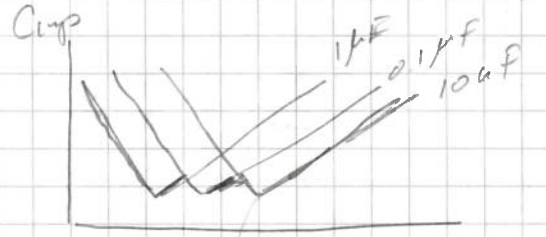
Impedance raises due to inductor

$resonance: X_c = X_L$

Different pakagen har different impedance:

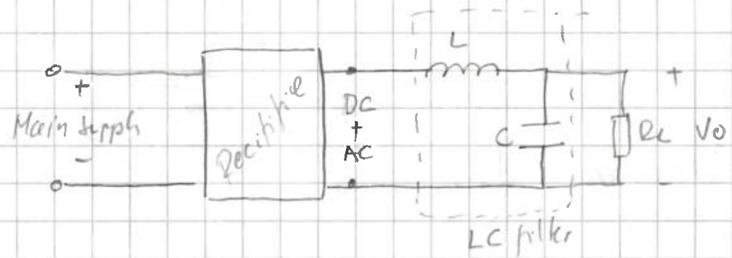


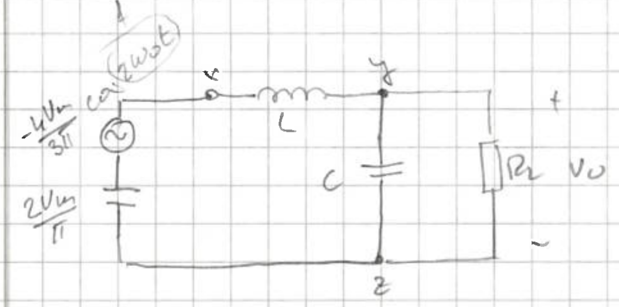
för Högt frekvens
JUS samma pakaging



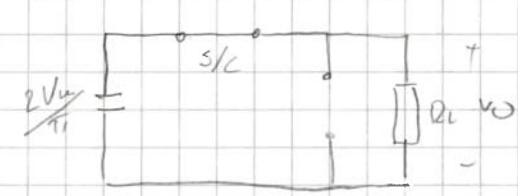
start frekvens och försök att täcka
vid bigger multiple capacitors

LC FILTER

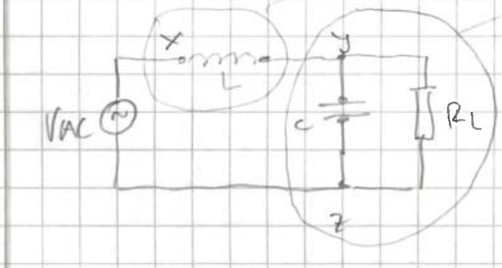




⊛ DC



$V_o DC = \frac{2V_m}{\pi}$



$Z_{xy} = j\omega L$

$Z_{xz} = (X_C \| R_L)$

$V_{o\,AC} = \frac{Z_{yz}}{Z_{xy} + Z_{yz}} V_{AC}$

if $\underline{Z_{xy} >> Z_{yz}}$ $\Rightarrow$ $V_o = \dfrac{Z_{yz}}{Z_{xy}} V_{ac}$

$X_C << R_L$

$X_C \parallel X_L \approx X_C$ $\Rightarrow$ $V_o = \dfrac{X_C}{X_L} V_{ac}$

$*\ \boxed{\begin{array}{l} X_L >> (X_C \parallel R_L) \\ X_C << R_L \end{array}}$

Two option

Critical Induction (L_c):

$I_{DC} = \dfrac{2V_m}{\pi R_L}$

$|I_{AC}|_{peak} = \dfrac{|V_{ac}|_{peak}}{|X_L|} = \dfrac{4V_m}{3\pi(2\omega_0 L)} = \dfrac{2V_m}{3\pi\omega_0 L}$

$L = L_c$ $\quad I_{DC} = |I_{AC}|_{peak} \Rightarrow \left.\dfrac{2V_m}{\pi R_L} = \dfrac{2V_m}{3\pi\omega_0 L}\right|_{L=L_c}$

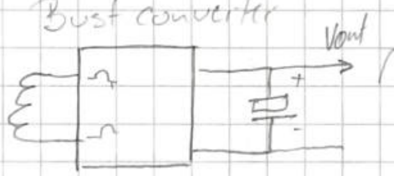
c = critical

$* \boxed{L_c = \dfrac{R_L}{3\omega_0}}$

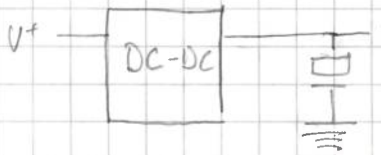
Allways $L > L_c$ $\quad |I_{AC}|_{peak} < I_{DC}$

How Remove Power Supplyer Ripple?

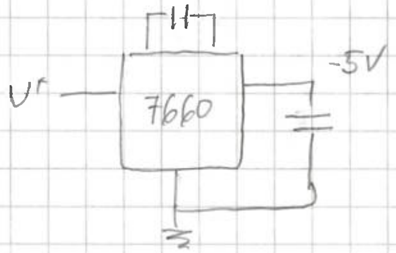
Bust converter

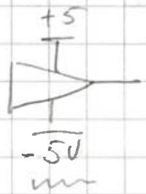


låv fekvenci rippl



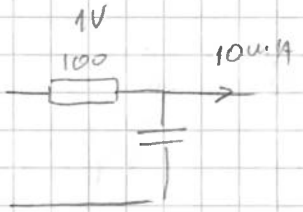
- DC - hig frequenci riple



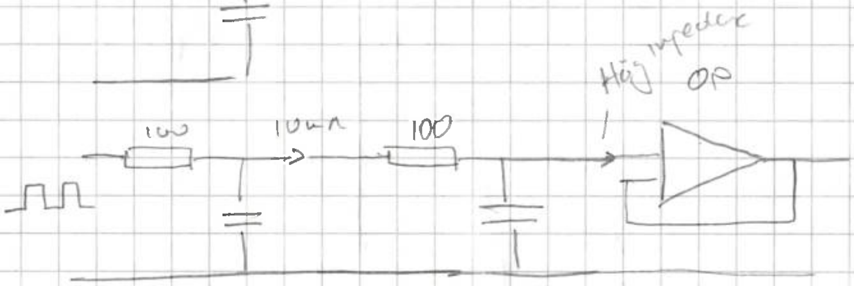


Use Regulator

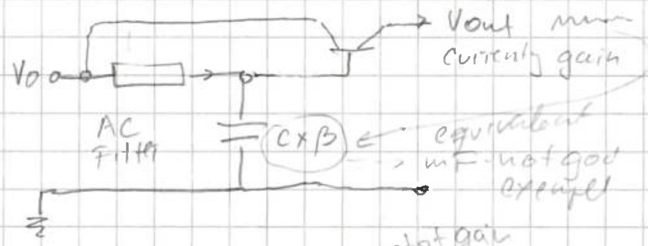
AC

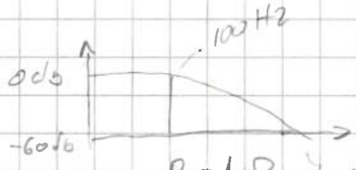


↓ resistor => ↑ capacitor value



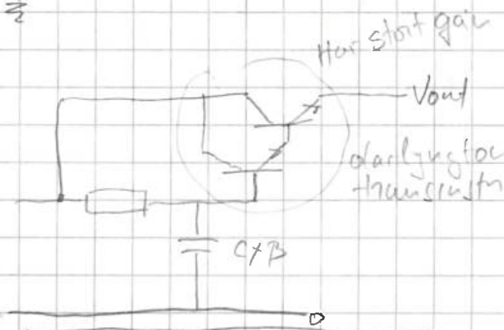
only för litt virch ou currenty

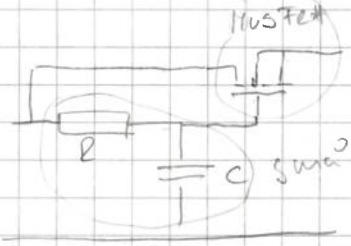




R = 1 Ω
C = 1 F

60 dB attenuation vid 100 Hz (försvagning)

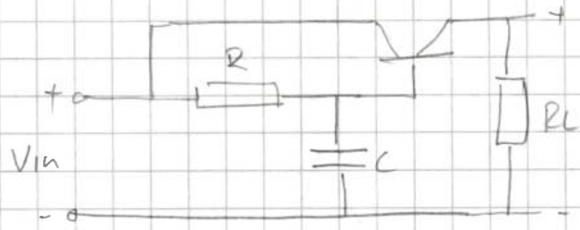




Only USU FÖR Riple!

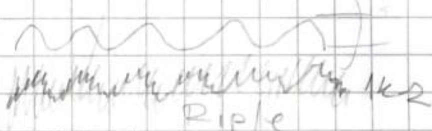
NOT GOD FÖR REGULATION

TEST



10k
↑R = Rippl ökar
↑ vid C = 7 μF

vid ripple
DC input:
=> output:



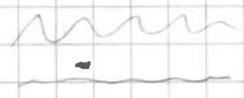
1kΩ
Riple

$$f_{-3dB} = \frac{1}{2\pi RC} \quad \left\{ \begin{array}{l} R = 1k \\ C = 100n \end{array} \right. \quad \Rightarrow f_{-3dB} = 1.59\ kHz$$

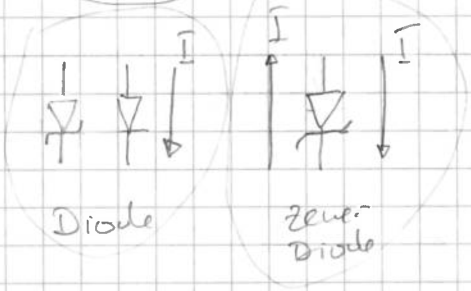
men $\beta = 100$ so:

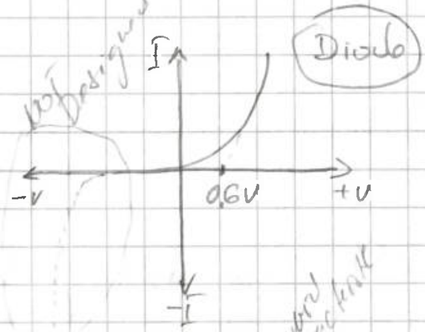
för $1k\Omega$ & $\underbrace{(100nF \times 100)}_{\Rightarrow 10\,\mu F}$ $\Rightarrow f_{-3dB} = 15.9\ Hz$

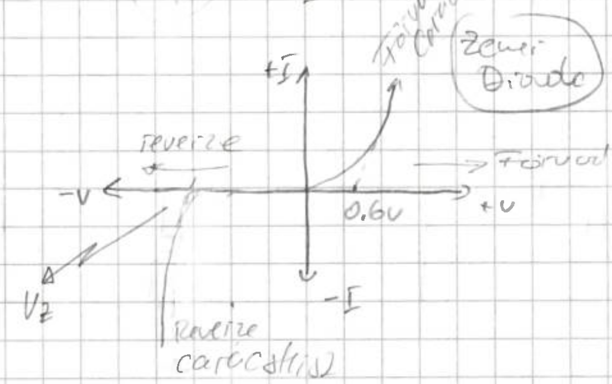
input
output



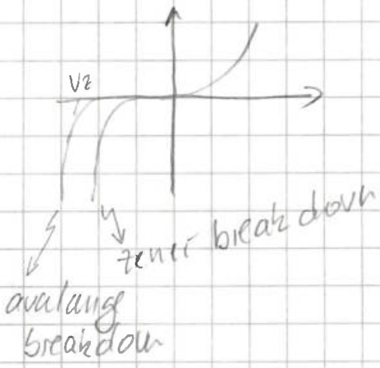
DIODE

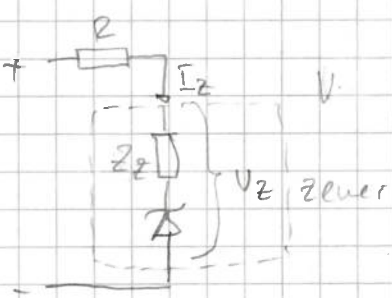






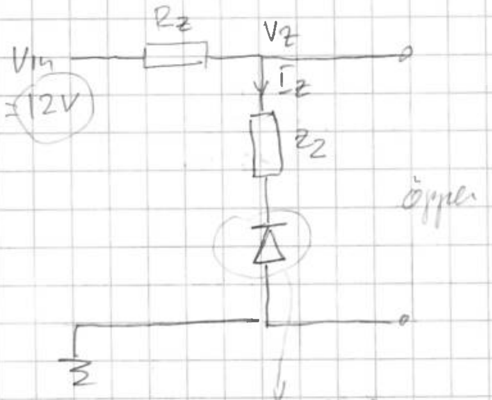
Zener





Z_Z är insidan of zener diode

Regulation (typical for zener diode)



datasheet
$V_Z = 5{,}1V$ @ $50mA$
(1N4733 Vishay)

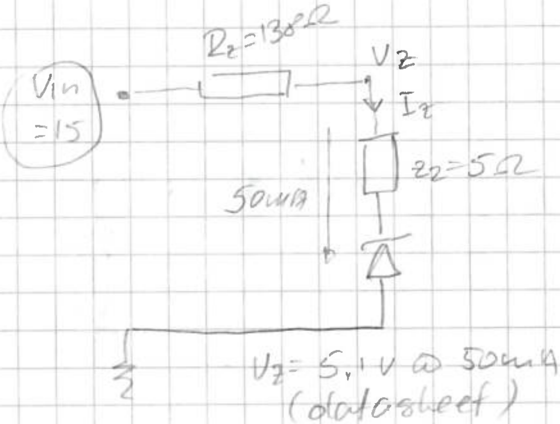
öppen:

$V_{in} = 12V$ $I_L = \text{open}$

$I_Z T_1 = 50mA$
$Z_Z T_1 = 5\,\Omega$ } datasheet

$$R_Z = \frac{V_{in} - 5{,}1}{I_Z}$$

$$R_Z = \frac{12 - 5{,}1}{50\,mA} = 138\,\Omega$$



$V_Z = 5{,}1V$ @ $50mA$
(datasheet)

$P_Z = V_Z \times I_Z = 5{,}1 \times 50 = 0{,}25W$

$V_{in} = 15V$
$R_Z = 138\,\Omega$
$Z_Z = 5\,\Omega$

$$I_Z = \frac{15 - 5{,}1}{138\,\Omega} = 71{,}7\,mA$$

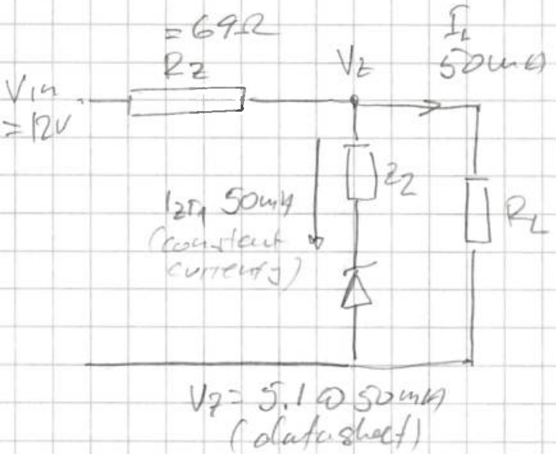
så $I_Z = 71{,}7mA - 50mA = 21{,}7mA$

$\Delta V_Z = \Delta I_Z \times Z_Z$

$= 21{,}7mA \cdot 5\,\Omega$

$= 0{,}11V$

låg current is ineffektiv



$V_{in} = 12V$
$V_Z = 5,1V$
$I_L = 50mA$

$$R_Z = \frac{V_{in} - 5,1V}{I_{ZT_1} + I_L} =$$

$$= \frac{12V - 5,1}{50mA + 50mA} = 69Ω$$

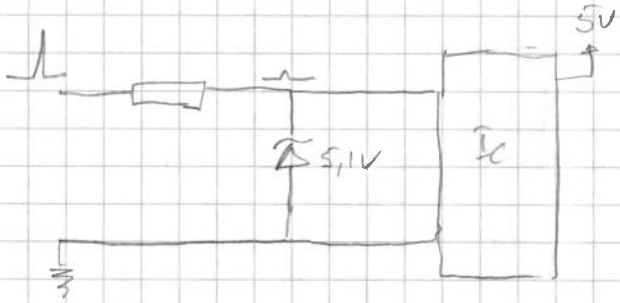
$I_{ZT_1} \neq I_Z$

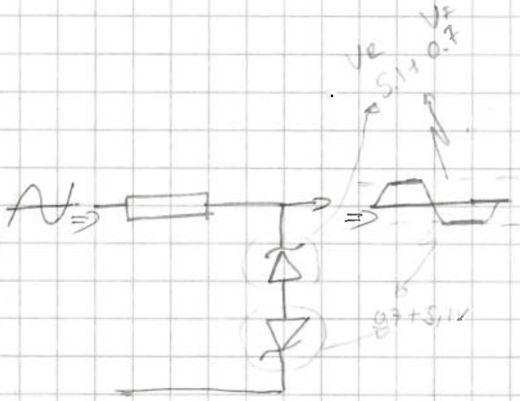
From Datasheet

$$I_Z = \frac{12V - 5,1V}{69Ω} = 100mA$$

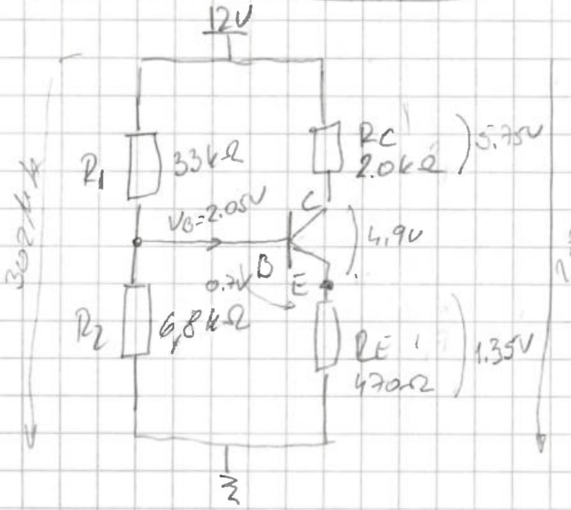
$P_E = 5,1V \times 100mA = 0,5W$

Clippin / clamping protection





TRANSISTOR BIASING



$R_1 + R_2$

$12V / 39,8kΩ = 302 µA$

$V_{R_2} = 6,8kΩ \cdot 302µA = 2,05V$

$V_{RE} = 2,05 - 0,7V = 1,35V$
$(V_B - V_{BE})$

$I_{RE} = 1.35 / 470 = 2,87 mA$

$V_{RC} = 2,0kΩ \cdot 2,87mA = 5,75V$

$V_{CE} = V_{CC} - V_{RC} - V_{RE} = 4,9V$