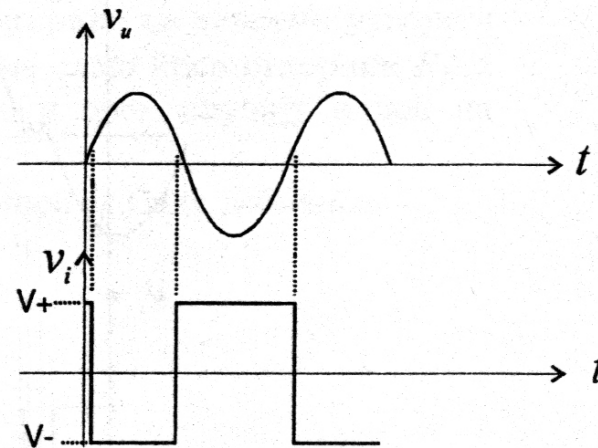
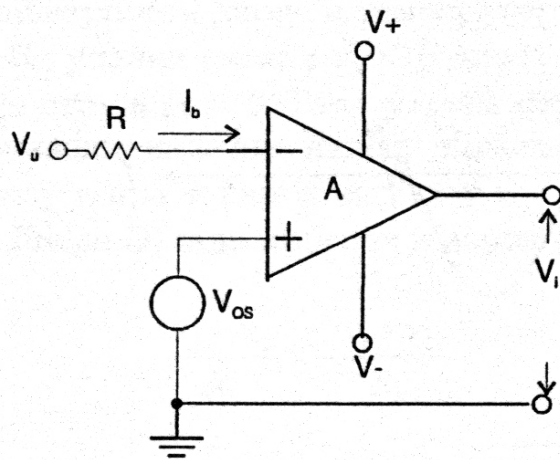




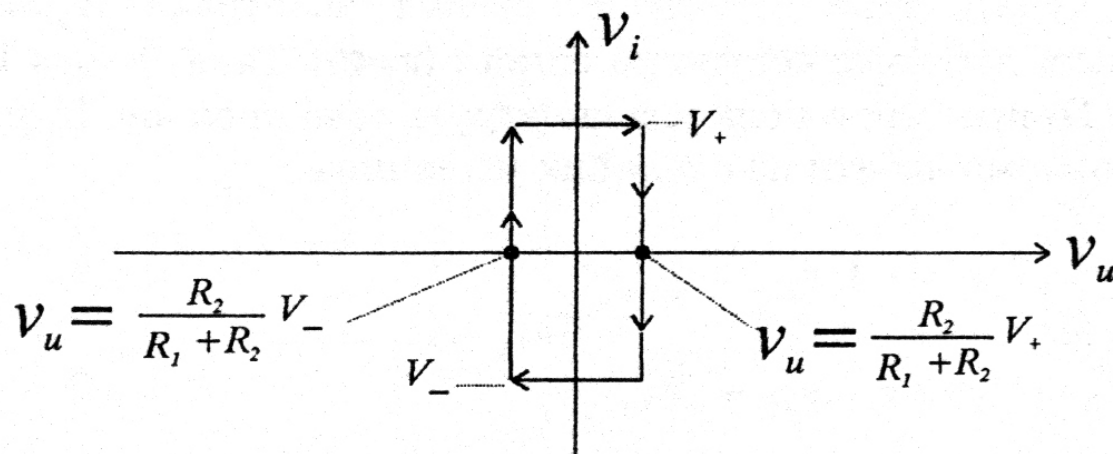
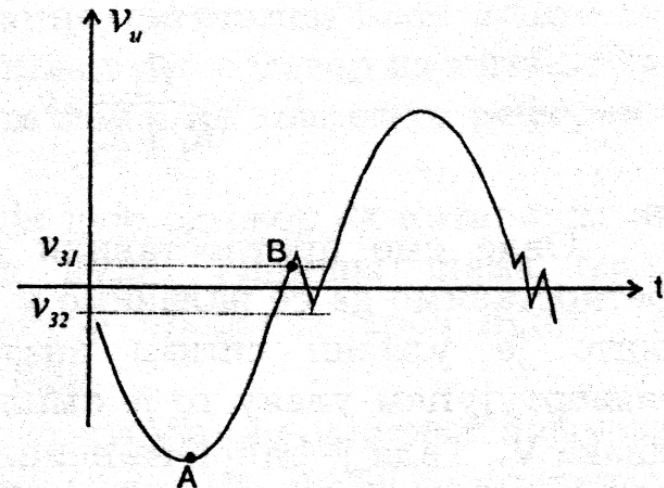
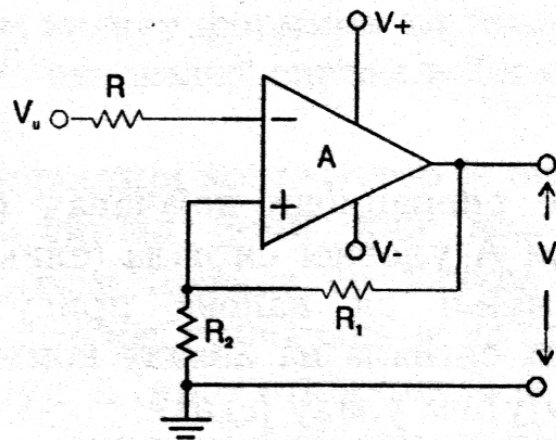
# DESETO PREDAVANJE

**KOLA SA OPERACIONIM  
POJAČAVAČIMA  
JEDNOSMERNI IZVORI ZA  
NAPAJANJE**

# KOMPARATOR



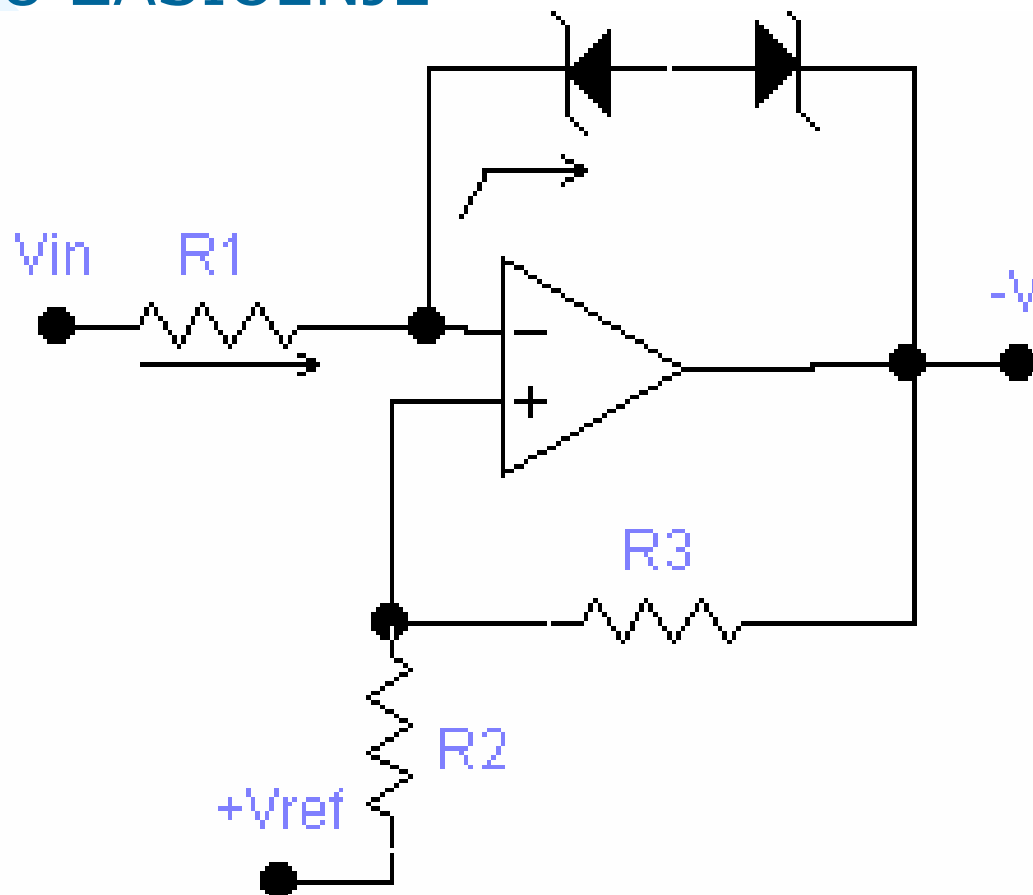
# KOMPARATOR SA HISTEREZISOM



# KOMPARATOR SA HISTEREZISOM

- ZENER DIODE OBEZBEĐUJU DA POJAČAVAČ NE  
IDE U ZASIĆENJE

49

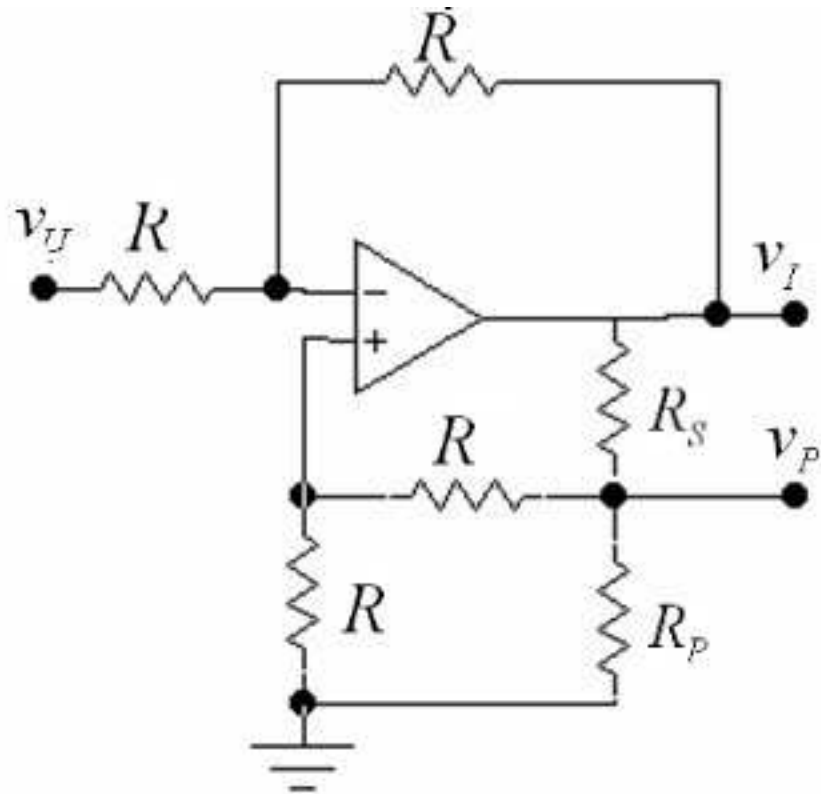


# NAPONSKI KONTROLISAN STRUJNI IZVOR

$$R \gg R_P, I_P \approx I_S$$

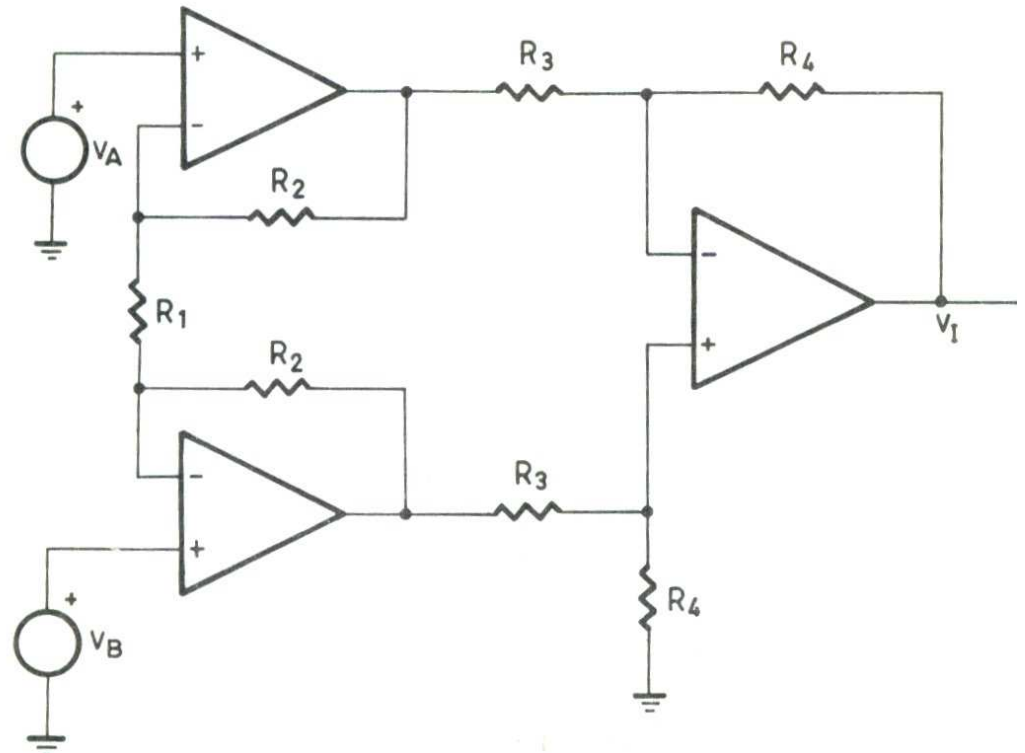
$$I_P = \frac{-v_U}{R_S}$$

48



# INSTRUMENTACIONI POJAČAVAČ

50

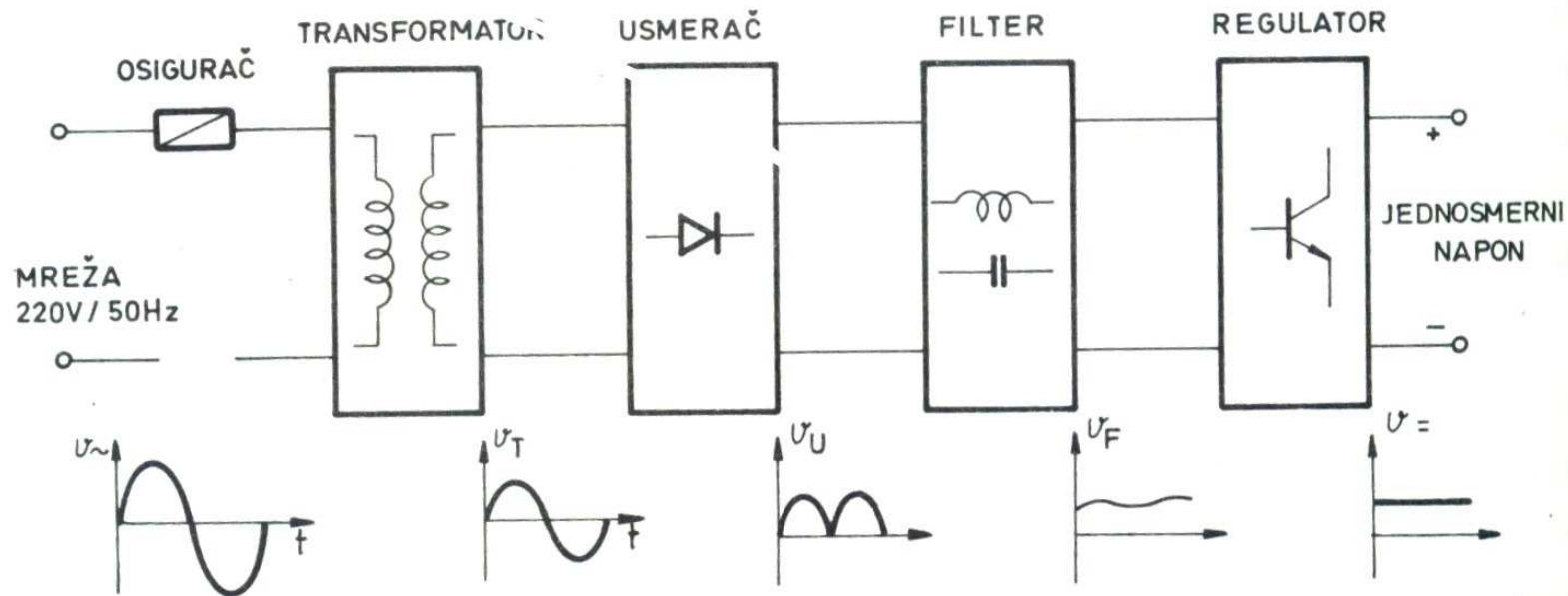


$$v_I = \left( 1 + 2 \frac{R_2}{R_1} \right) \frac{R_4}{R_3} (v_B - v_A)$$

# IZOLACIONI POJAČAVAČ

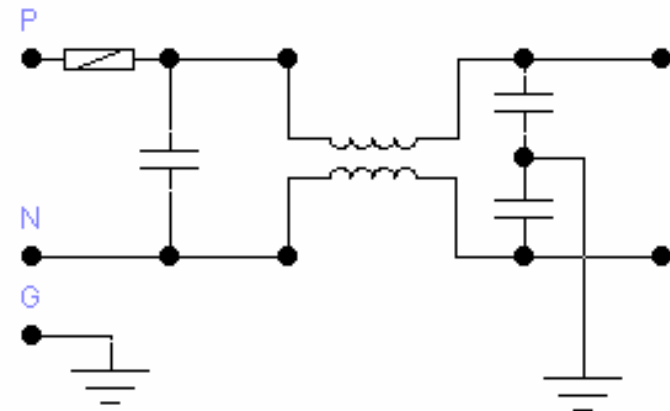
- IZOLACIONI POJAČAVAČ OBEZBEĐUJE GALVANSKU IZOLACIJU IZMEĐU ULAZNOG I IZLAZNOG DELA KOLA
- OVI POJAČAVAČI DOZVOLJAVAJU DA SE IZDVOJI MASA (REFERENTNA TAČKA) ULAZNOG DELA KOLA OD MASE IZLAZNOG DELA
- OBIČNO SLUŽE ZA POJAČANJE MALIH JEDNOSMERNIH ILI SPOROPROMENLJIVIH SIGNALA U INDUSTRIJI, MEDICINI (KONTROLA I UPRAVLJANJE INDUSTRIJSKIM PROCESIMA, BIOMEDICINSKA MERENJA
- ZA IZOLACIJU KORISTE TRANSFORMATORSKU SPREGU, OPTIČKO RAZDVAJANJE POMOĆU FOTO SPREŽNIKA ILI KONDENZATORSKORAZDVAJANJE

# JEDNOSMERNI IZVORI ZA NAPAJANJE



- ULAZNI MREZNI  
FILTAR (EMI)
- U ULAZNIM MREŽNIM  
FILTRIMA SE KORISTE  
KERAMIČKI KONDENZATORI

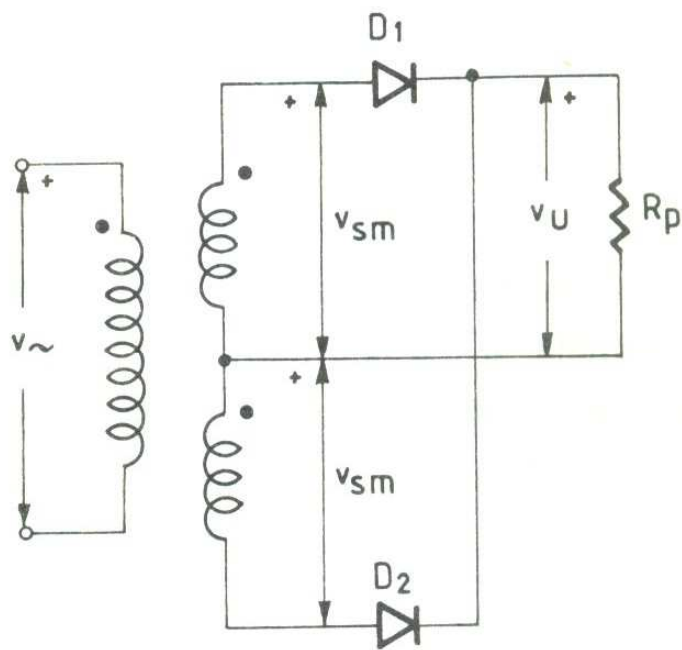
27



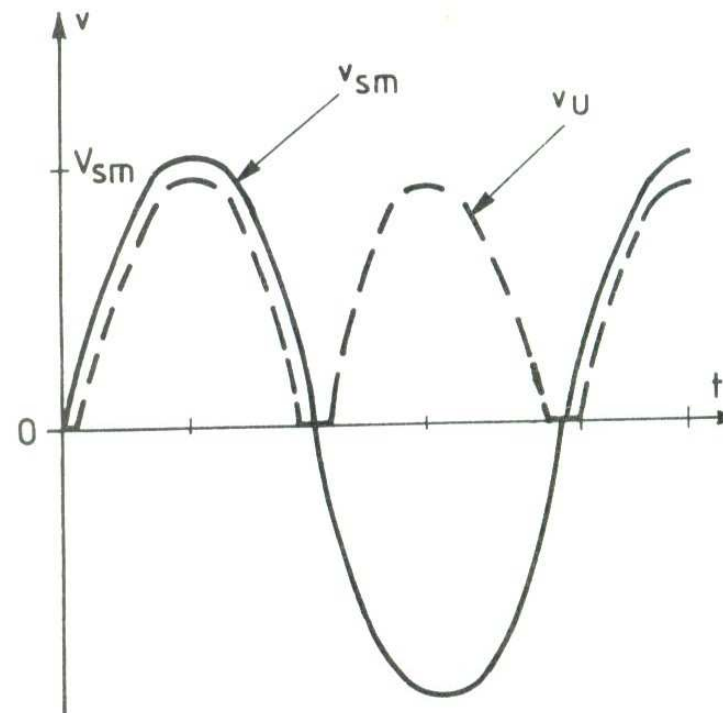


# USMERAČI

- PRETVARAJU NAIZMENIČNI NAPON U JEDNOSMERNI

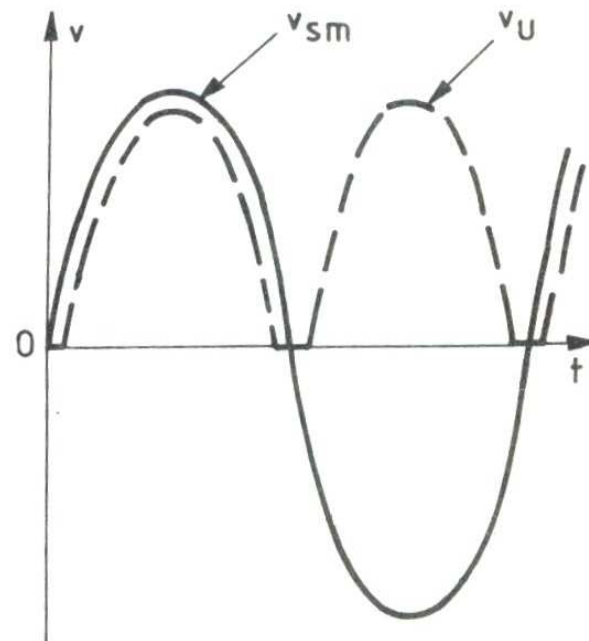
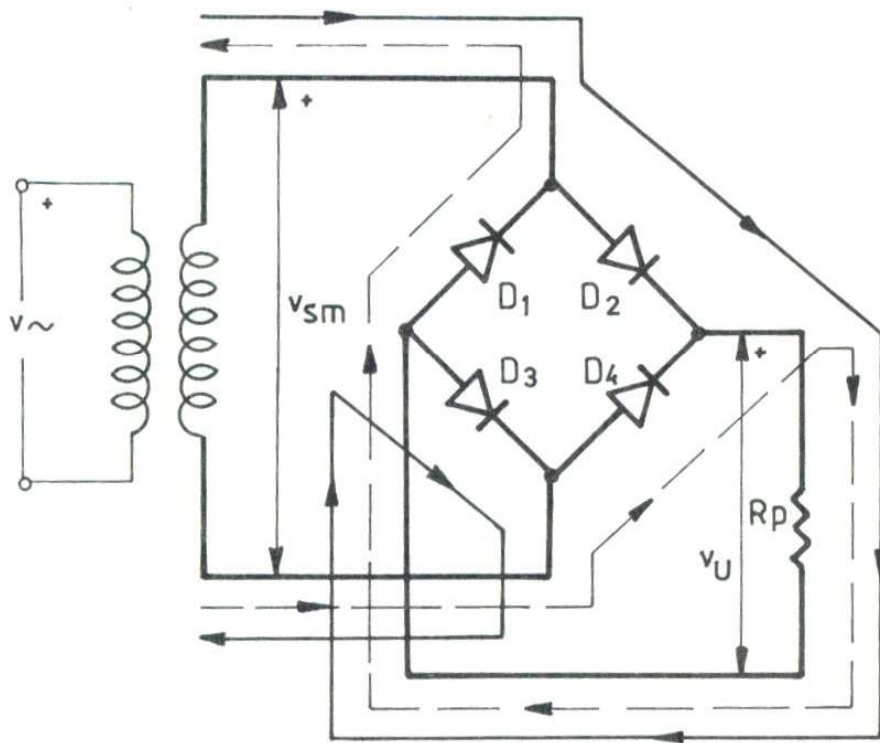


(a)

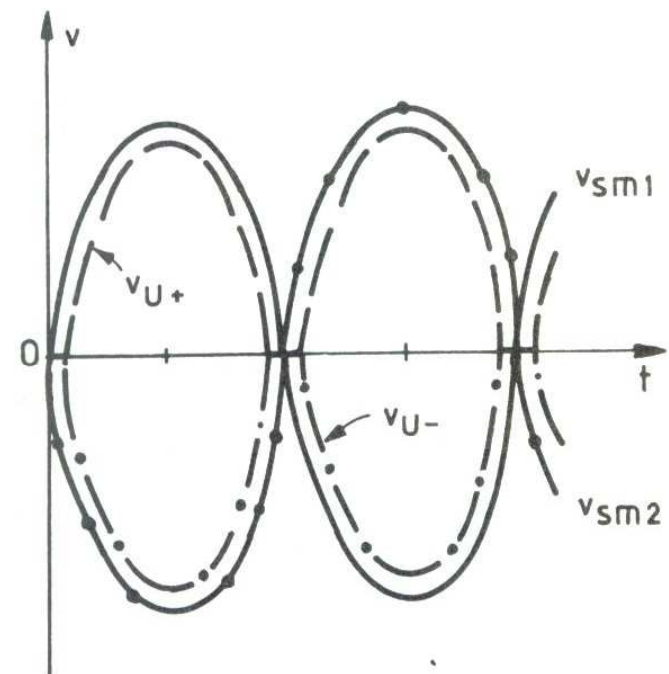
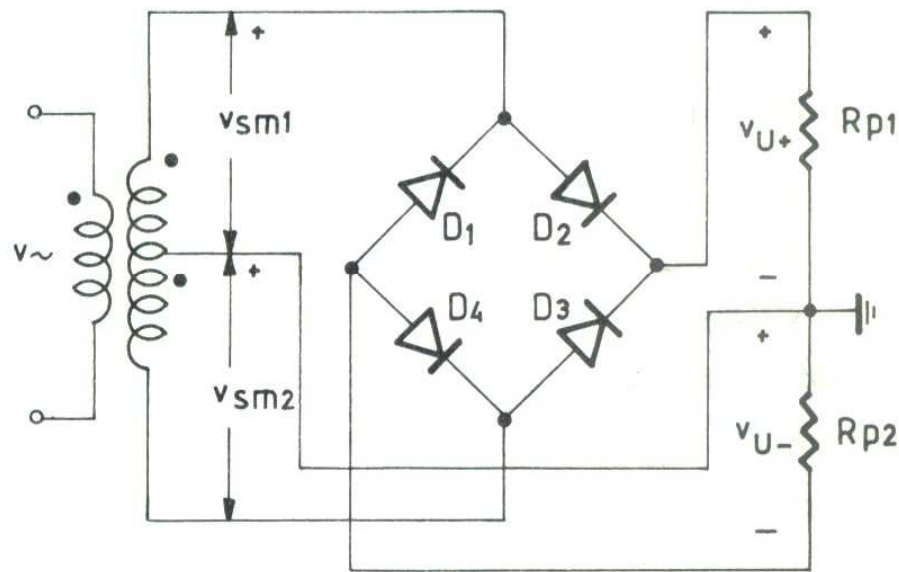


(b)

# USMERAČ SA GRECOVIM SPOJEM

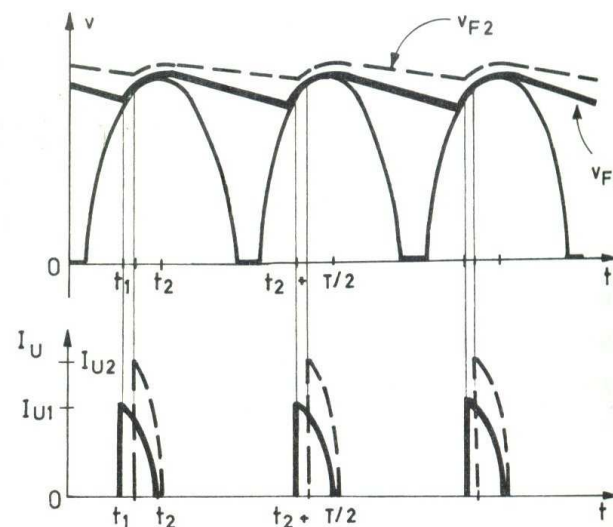
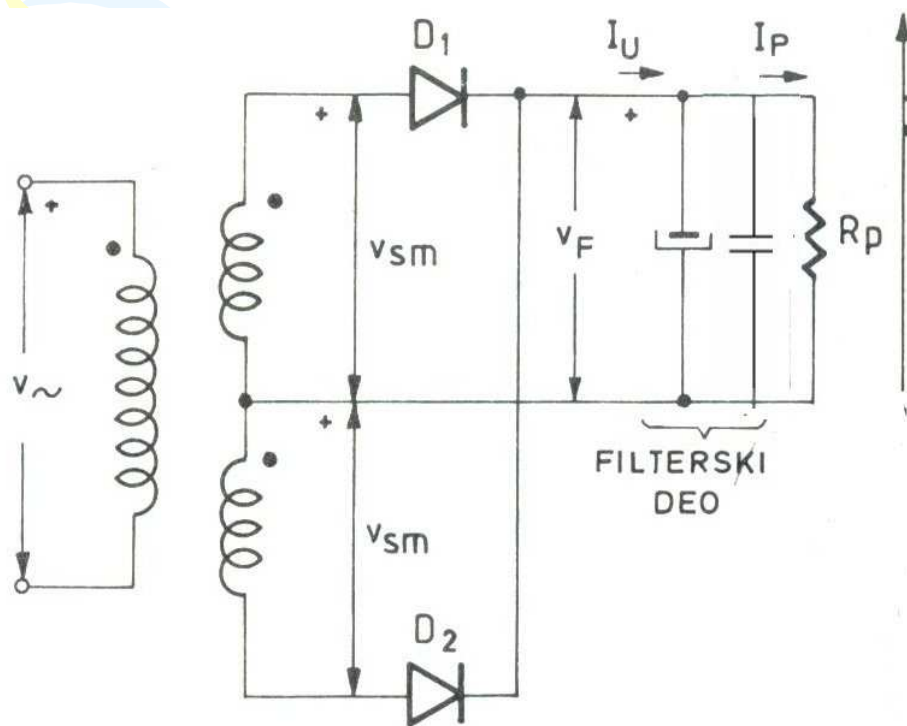


# USMERAČ KOJI DAJE POZITIVAN I NEGATIVAN NAPON



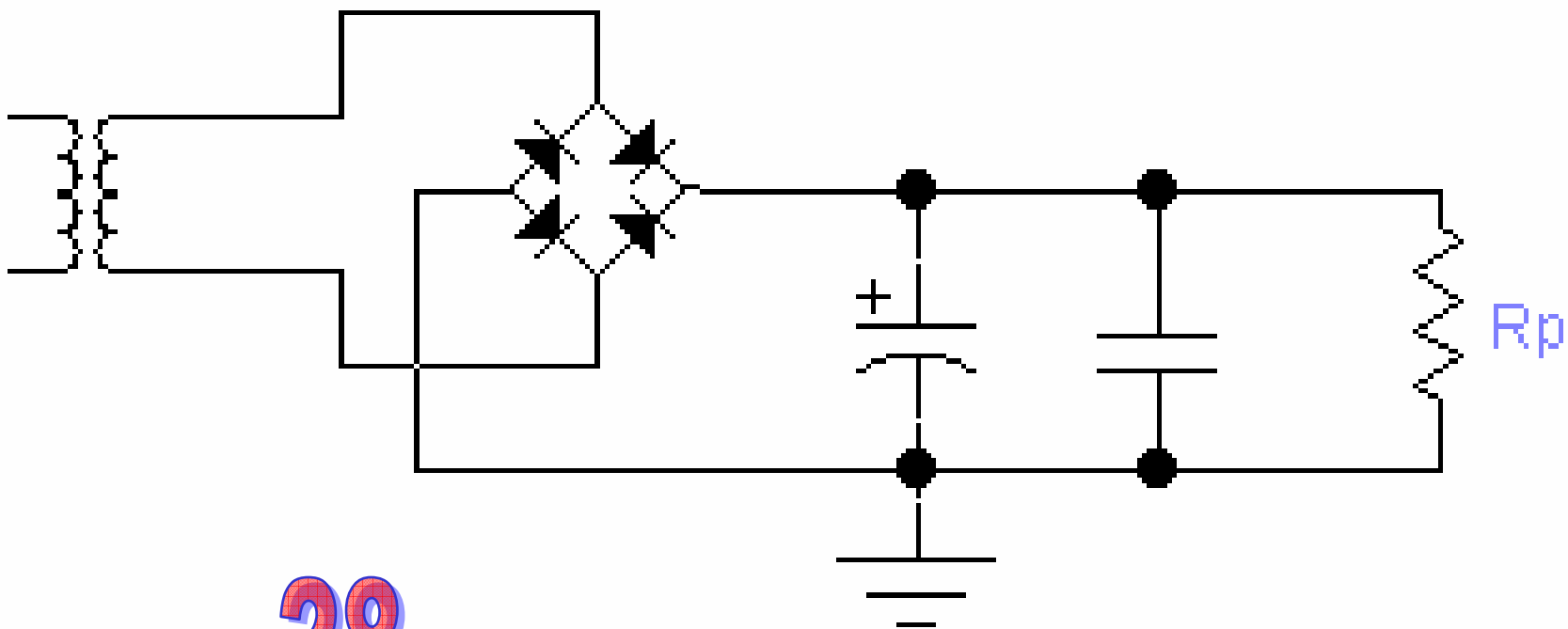
# FILTRI ZA USMERAČE

- FILTRI IZ JEDNOSMERNOG PULSIRAJUĆEG NAPONA SA IZLAZA ISPRAVLJAČA IZDVAJAJU JEDNOSMERNU KOMPONENTU



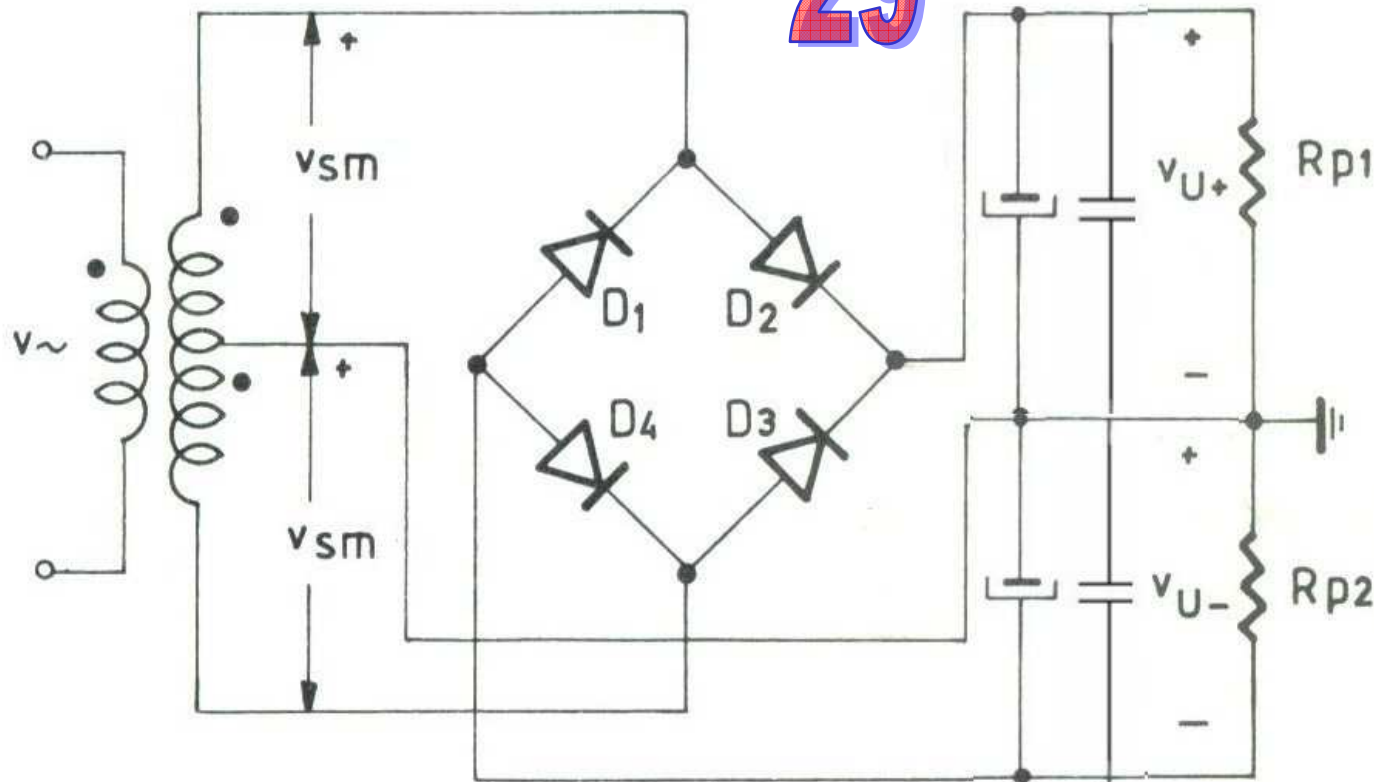
- U IZLAZNIM MREŽNIM FILTERIMA KOD MREŽNIH ISPRAVLJAČA SE KORISTI PARALELNA VEZA ELEKTROLITSKOG I KERAMIČKOG KONDENZATORA

# MREŽNI ISPRAVLJAČ SA DVOSTRANIM ISPRAVLJANJEM



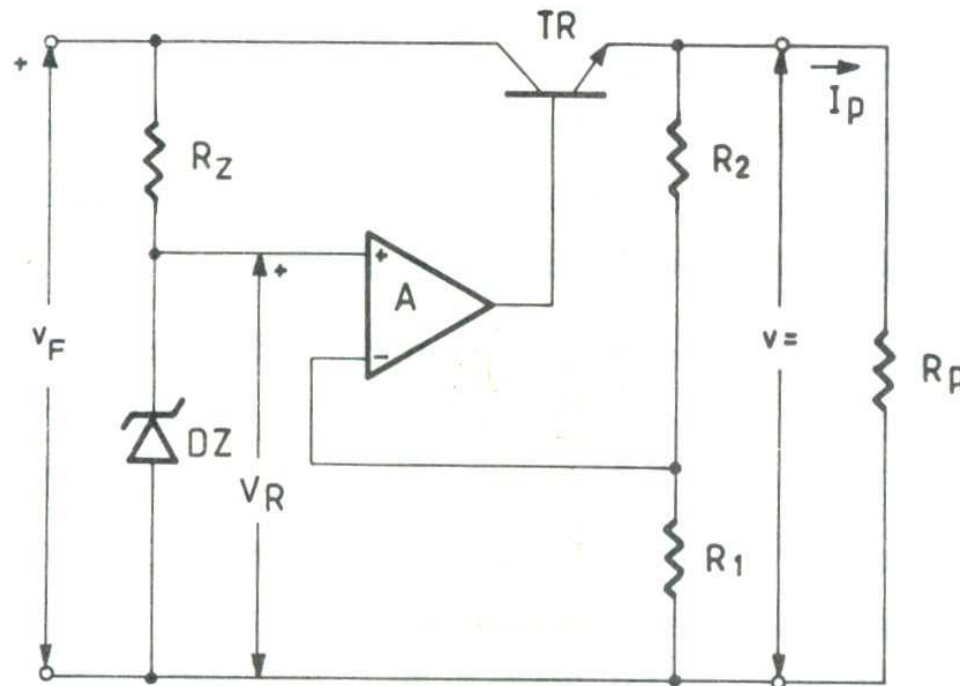
# MREZNI ISPRAVLJAC SA DVOSTRANIM ISPRAVLJANJEM KOJI DAJE POZITIVAN I NEGATIVAN NAPON

29

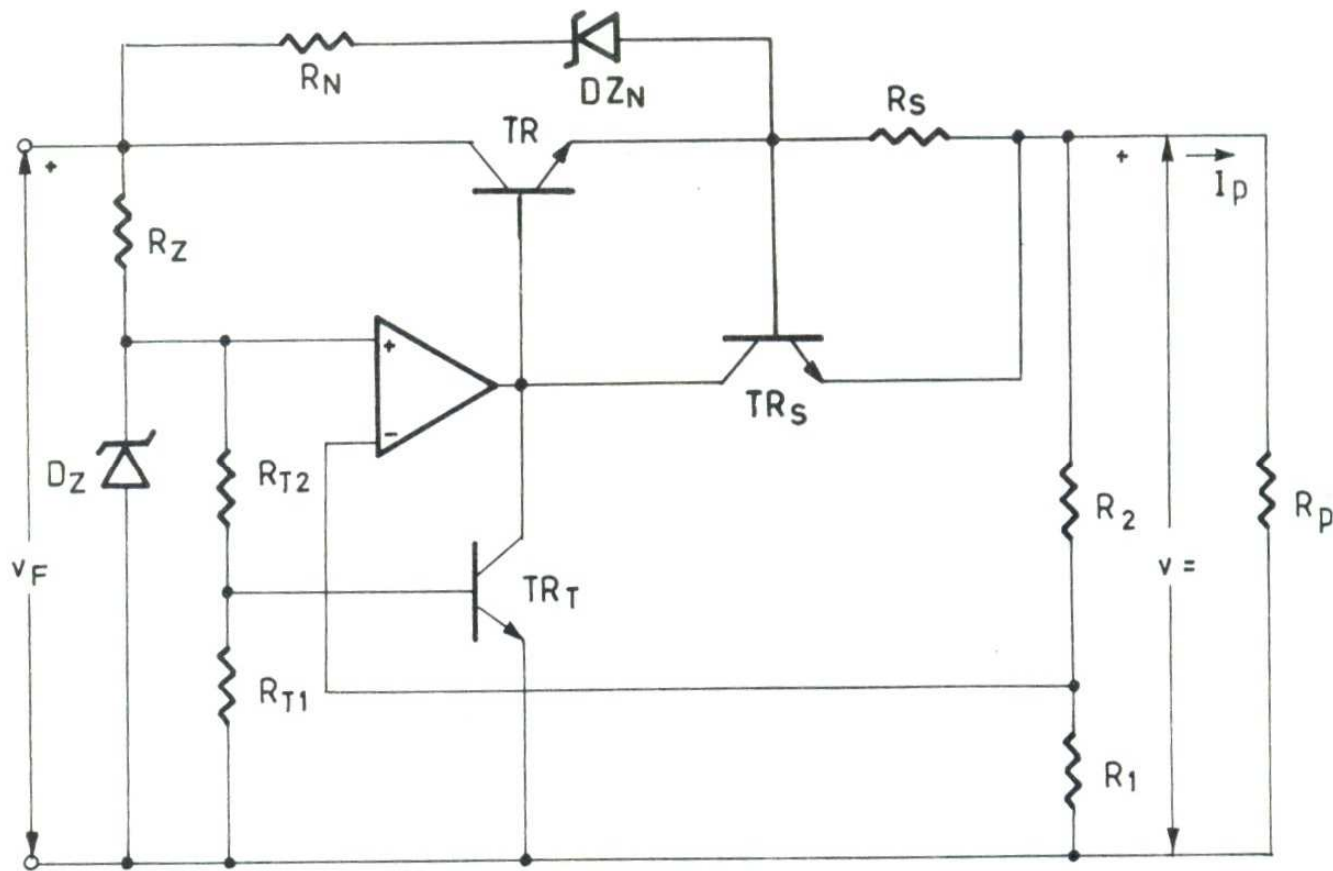


# LINEARNI STABILIZATORI (REGULATORI)

- STABILIZATORI NAPONA OBEZBEĐUJU KONSTANTAN IZLAZNI NAPON PRI PROMENAMA STRUJE POTROŠAČA I ULAZNOG NAPONA

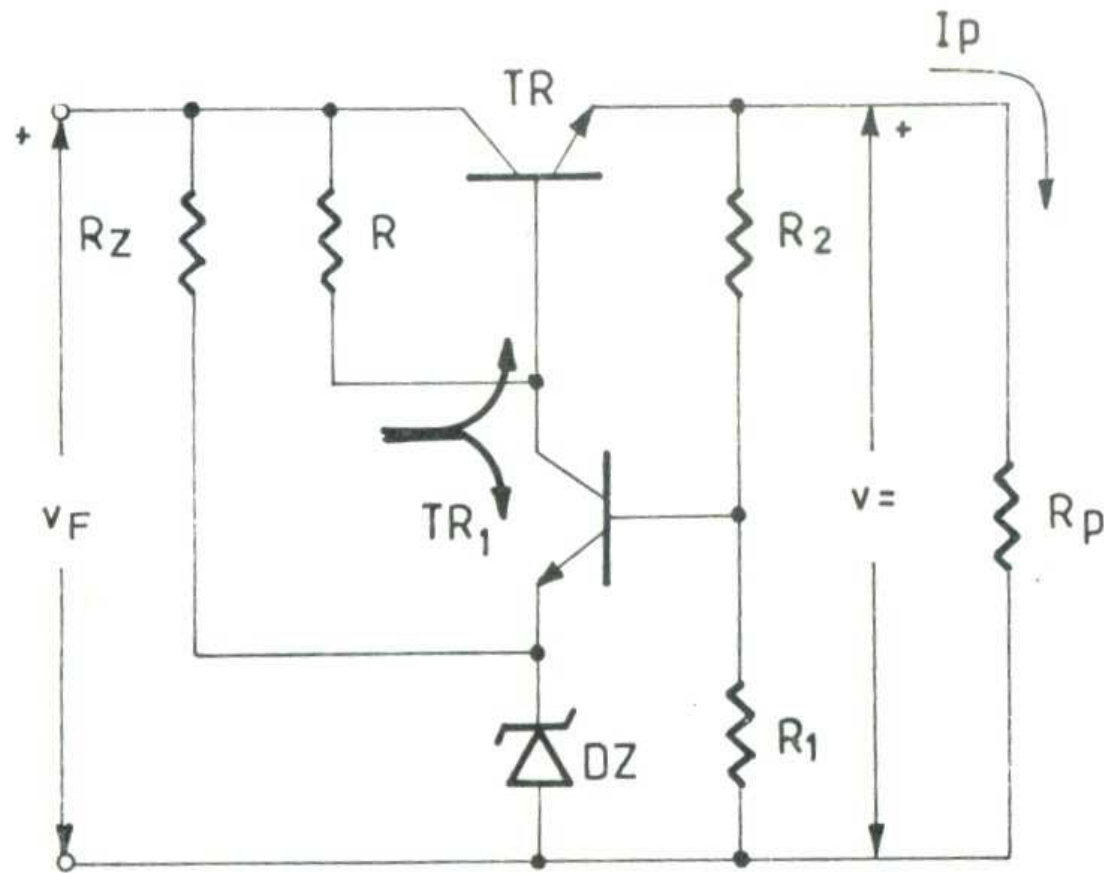


# STABILIZATOR SA KOLIMA ZA ZAŠTITU



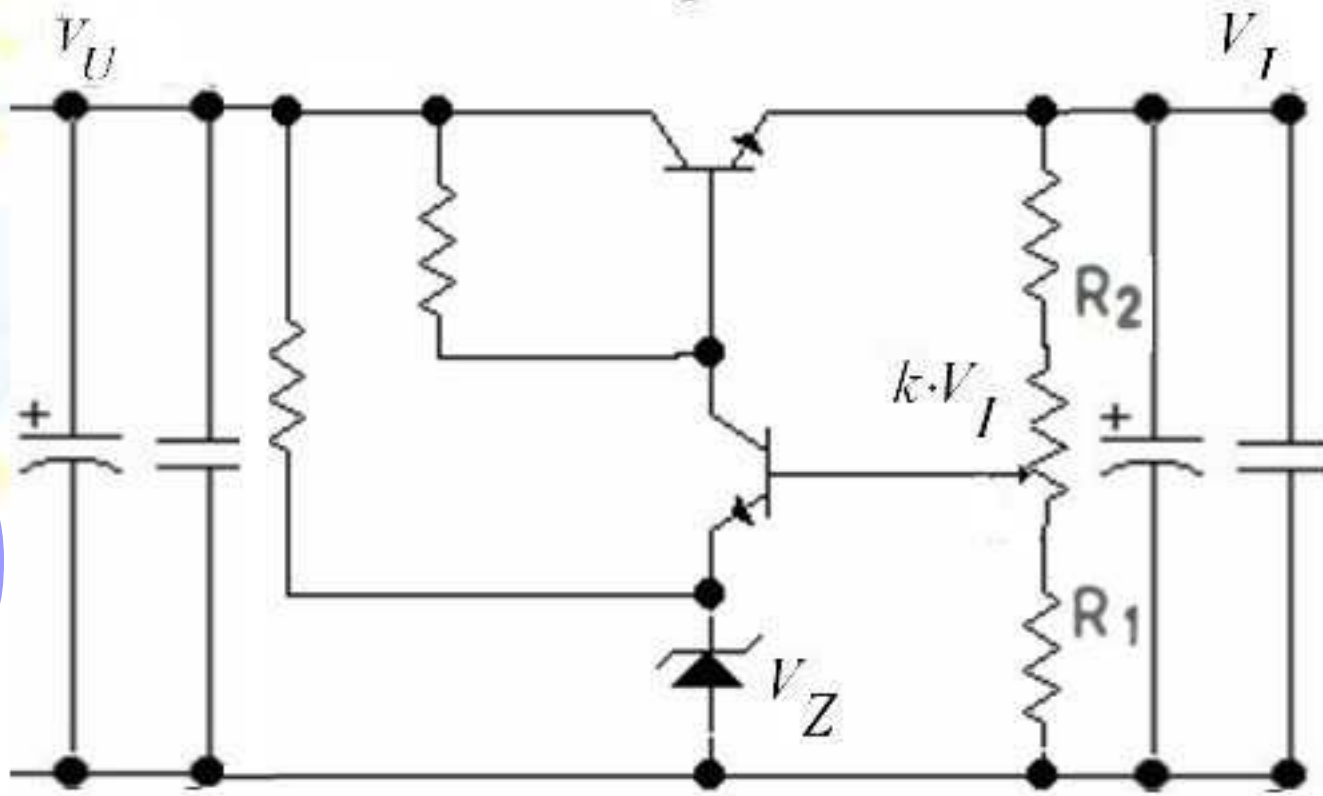


# REALIZACIJA STABILIZATORA U DISKRETNJOJ TEHNICI



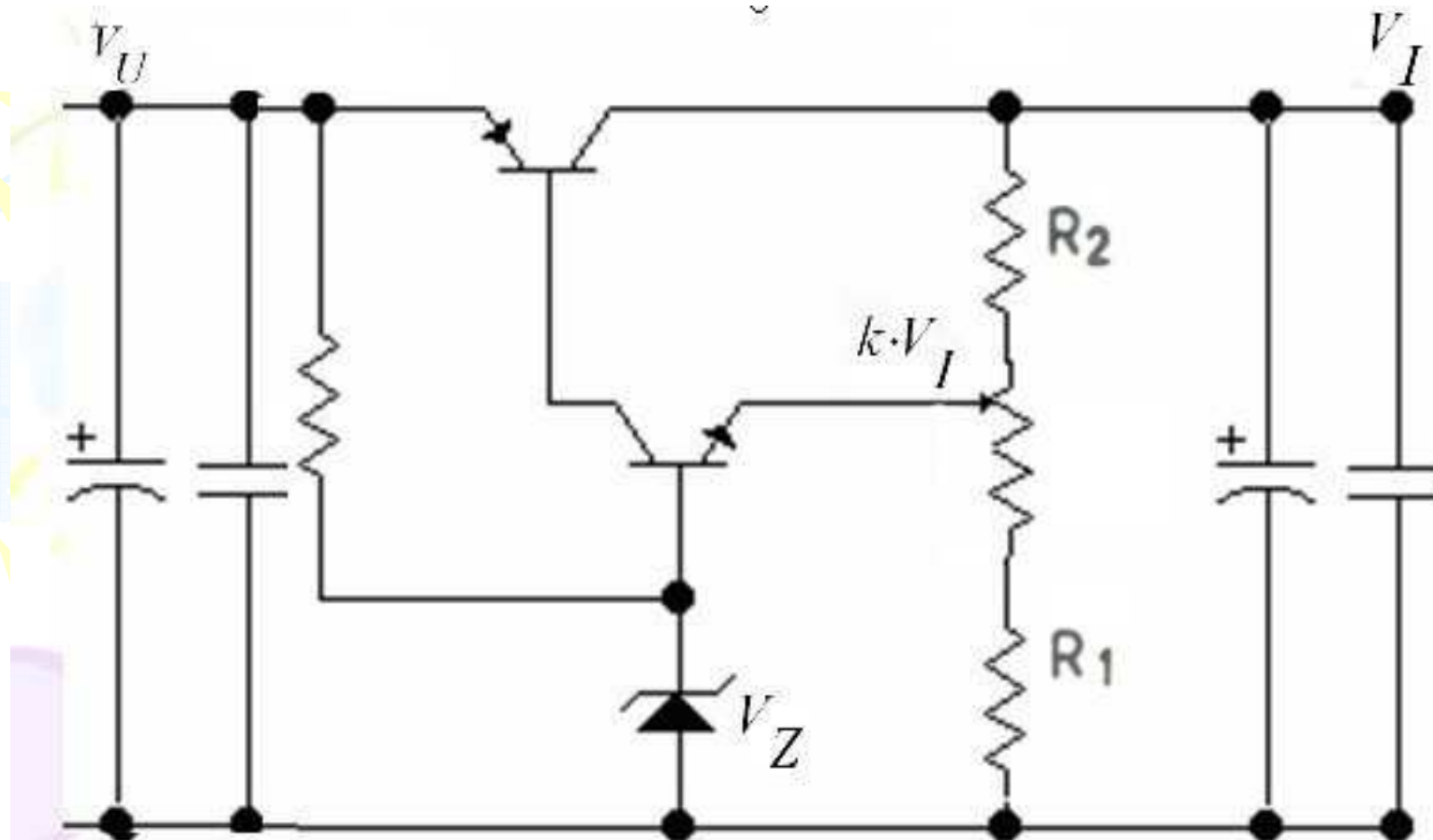
# STABILIZATOR NAPONA SA PODESIVIM IZLAZOM

30



$$V_I \approx \left( \frac{R_2}{R_1} + 1 \right) (V_Z + V_{BE2}) = \frac{1}{k} (V_Z + V_{BE2})$$

# STABILIZATOR NAPONA SA PODESIVIM IZLAZOM

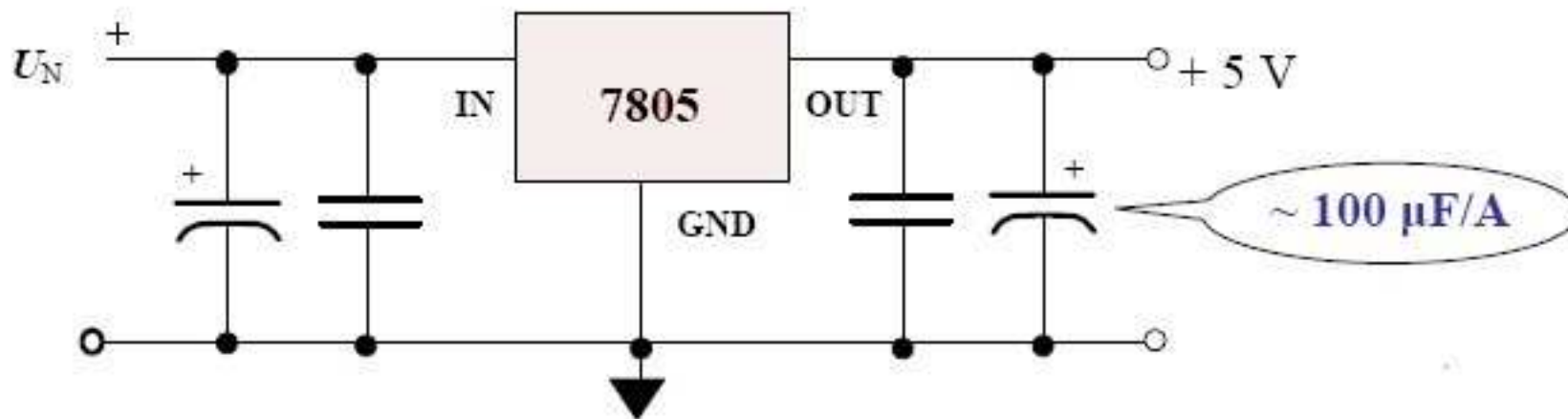


- MINIMALNI ULAZNI NAPON :

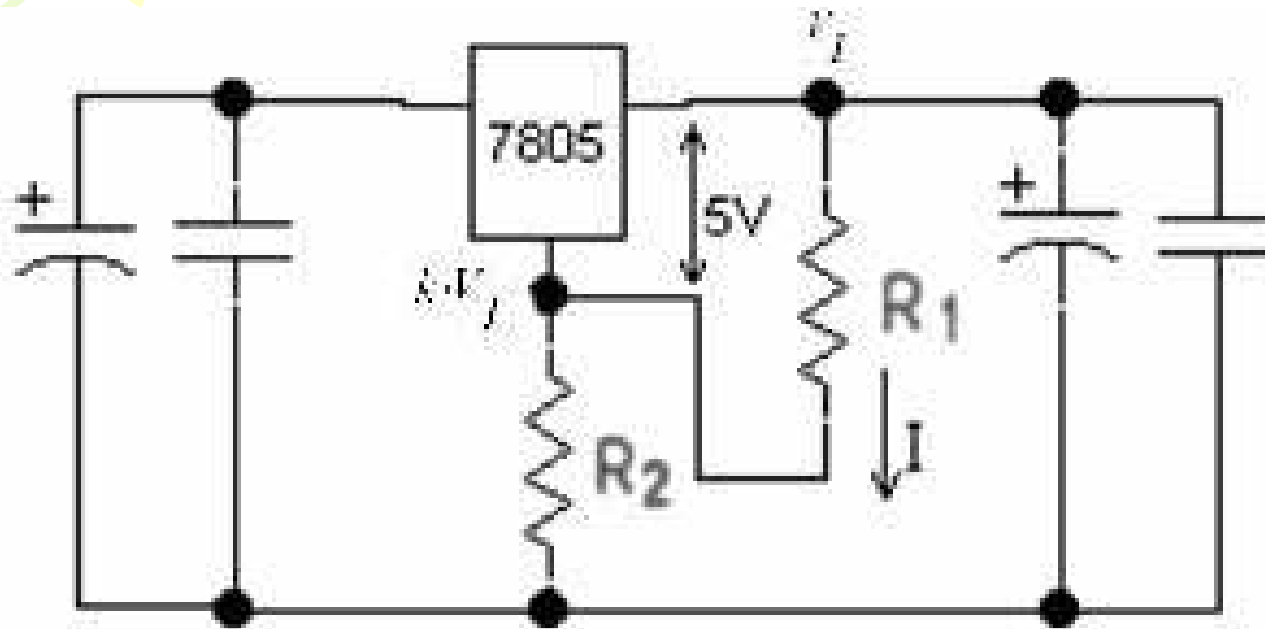
$$V_{U_{MIN}} = V_I + V_{ECSAT}$$

# INTEGRISANI STABILIZATORI NAPONA

- 78XX – INTEGRISANI STABILIZATORI  
FIKSNOG IZLAZNOG NAPONA SA  
KONSTANTNIM NAPONOM XX=05,06,09,12
- 79XX – INTEGRISANI STABILIZATORI KOJI  
DAJU NEGATIVNE NAPONE



# STABILIZATOR ZA IZLAZNI NAPON 6V SA 7805

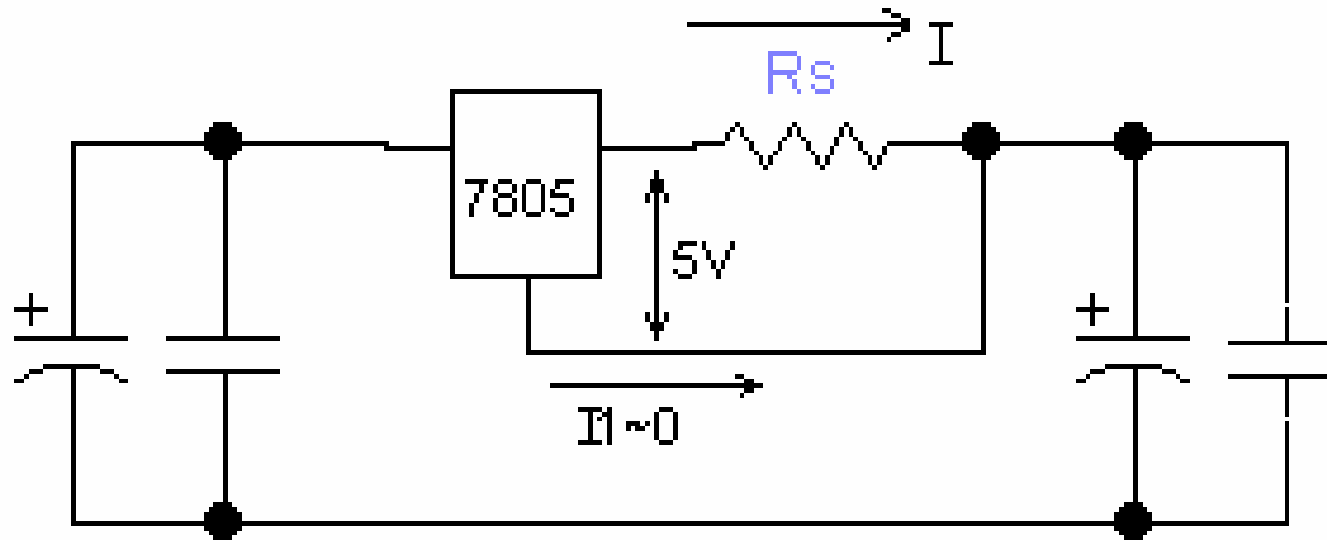


$$I = \frac{5}{R_1}$$

$$V_I = 5 + R_2 I$$

$$V_I = 5 \left( 1 + \frac{R_2}{R_1} \right)$$

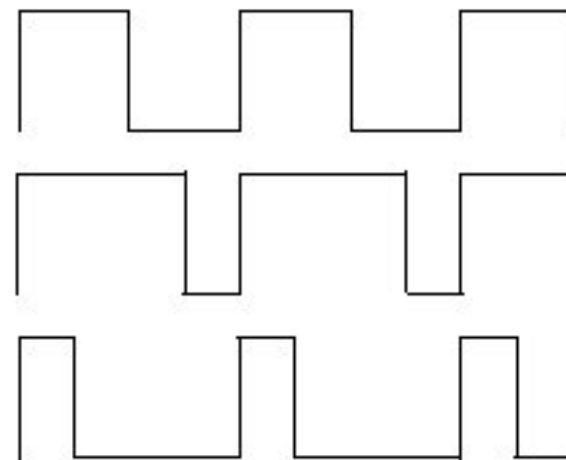
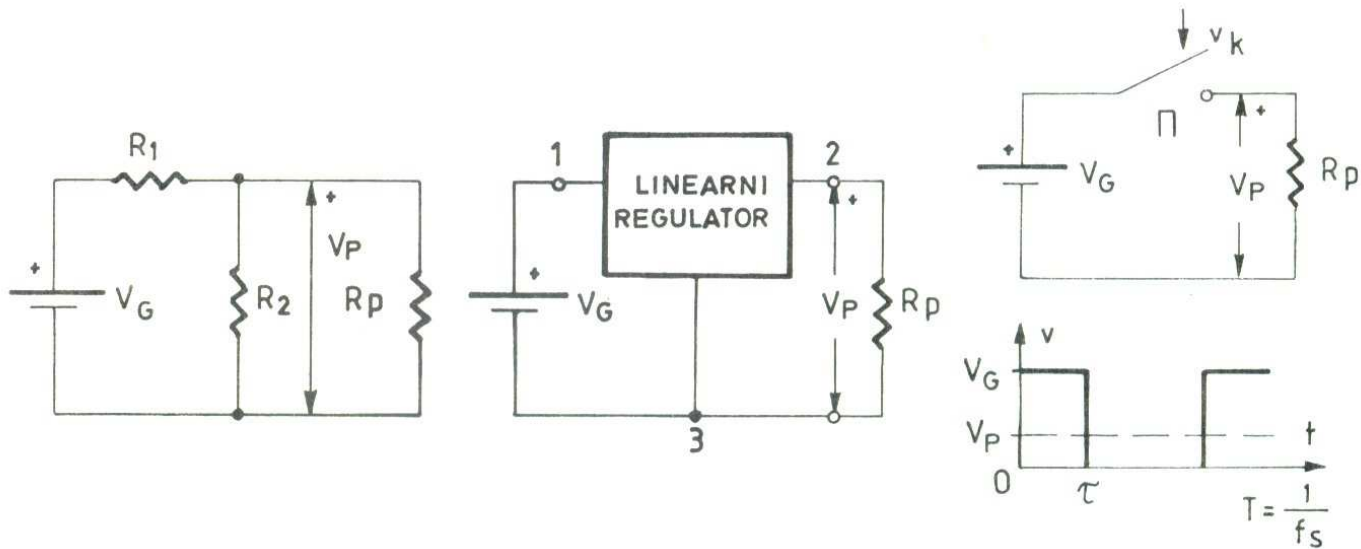
# STABILISANI STRUJNI IZVOR SA 7805



$$I = \frac{5V}{R_s}$$

33

# PREKIDAČKI DC/DC KONVERTORI

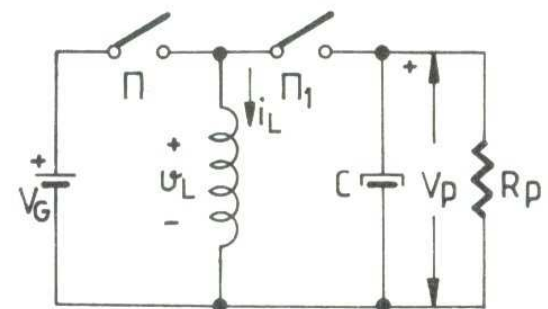
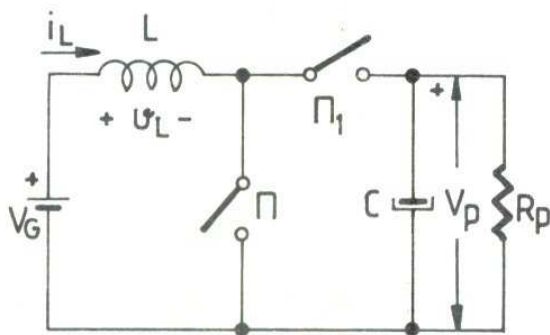
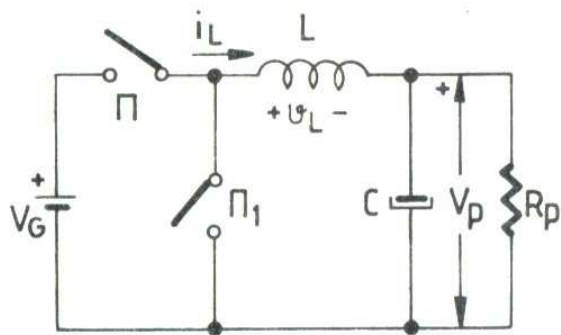


$$\overline{u_o(t)} = \frac{U}{2}$$

$$\overline{u_o(t)} = \frac{3}{4}U$$

$$\overline{u_o(t)} = \frac{1}{4}U$$

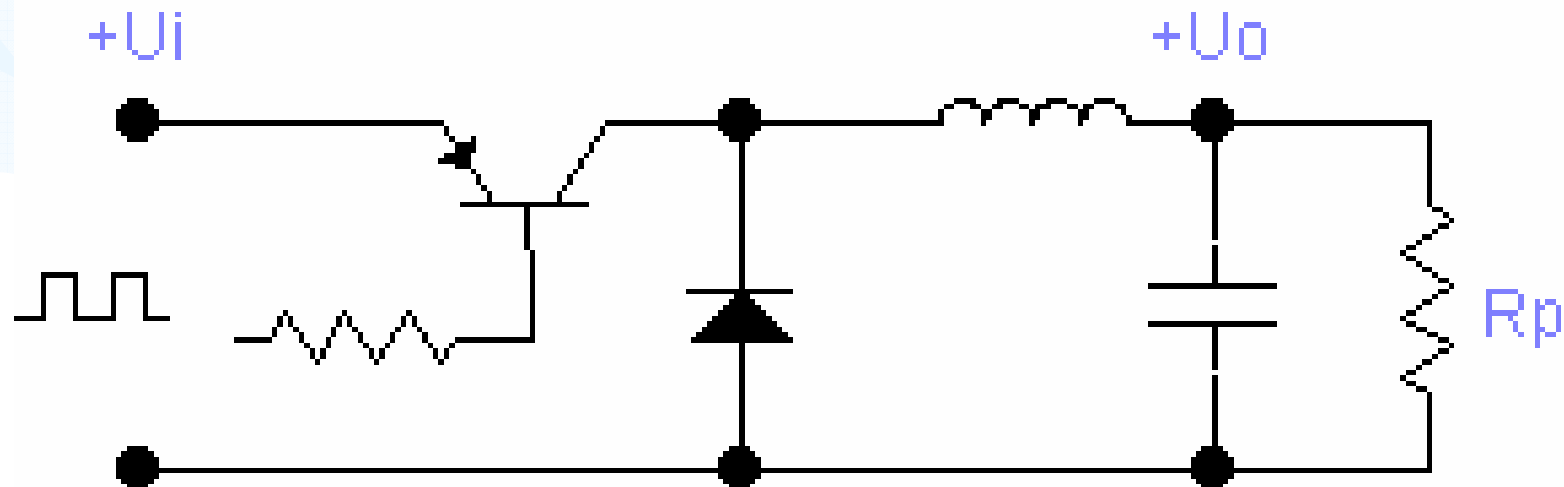
# PREKIDAČKI DC/DC KONVERTORI



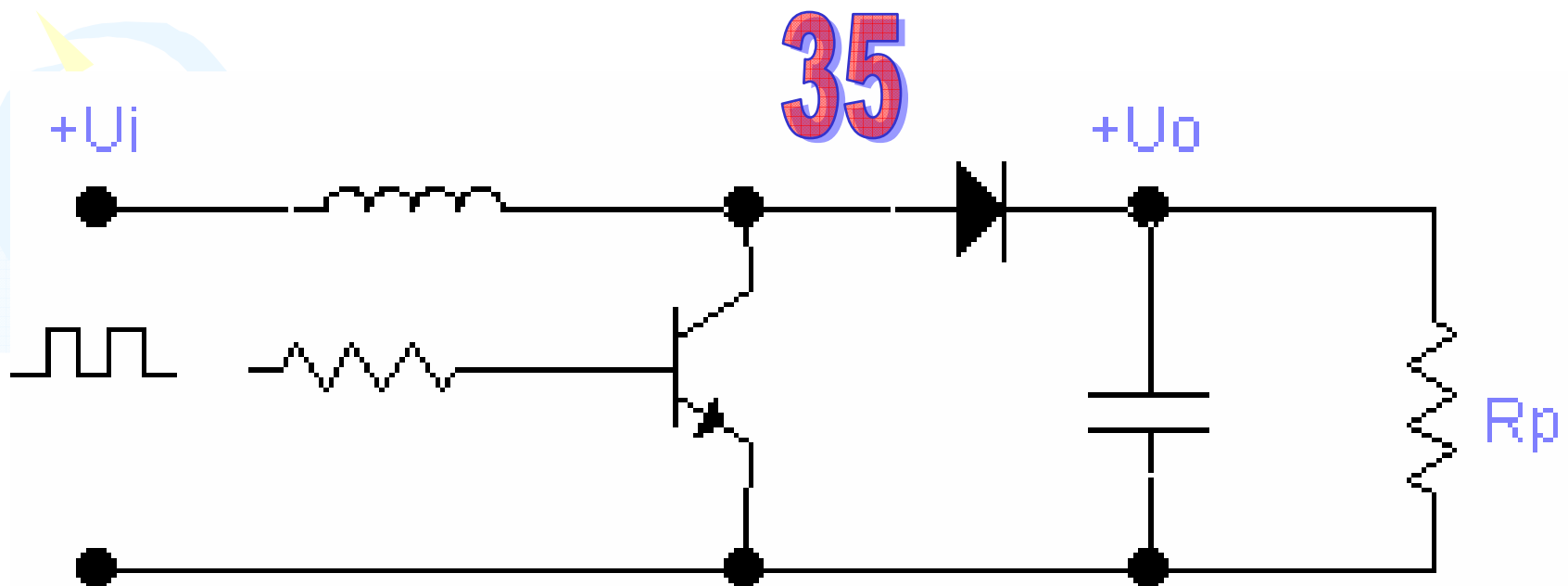


# DC-DC KONVERTOR ZA SNIŽAVANJE NAPONA (STEP DOWN)

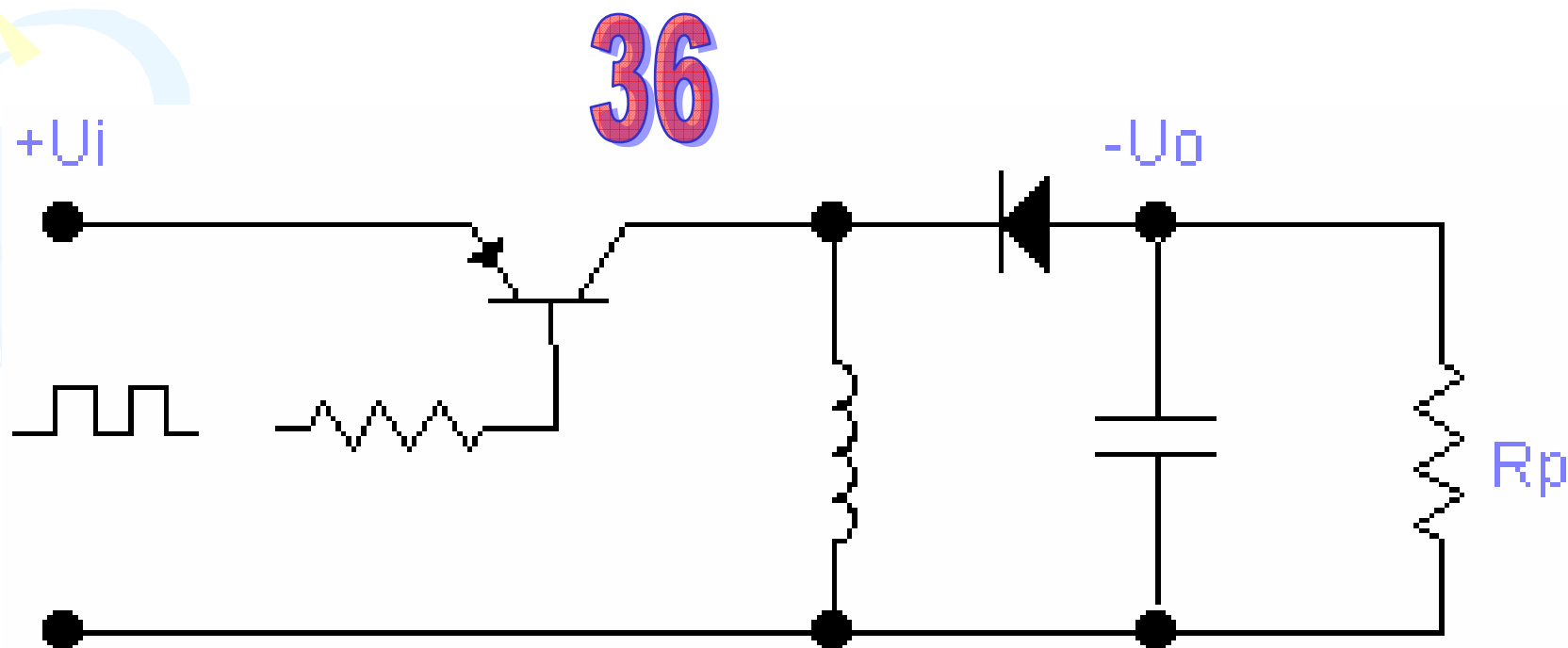
34



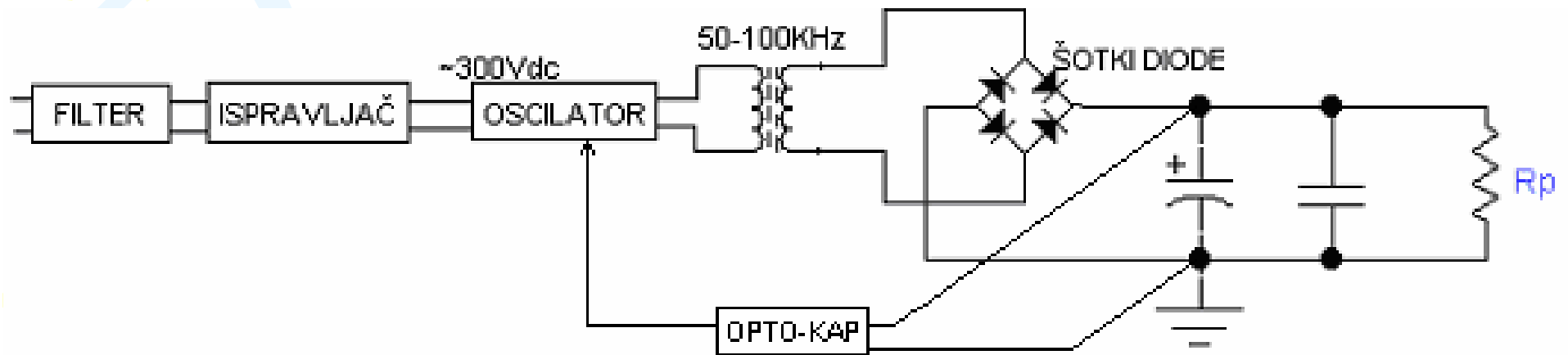
# DC/DC KONVERTOR ZA POVEĆANJE NAPONA (STEP UP)



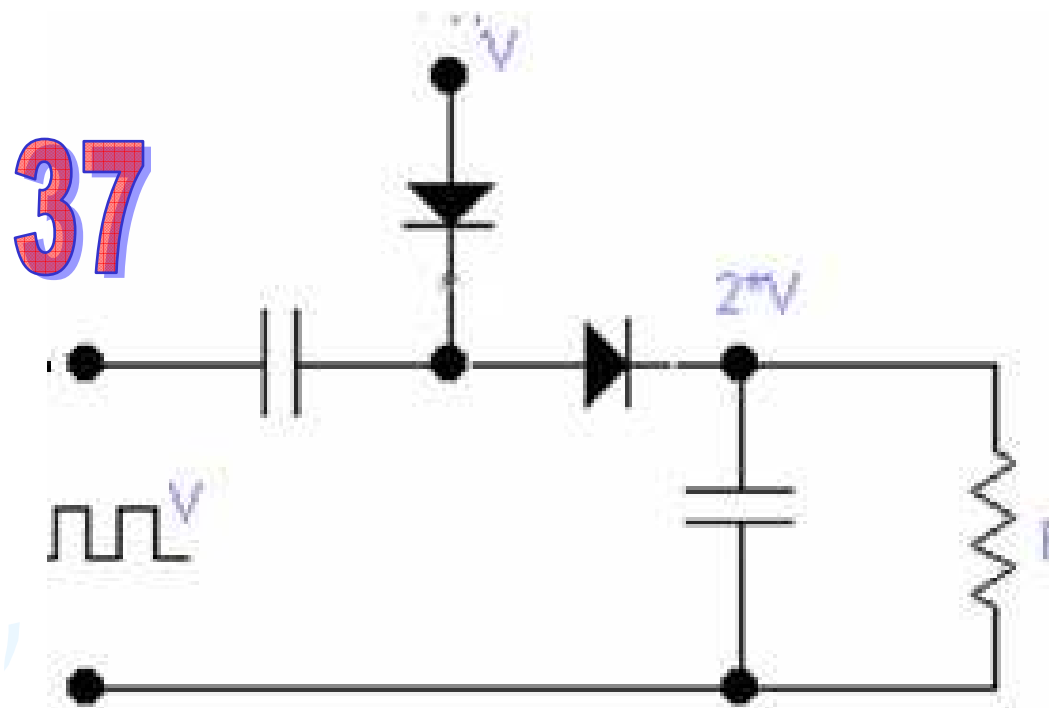
# POZITIVNOG NAPONA PRAVI NEGATIVNI NAPON (POVEĆANJE/SNIŽENJE NAPONA)



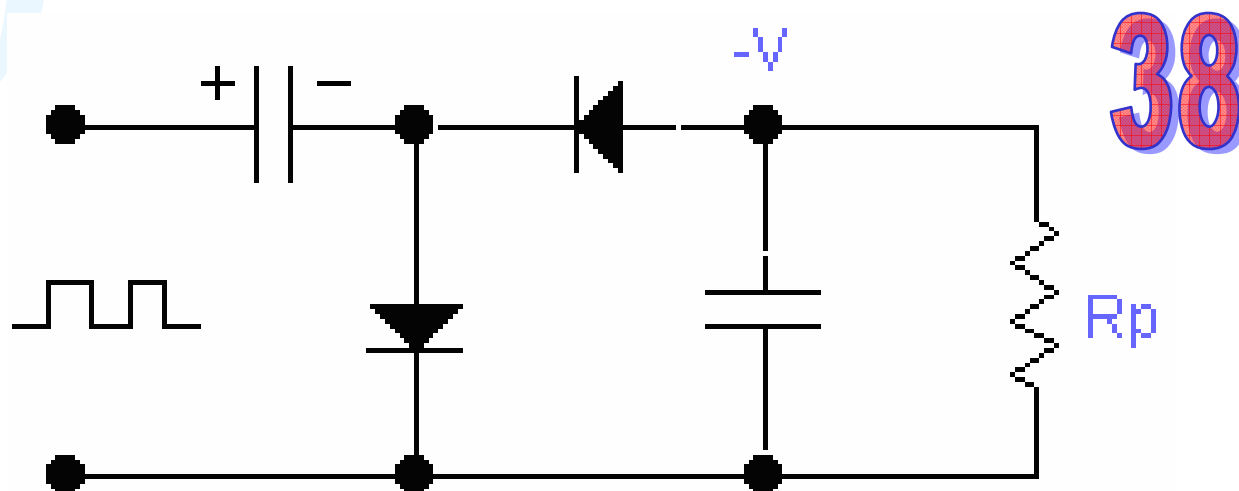
# BLOK ŠEMA PREKIDAČKOG IZVORI ZA NAPAJANJE



# KONDENZATORSKE PUMPE

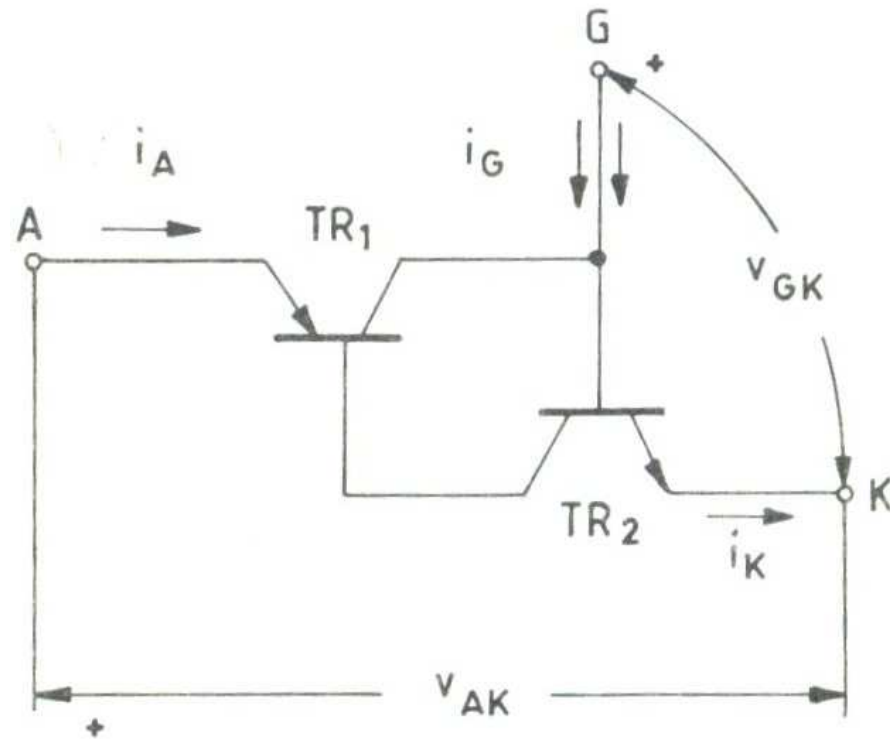
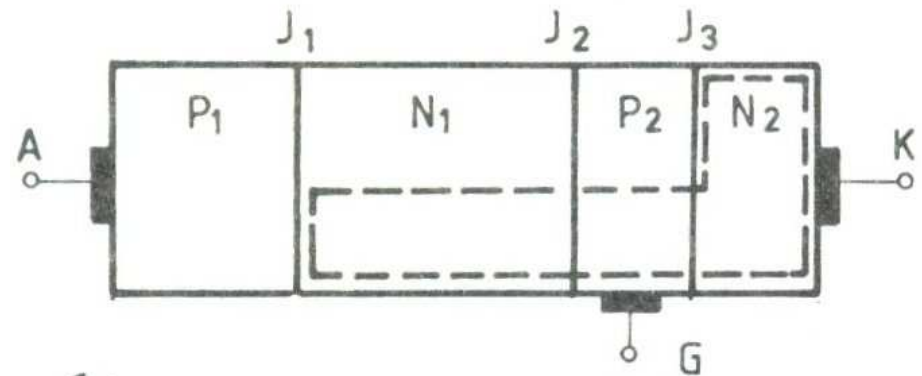


# KONDENZATORSKA PUMPA KOJA OD POZITIVNOG NAPONA PRAVI NEGATIVAN

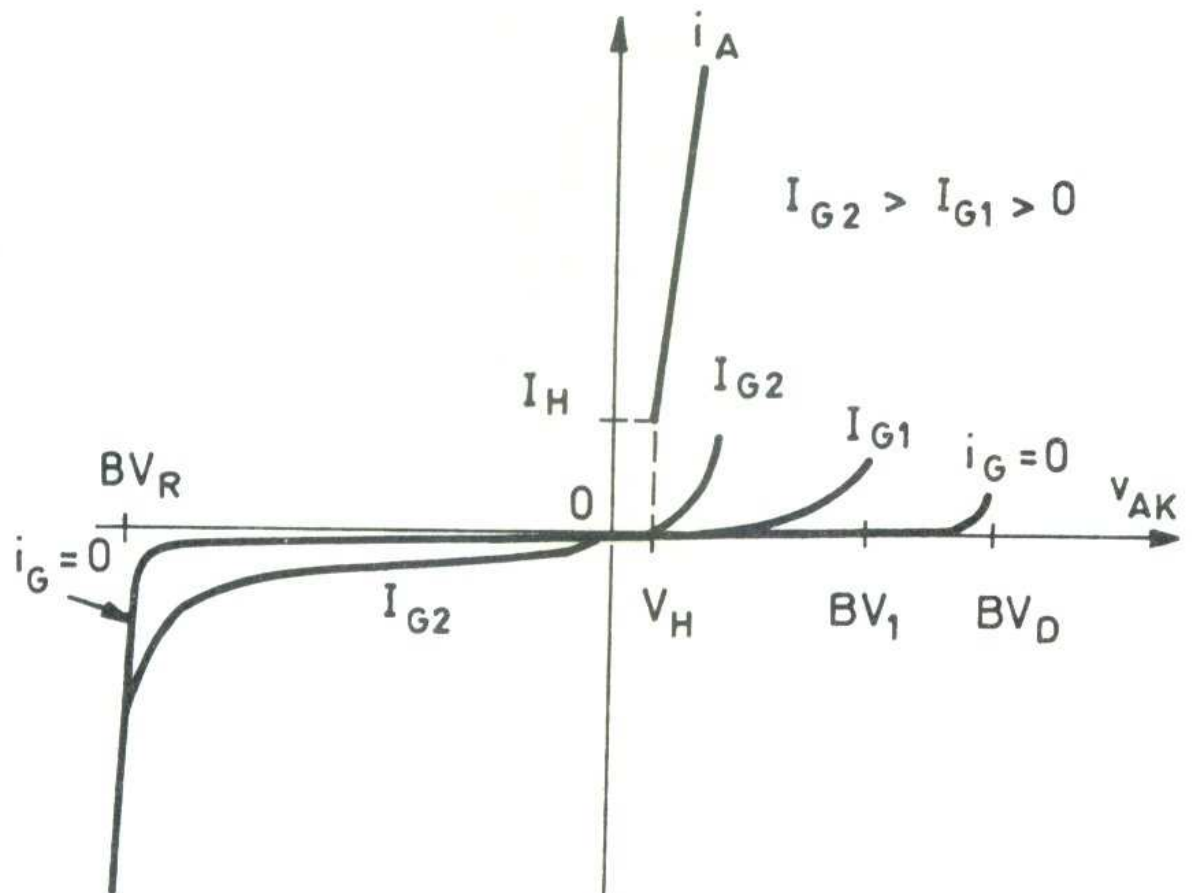
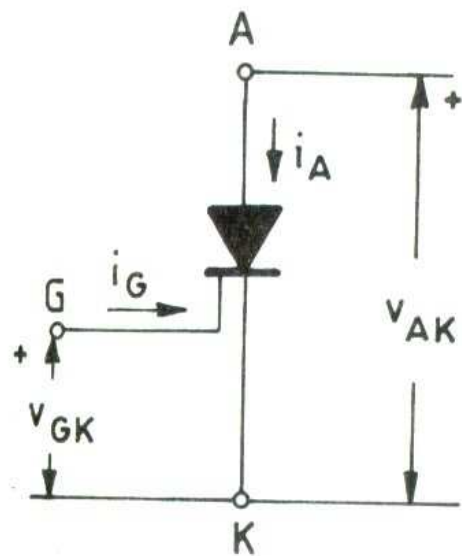


# EKVIVALENTNI MODEL TIRISTORA

19



# STATIČKE KARAKTERISTIKE TIRISTORA





# ISKLJUČENJE TIRISTORA

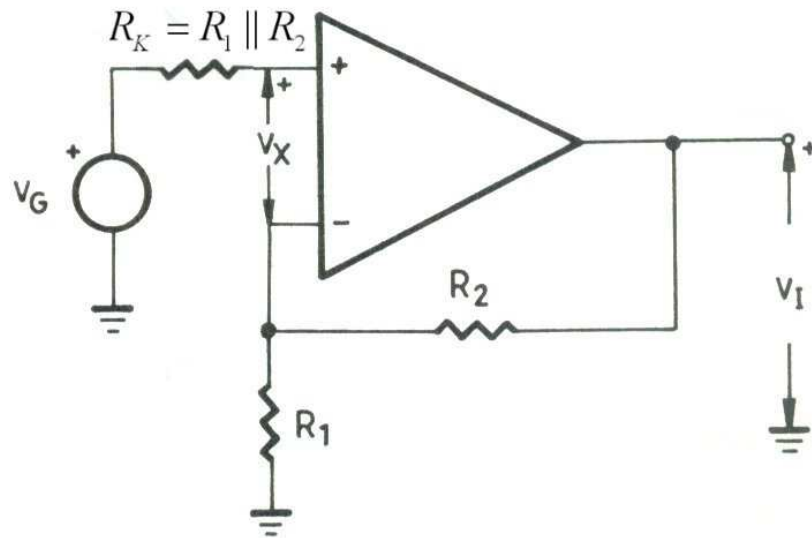
- TIRISTOR SE ISKLJUČUJE TAKO ŠTO SE ANODNA STRUJA SMANJI ISPOD VREDNOSTI STRUJE DRŽANJA  $I_H$
- POSTOJE I TIRISTORI KOJI SE MOGU ISKLJUČIVATI NEGATIVNIM STRUJNIM IMPULSOM NA GEJTU; ZOVU SE GTO (GATE TURN OFF) TIRISTORI

# NEINVERTUJUĆI POJAČAVAČ

- POJAČANJE

$$A = \left( \frac{R_2}{R_1} + 1 \right)$$

$$R_u = \infty$$



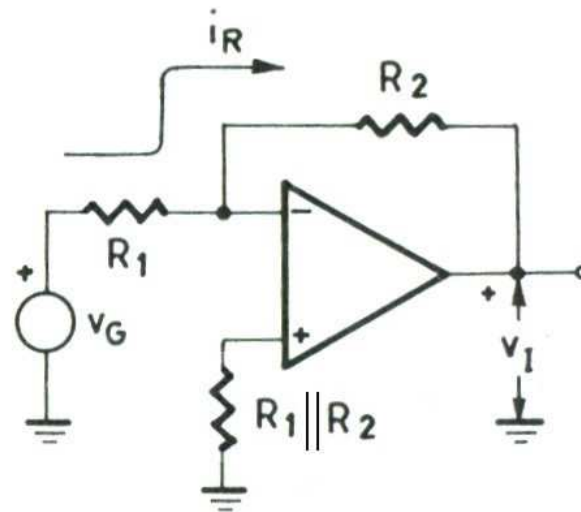
40

# INVERTUJUĆI POJAČAVAČ

- POJAČANJE U ZATVORENOJ POVRATNOJ SPREZI

$$A = -\frac{R_2}{R_1}, R_u = R_1$$

39



# DIFERENCIJALNI POJAČAVAČ

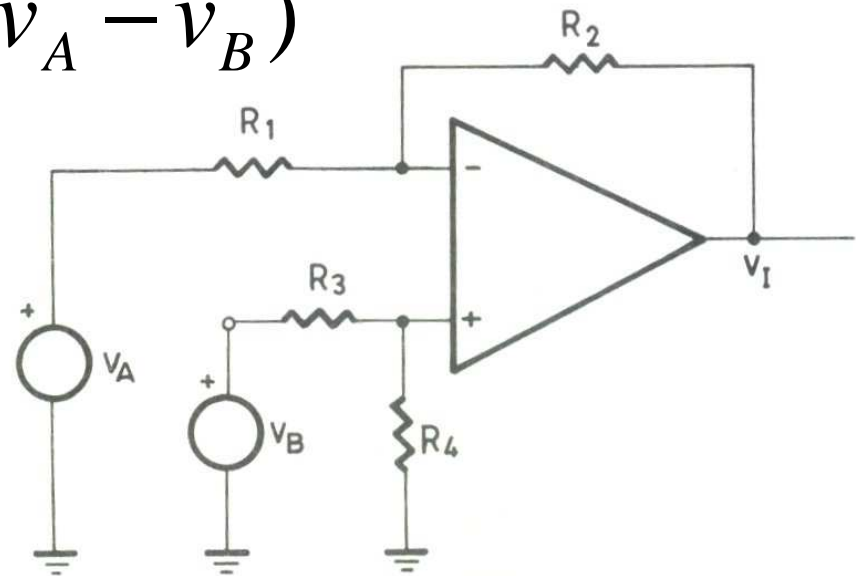
- PRIMENOM PRINCIPA SUPERPOZICIJE IZLAZNI NAPON JE:

$$v_I = \frac{R_4}{R_3 + R_4} \left( 1 + \frac{R_2}{R_1} \right) v_B - \frac{R_2}{R_1} v_A$$

- ZA  $\frac{R_2}{R_1} = \frac{R_4}{R_3} = k$  IZLAZNI NAPON

$$v_I = \frac{R_2}{R_1} (v_B - v_A) = k(v_A - v_B)$$

$$R_u = R_1 + R_3$$



41

# ANALOGNI SABIRAČ

$$i_1 = \frac{v_1}{R_1}$$

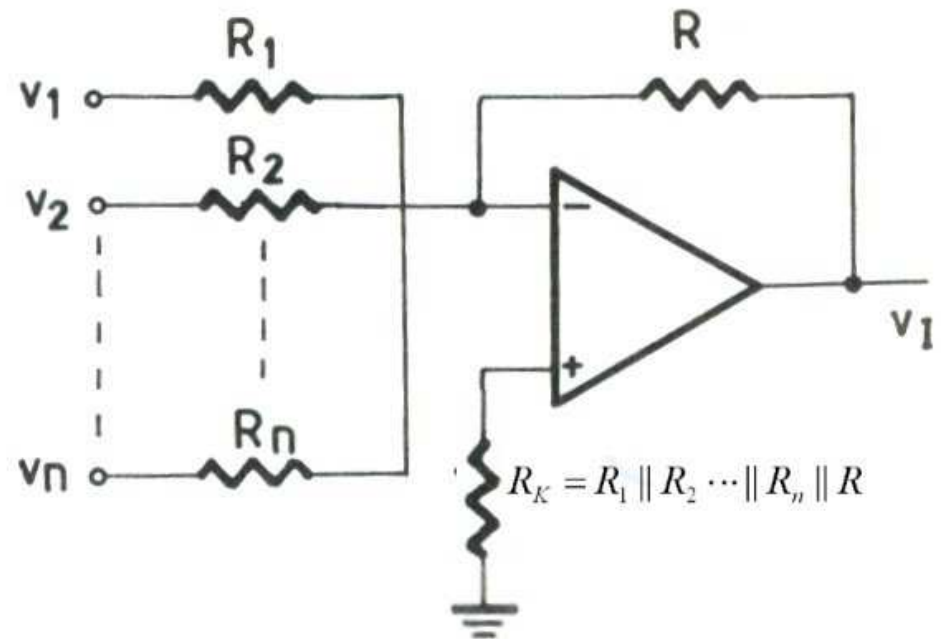
$$i_k = \frac{v_k}{R_k}$$

$$v_I = -\sum_{k=1}^n R i_k = -\sum_{k=1}^n \frac{R}{R_k} v_k$$

$$v_I = A_1 v_1 + A_2 v_2 + \dots + A_n v_n$$

$$A_1 = -\frac{R}{R_1}, A_2 = -\frac{R}{R_2}, \dots, A_n = -\frac{R}{R_n}$$

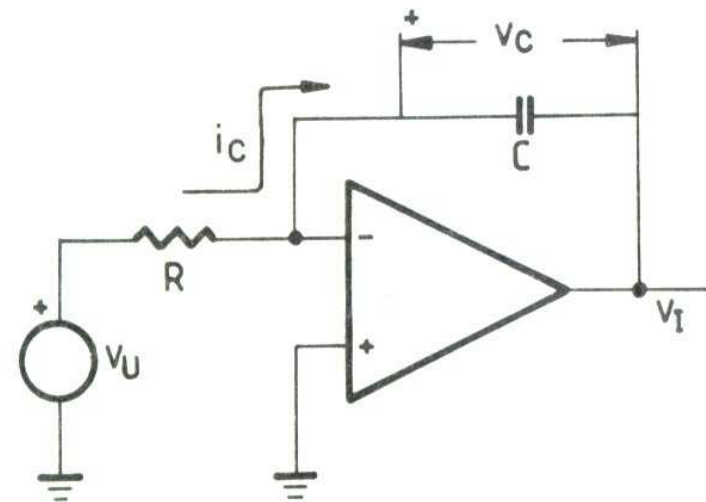
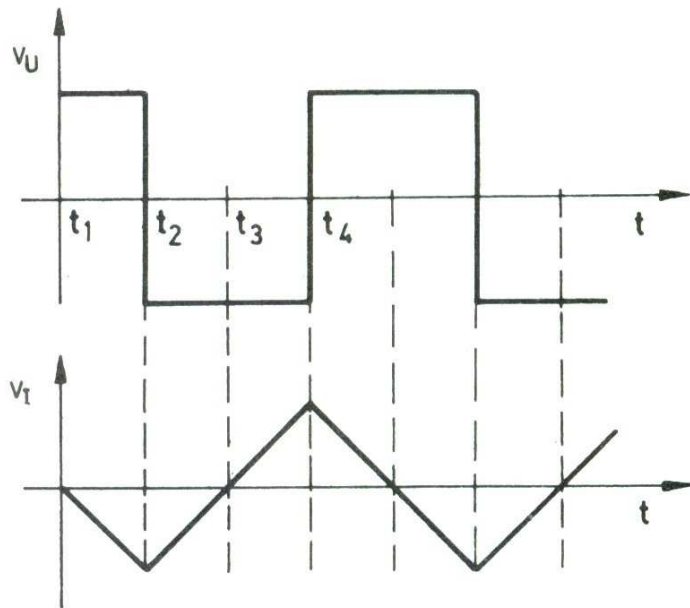
$$R_{u1} = R_1, R_{u2} = R_2, \dots, R_{un} = R_n$$



42

# INTEGRATOR

$$v_I = -v_C = -\frac{1}{C} \int i_C dt = -\frac{1}{RC} \int v_u(t) dt$$

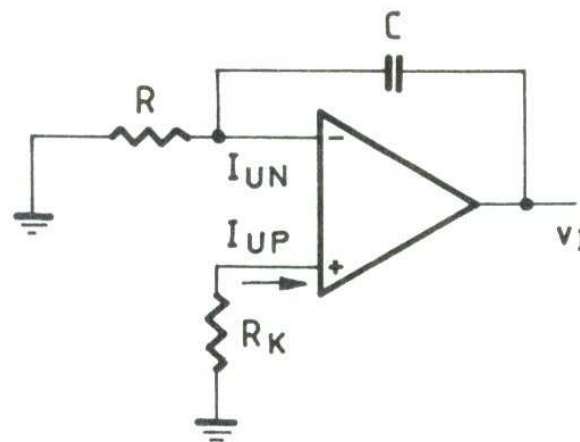


# UTICAJ ULAZNIH STRUJA I NAPONA OFSETA NA RAD INTEGRATORA

- ULAZNA STRUJA  $I_{UN}$  BI PODIZALA IZLAZNI NAPON DO ODLASKA OP U ZASIĆENJE

$$v_I = -R_k I_{UP} + \frac{1}{C} \int \left( I_{UN} - \frac{R_K}{R} I_{UP} \right) dt$$

- OTPORNIK  $R_K$  RUMANJUJE UTICAJ ULAZNIH STRUJA



- NAPON OFSETA TAKODJE UTIČE NA IZLAZNI NAPON

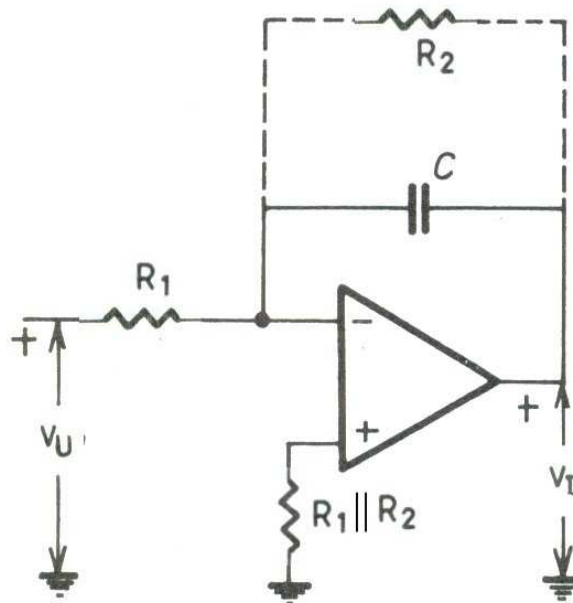
$$v_I = V_{os} + \frac{1}{C} \int \frac{V_{os}}{R} dt$$

# INTEGRATOR

- PORAST IZLAZNOG NAPONA USLED JEDNOSMERNIH KOMONENTI ULAZNIH STRUJA I NAPONA OFSETA MOŽE SE OGRANIČITI OTPORNIKOM R2

$$R_2 \gg R_1$$

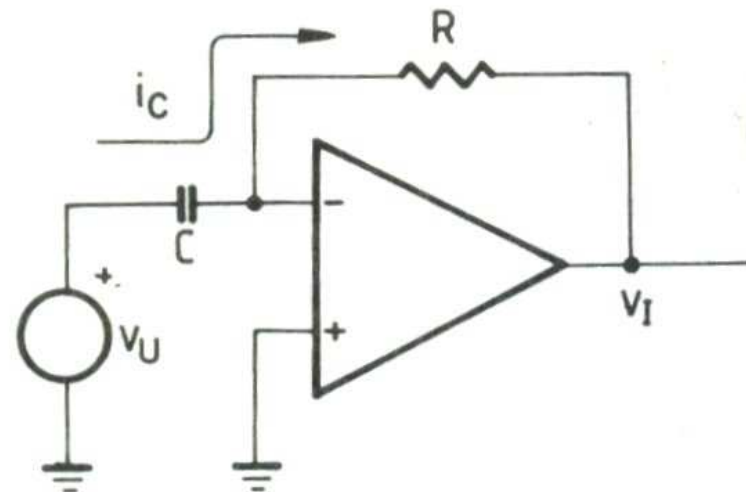
43



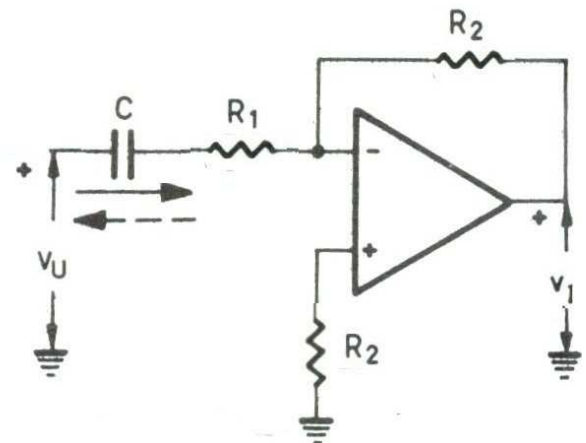


# DIFERENCIJATOR

$$v_I = -R_C i_C = -RC \frac{dv_u}{dt}$$



$$R_1 \ll R_2$$



44

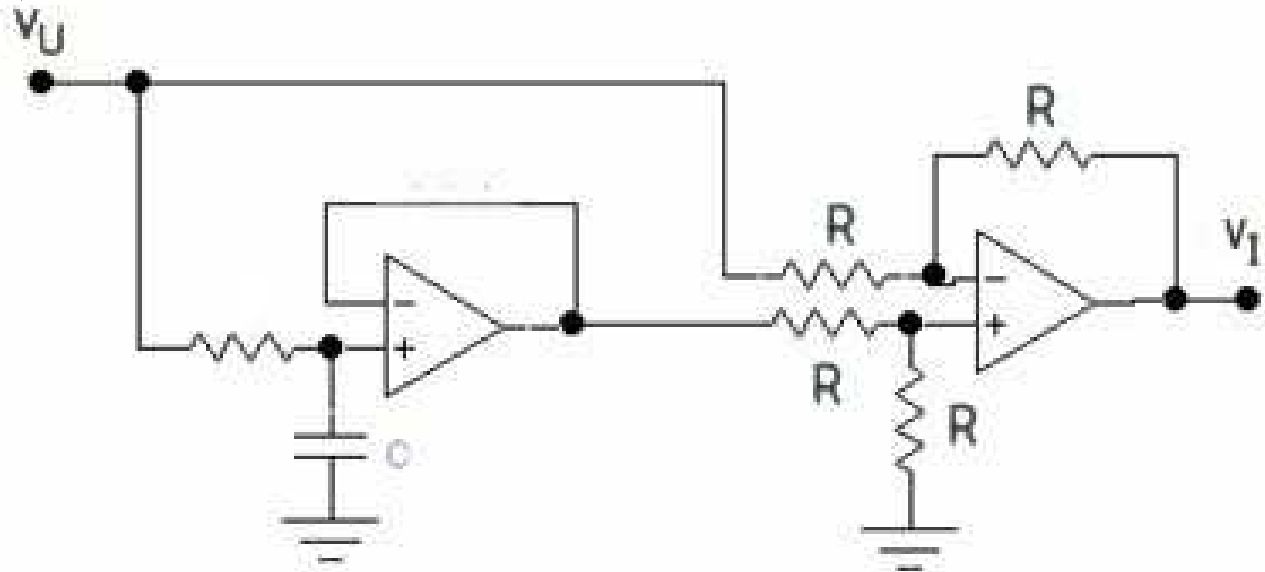
# POTISKIVANJE SPOROPROMENLJIVE JEDNOSMERNE KOMPONENTE

$$v_U = V + v_p(t)$$

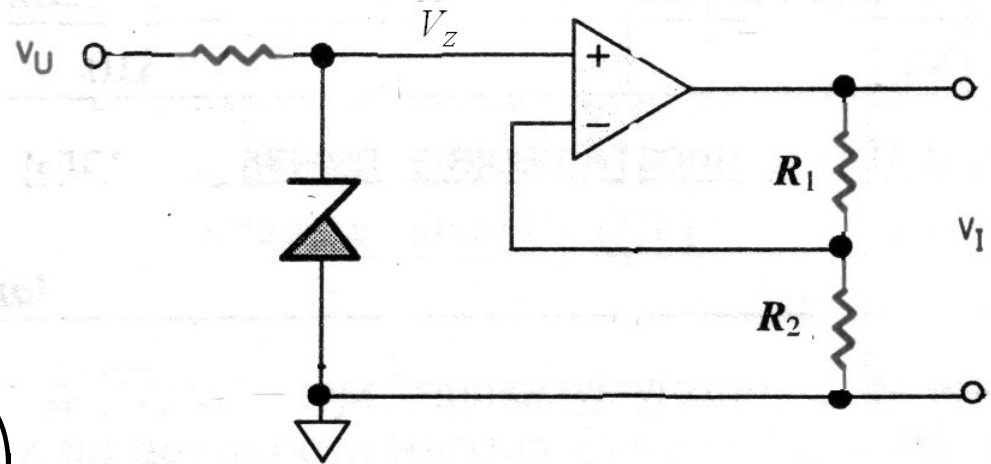
$$\overline{v_U} = V$$

$$v_I = -v_p(t)$$

45

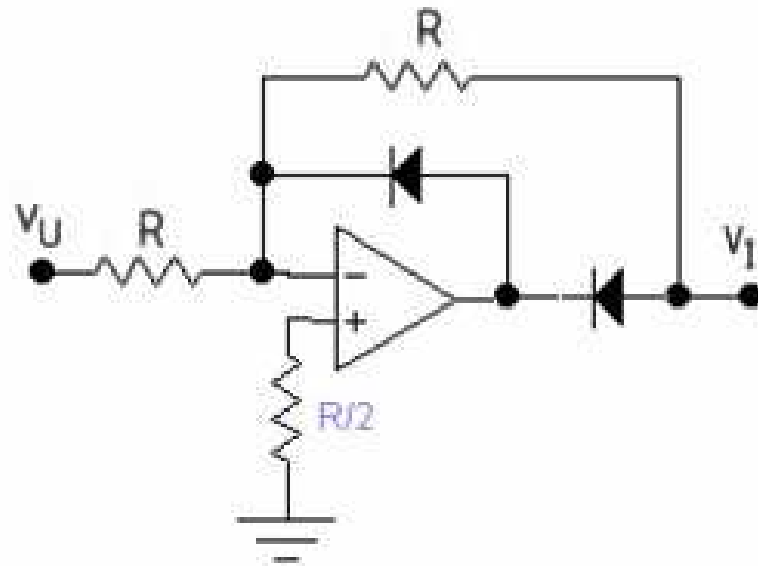


# STABILISAN NAPONSKI IZVOR



$$v_I = V_Z \left( 1 + \frac{R_2}{R_1} \right)$$

# IDEALNA DIODA



47

