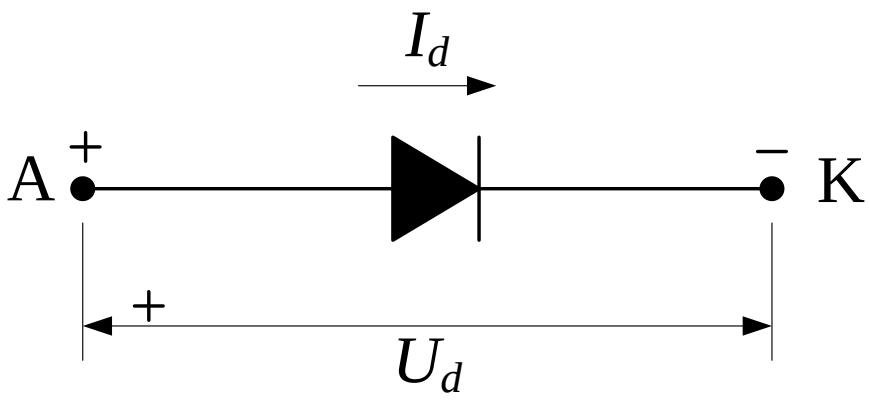
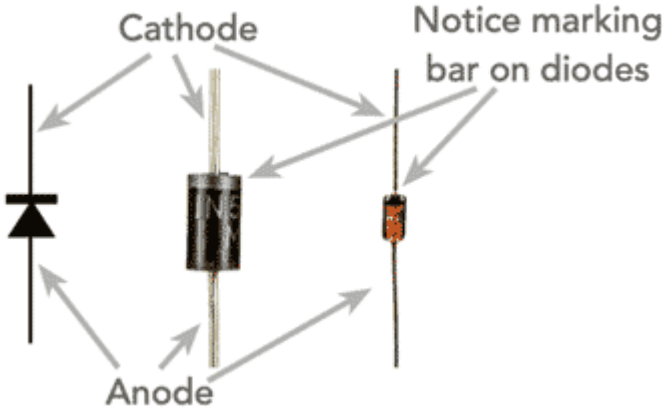
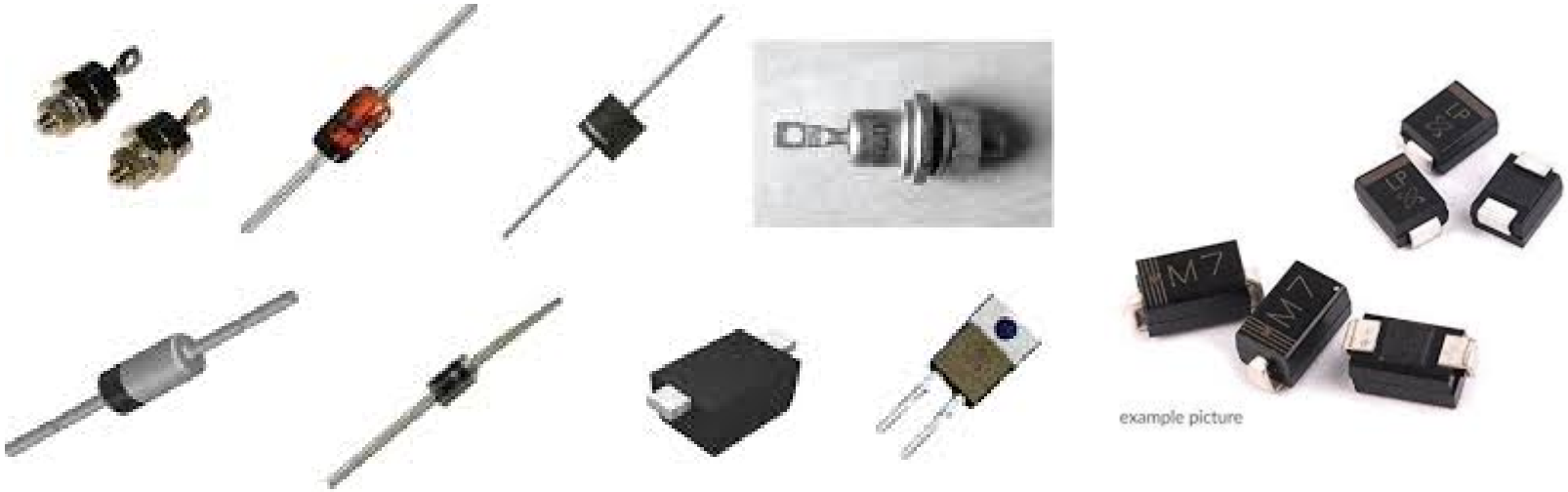
DIODE

- ISPRAVLJAČI I STABILIZATORI NAPONA

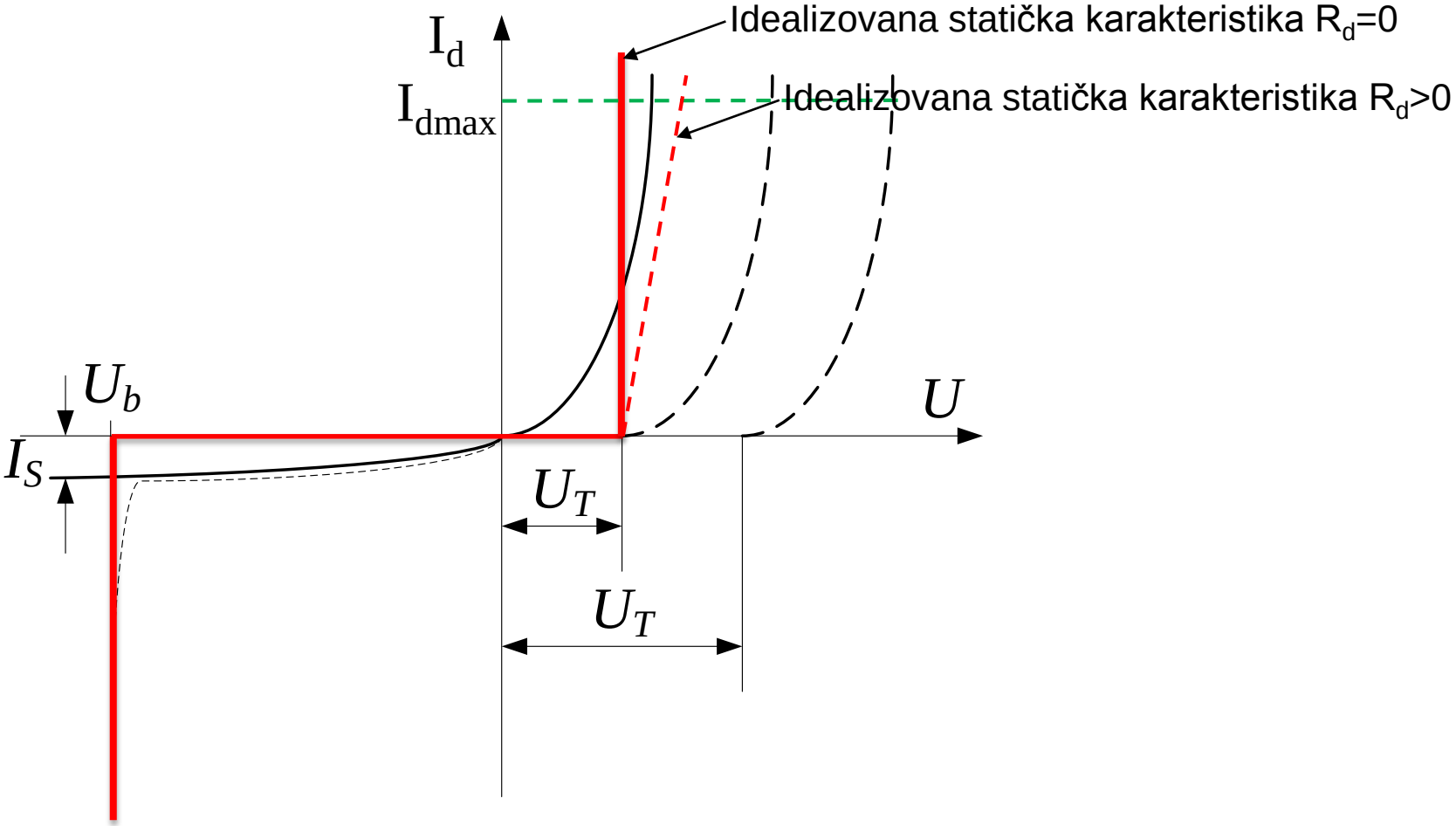
Referentni smerovi struje i napona diode



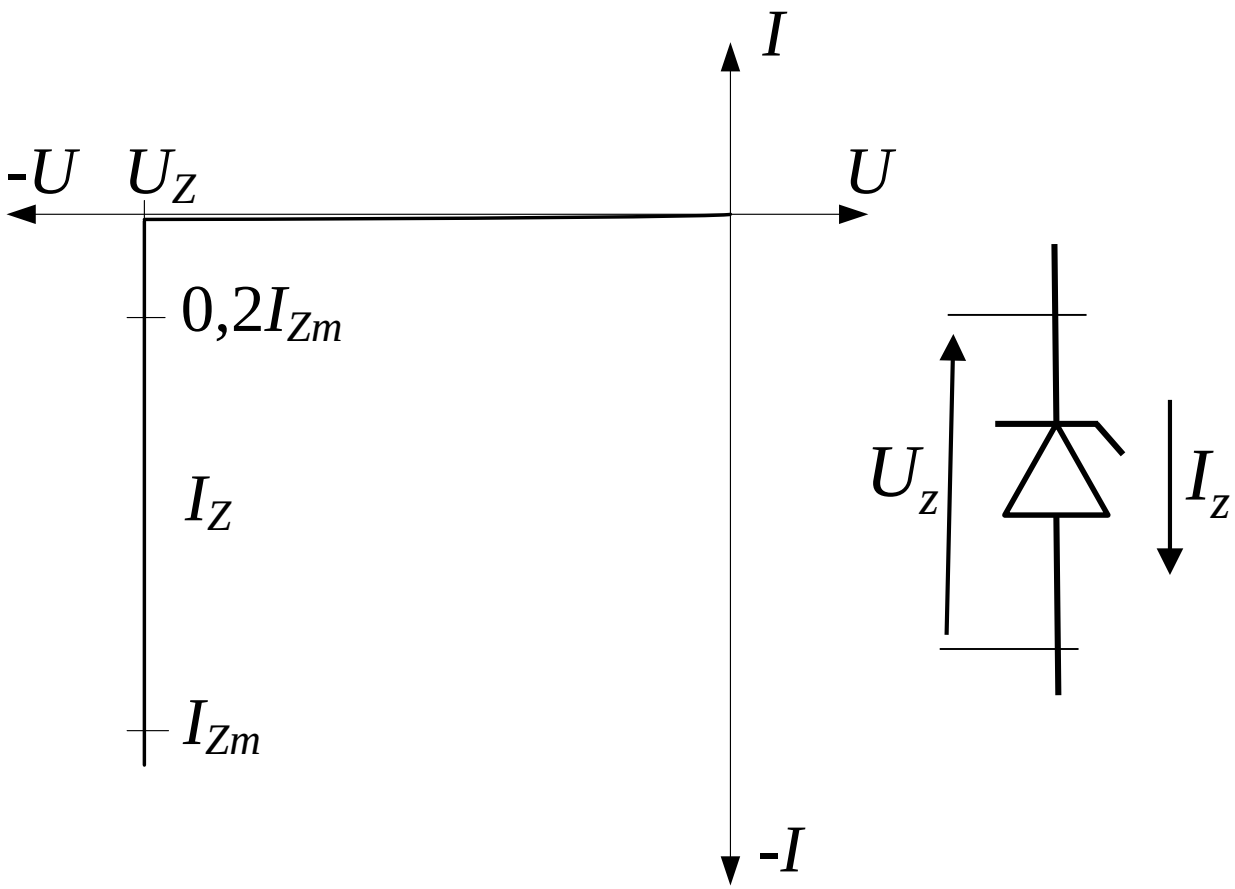




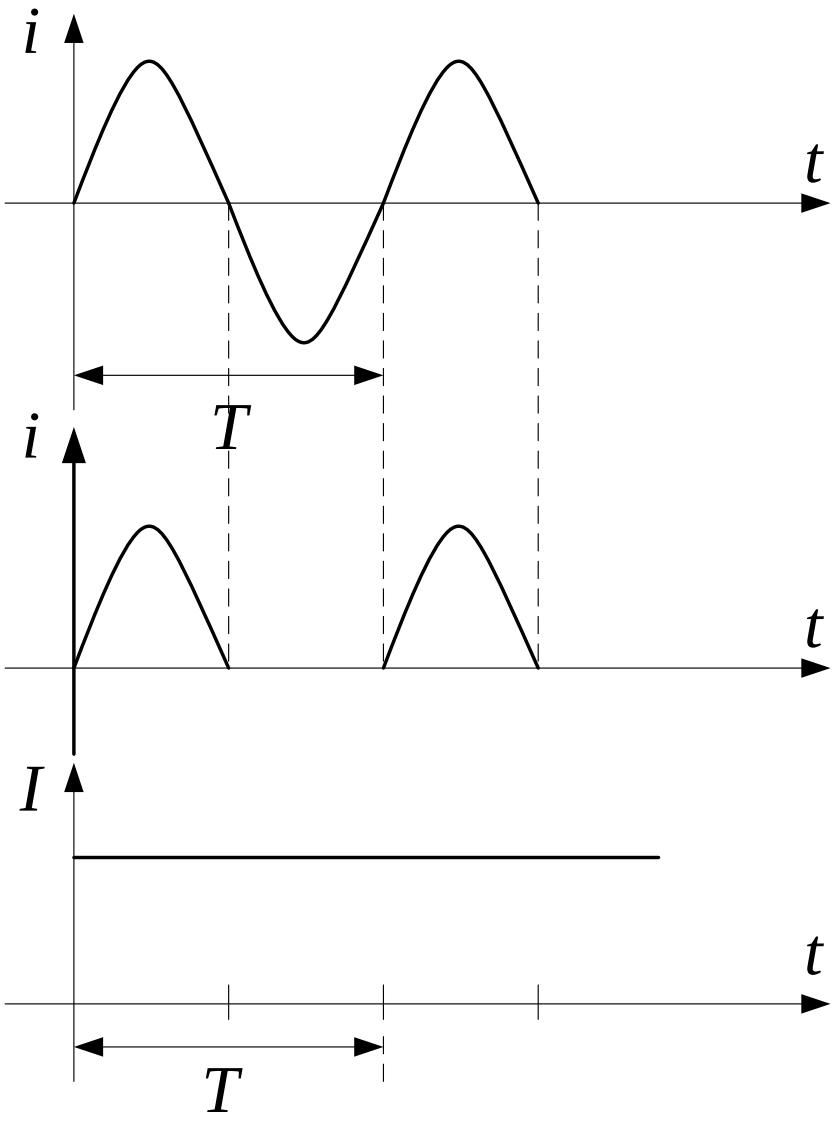
Statička karakteristika diode



Zener ili probojne diode



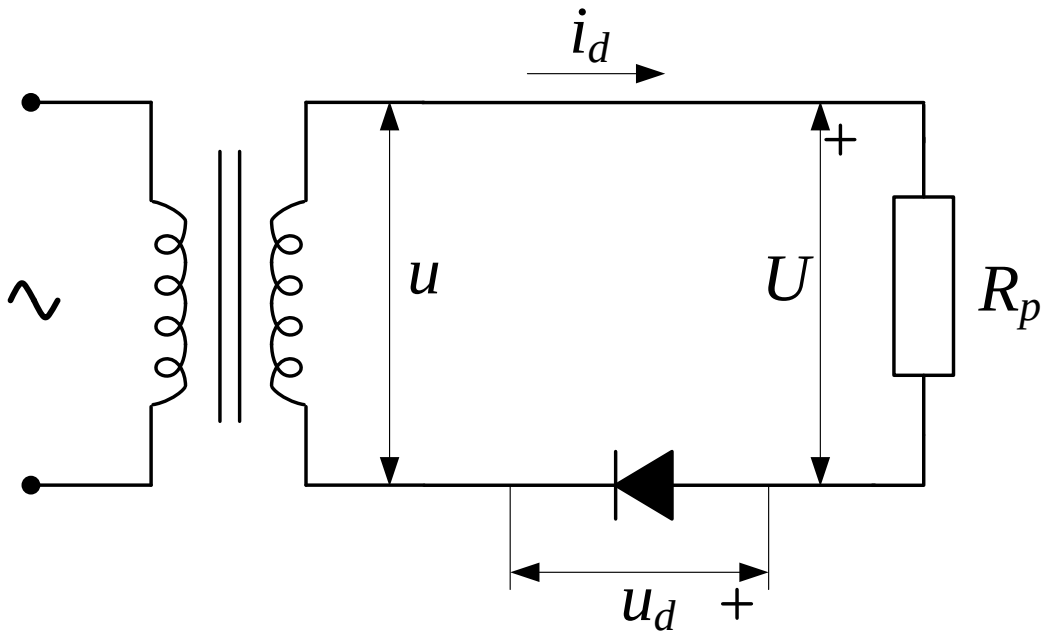
Usmeravanje naizmenične struje



- idealni usmerač

- idealni ispravljač

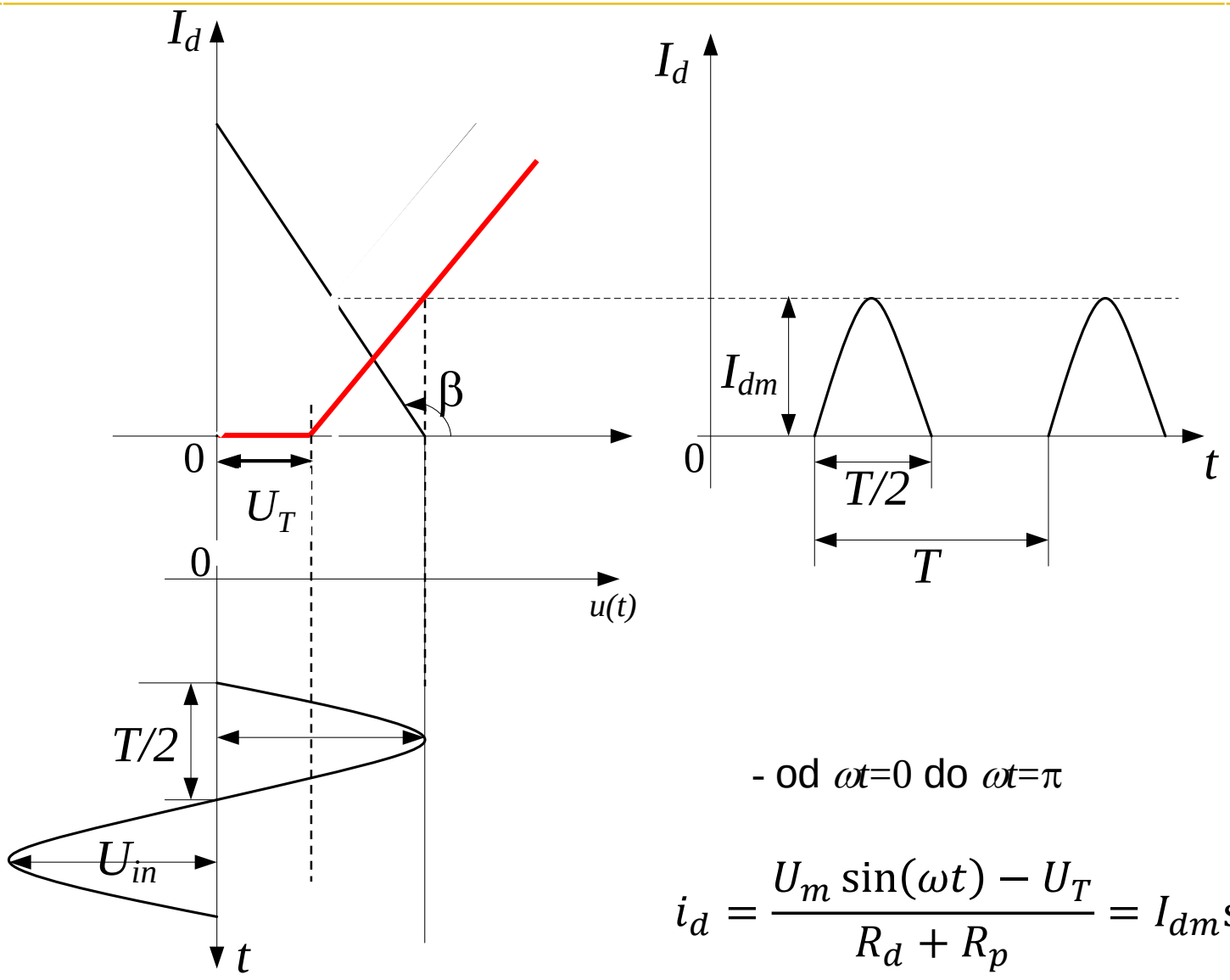
Jednofazno polutalasno usmeravanje



$$u(t) = U_m \cdot \sin(\omega \cdot t)$$

$$U_m \cdot \sin(\omega \cdot t) - u_d - R_p \cdot i_d = 0$$

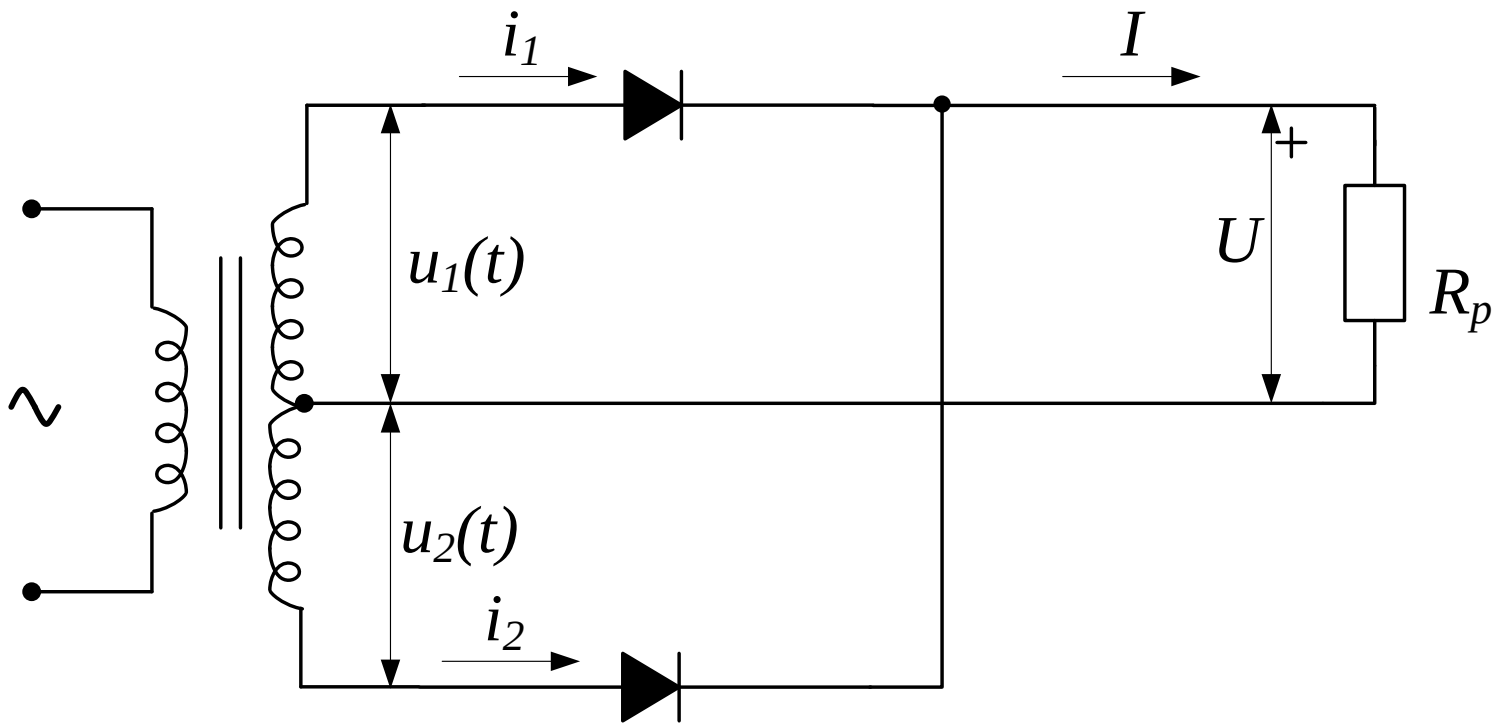
$u_d = U_T + R_d \cdot i_d$ - statička otpornost diode R_d

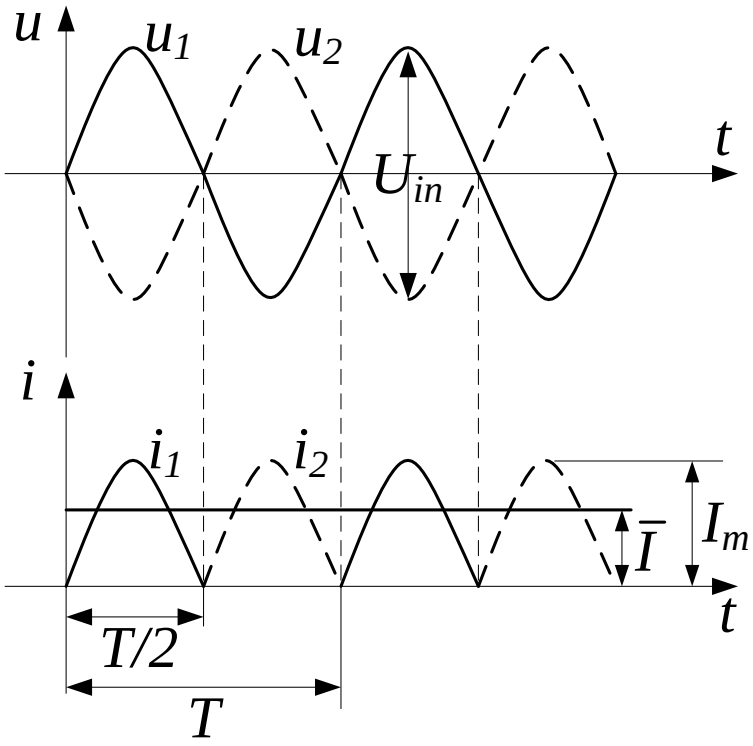


- od $\omega t=0$ do $\omega t=\pi$

$$i_d = \frac{U_m \sin(\omega t) - U_T}{R_d + R_p} = I_{dm} \sin(\omega t)$$

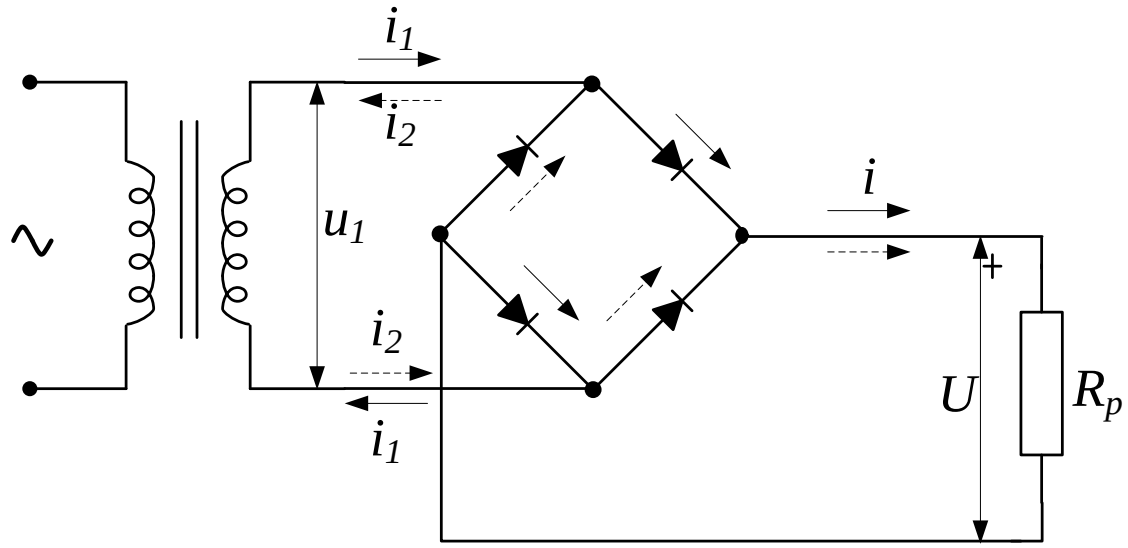
Dvofazno polutalasno usmeravanje

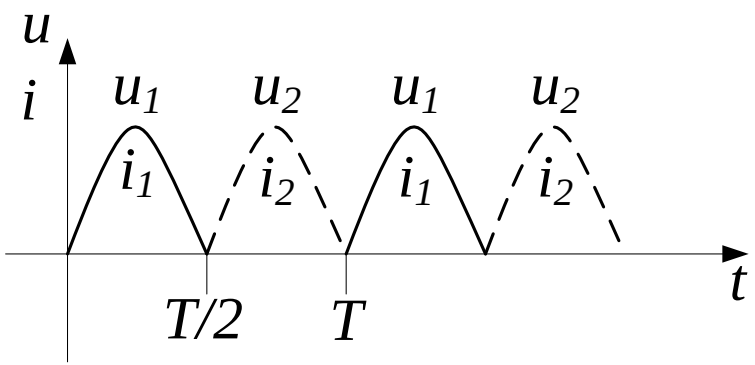




$$\bar{I} = \frac{2}{\pi} \cdot I_m = \frac{2}{\pi} \cdot \frac{U_m\text{-}U_T}{R_d + R_p}$$

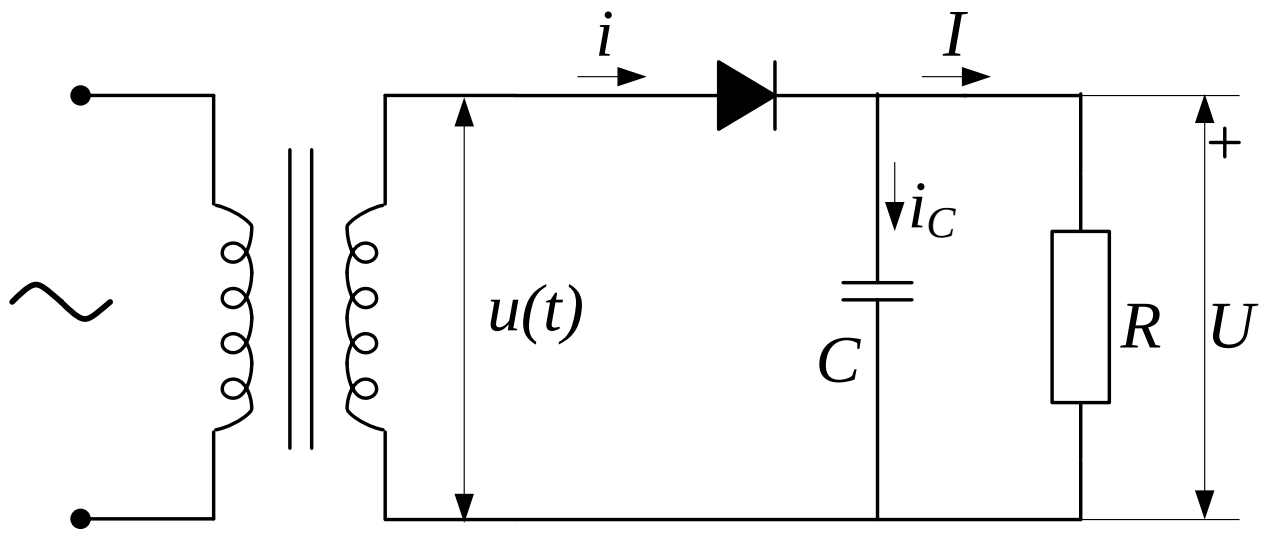
Jednofazno punotalasno usmeravanje



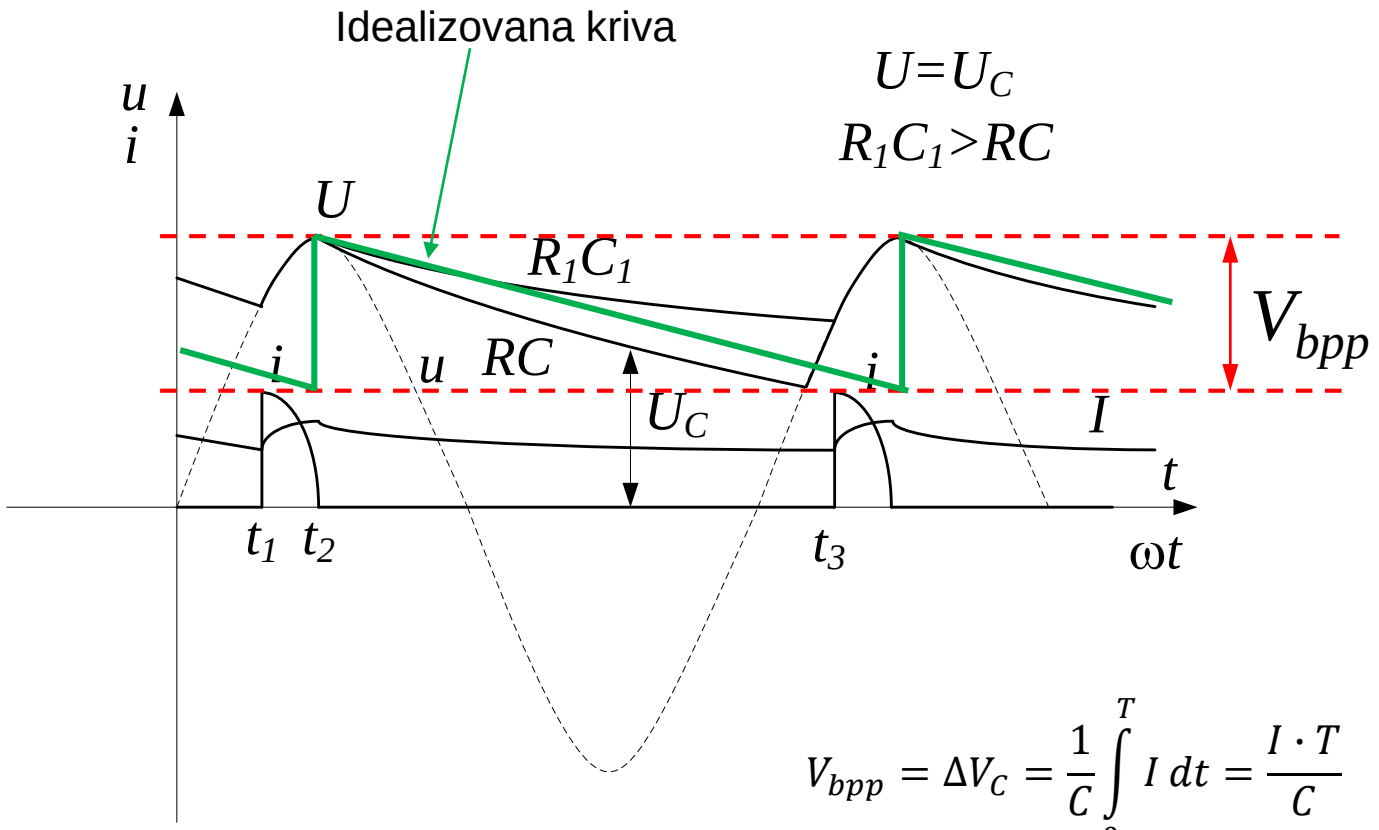


$$\bar{I} = \frac{2}{T}\int_0^{T/2} i \cdot dt = \frac{2}{T} \cdot \frac{U_m}{2 \cdot R + R_p} \int_0^{T/2} \sin(\omega \cdot t) \cdot dt = \frac{2}{\pi} \cdot \frac{U_m - U_T}{2 \cdot R + R_p} = \frac{2 \cdot I_{dm}}{\pi}$$

Kapacitivni filter

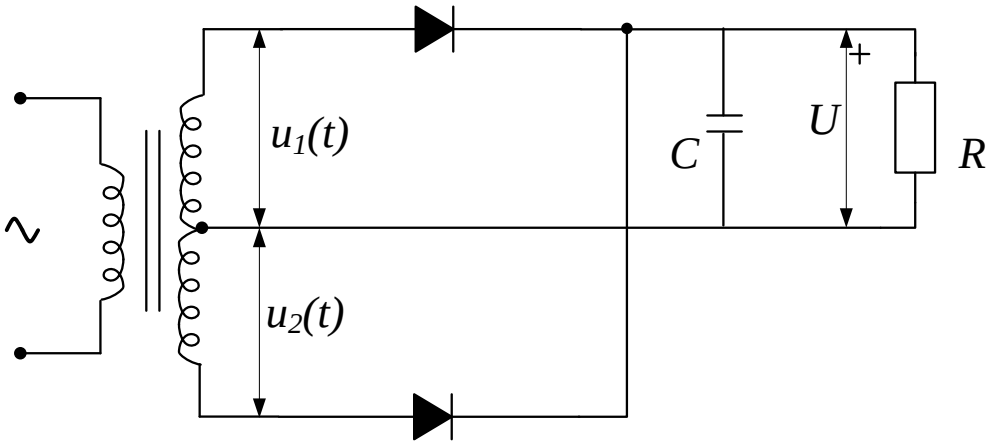


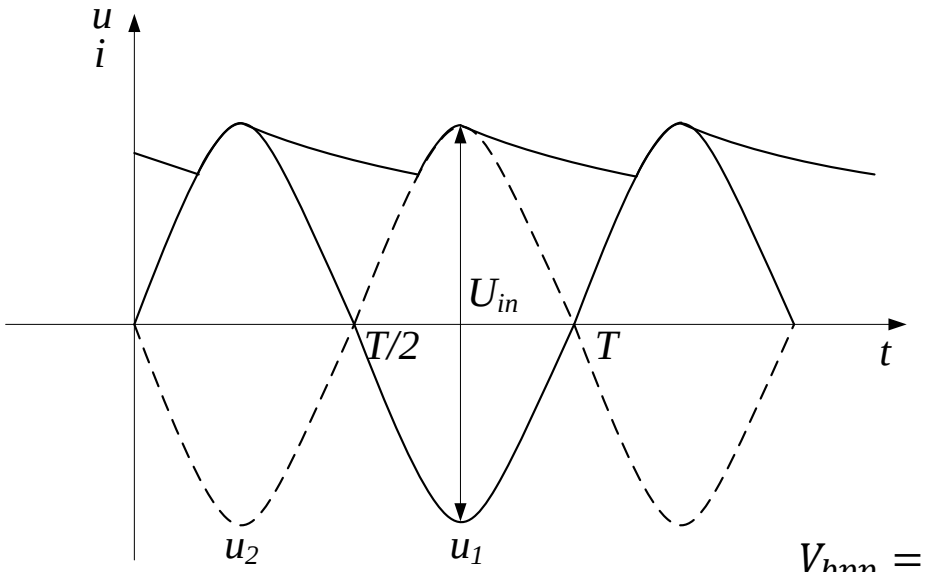
- kapacitivni filter vezan na kraj jednofaznog polutalasnog usmerača



$$V_{bpp} = \Delta V_C = \frac{1}{C}\int_0^T I\,dt = \frac{I \cdot T}{C}$$

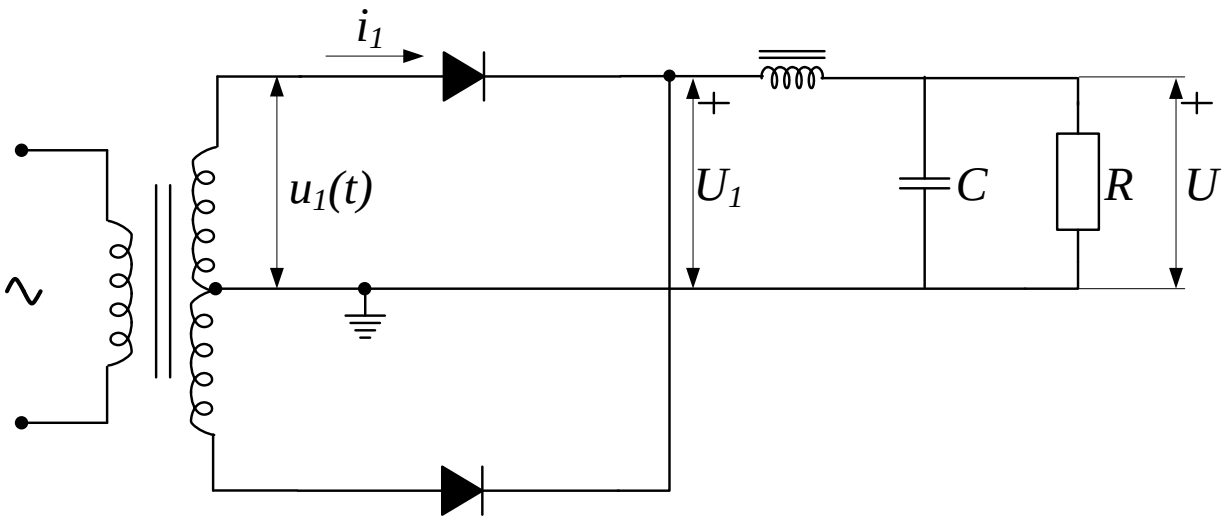
- kapacitivni filter vezan na kraj dvofaznog polutalasnog ispravljača

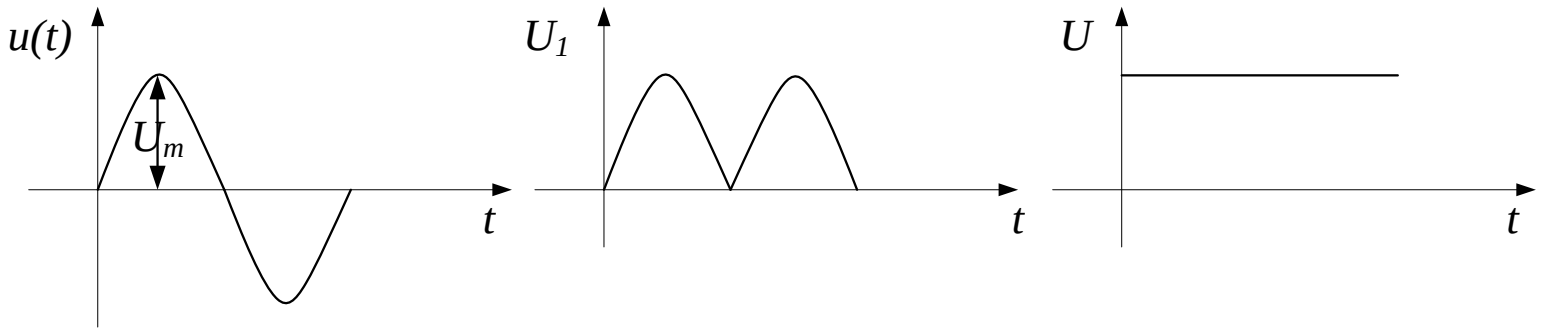




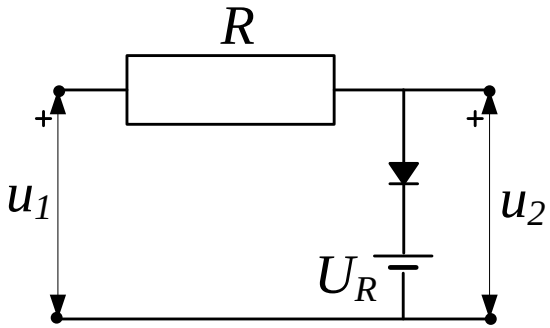
$$V_{bpp} = \Delta V_C = \frac{1}{C}\int_0^{T/2} I\,dt = \frac{I \cdot T}{2 \cdot C}$$

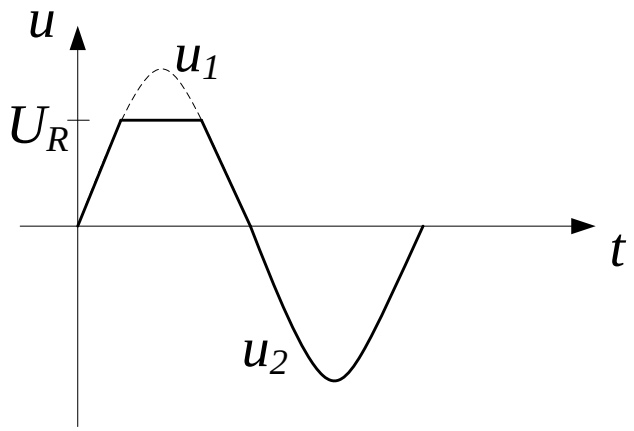
LC filter

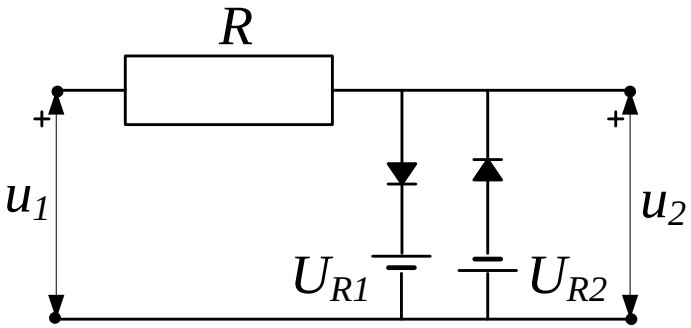


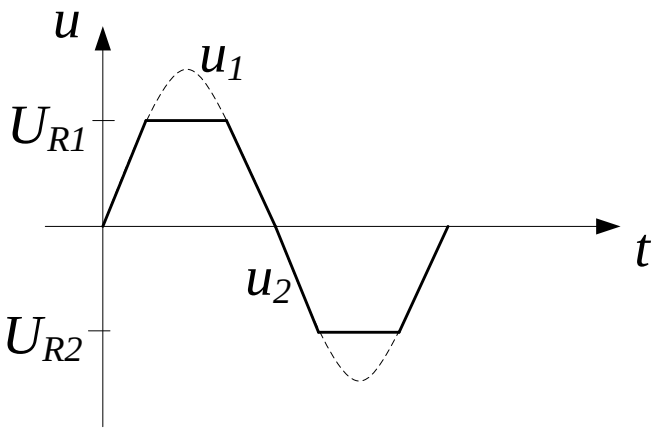


Dioda kao ograničavač napona

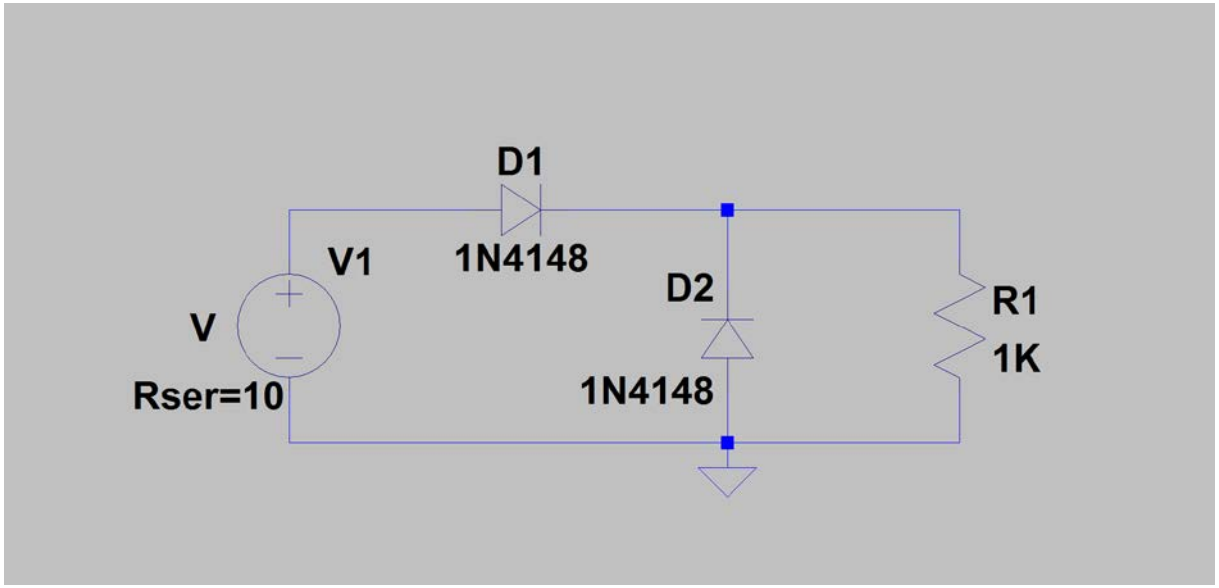








PRIMER 1



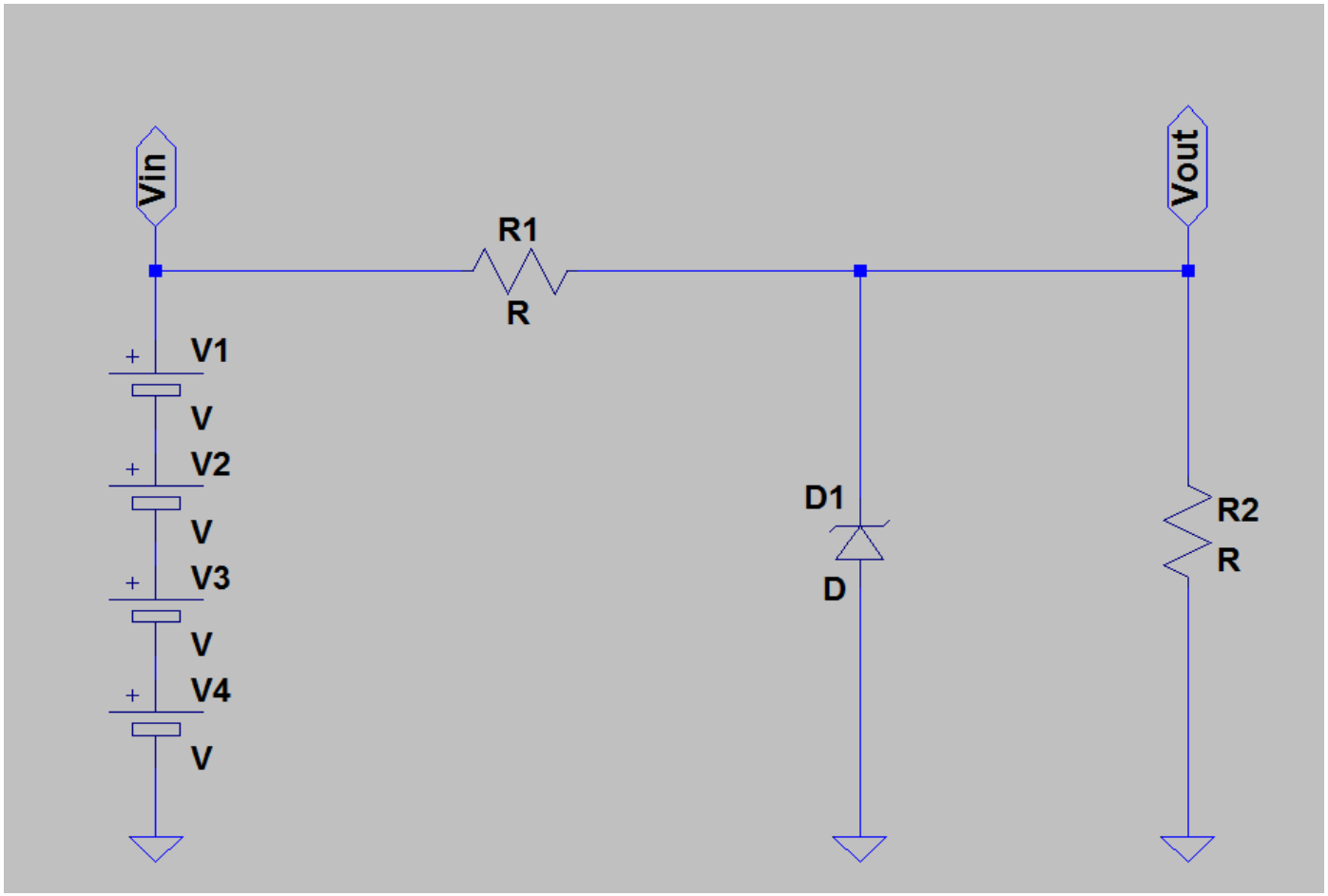
ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Repetitive peak reverse voltage		V_{RRM}	100	V
Reverse voltage		V_R	75	V
Peak forward surge current	t_p = 1 µs	I_{FSM}	2	A
Repetitive peak forward current		I_{FRM}	500	mA
Forward continuous current		I_F	300	mA
Average forward current	V_R = 0	$I_{F(AV)}$	150	mA
Power dissipation	l = 4 mm, T_L = 45 °C	P_{tot}	440	mW
	l = 4 mm, $T_L \leq$ 25 °C	P_{tot}	500	mW

- V1 = 75V $\rightarrow$ D2 nije u proboju
- $I_{D1} = \frac{V1 - V_{D1}}{R1 + R_{ser}}$ *pa je*
- $P_{D1} = V_{D1} \cdot I_{D1} = 0{,}6 \cdot \frac{75V - 0{,}6V}{1010} = 56mW < P_{tot}$

- V1 = 80V $\rightarrow$ D2 je u proboju
- $I_{V1} = I_{D1} = \frac{V_1 - V_{D1} - V_{D2}}{R_{ser}} = I_{D2} + I_{R1} = \frac{80V - 0{,}6V - 75V}{10} = 440mA$
- $I_{D2} = I_{V1} - I_{R1} = 440mA - 75mA = 365mA$
- $P_{D2} = V_{D2} \cdot I_{D2} = 75V \cdot 365mA = 27{,}375W \gg P_{tot}$
- $P_{D1} = V_{D1} \cdot I_{D1} = 0{,}6 \cdot 440mA = 264mW < P_{tot}$

Stabilizator napona sa Zener diodom



Stabilizator napona sa Zener diodom

- $I_1 = I_z + I_2$
- $V_{in} - I_1 \cdot R_1 - V_{out} = 0$
- $V_{out} = V_{in} - (I_z + I_2) \cdot R_1$

PRIMER 2

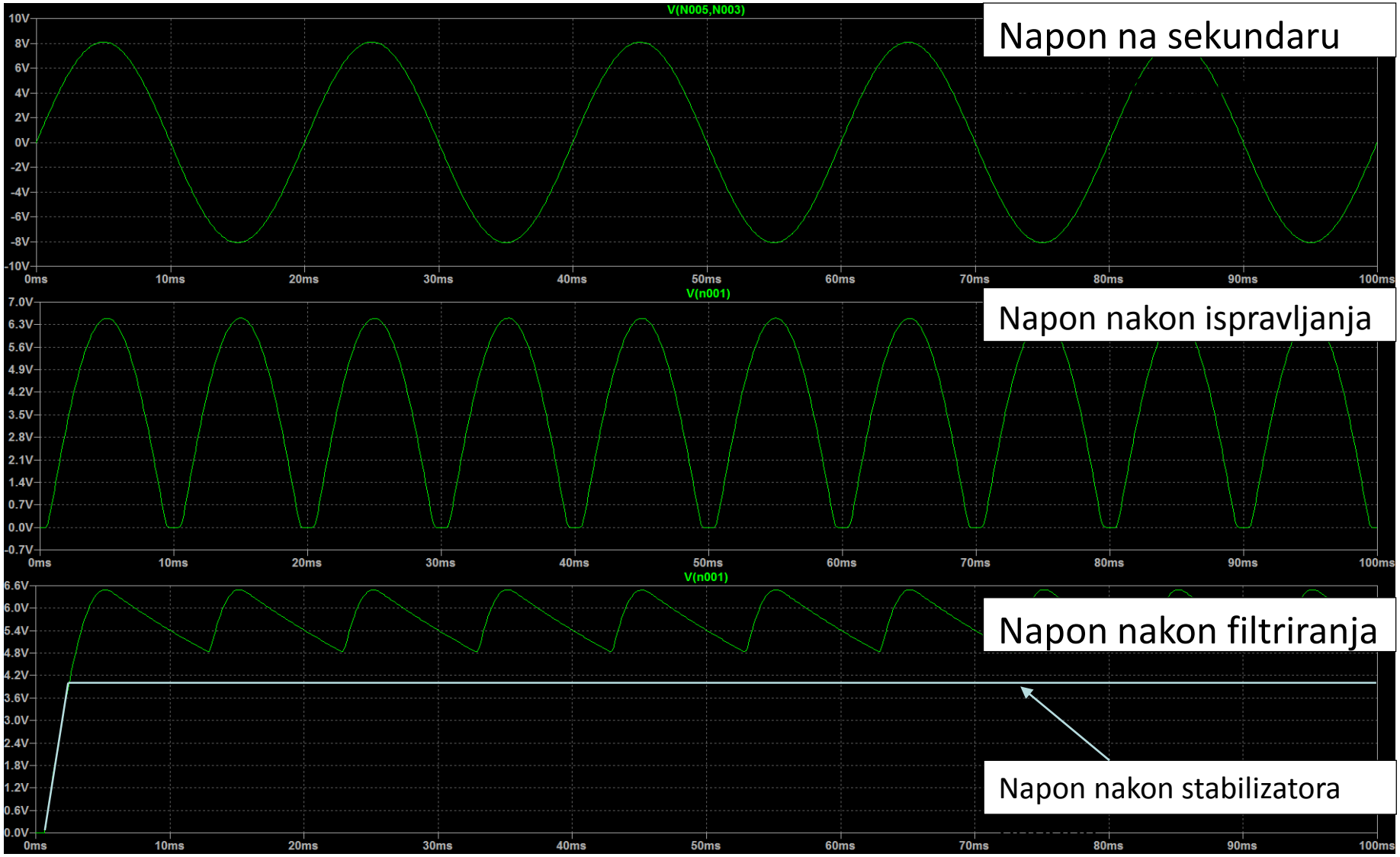
- Napon baterije 1,2 – 1,5V pa je $4{,}8 \leq V_{in} \leq 6V$
- $V_{out} = 4V$ pa je $V_Z = 4V$ i $I_{Zmin} = 5mA$
- $40\Omega \leq R_2 \leq 200\Omega$

- $R_1 = \frac{V_{in\_min} - V_{out}}{(I_{Z\_min} + I_{2\_max})}$
- $R_1 = \frac{4{,}8V - 4V}{5mA + 100mA} = 7{,}6\Omega$
- $I_z = \frac{V_{in\_max} - V_{out}}{R_1} - I_{2\_min}$
- $I_z = \frac{6V - 4V}{7{,}6\Omega} - 20mA = 243mA$

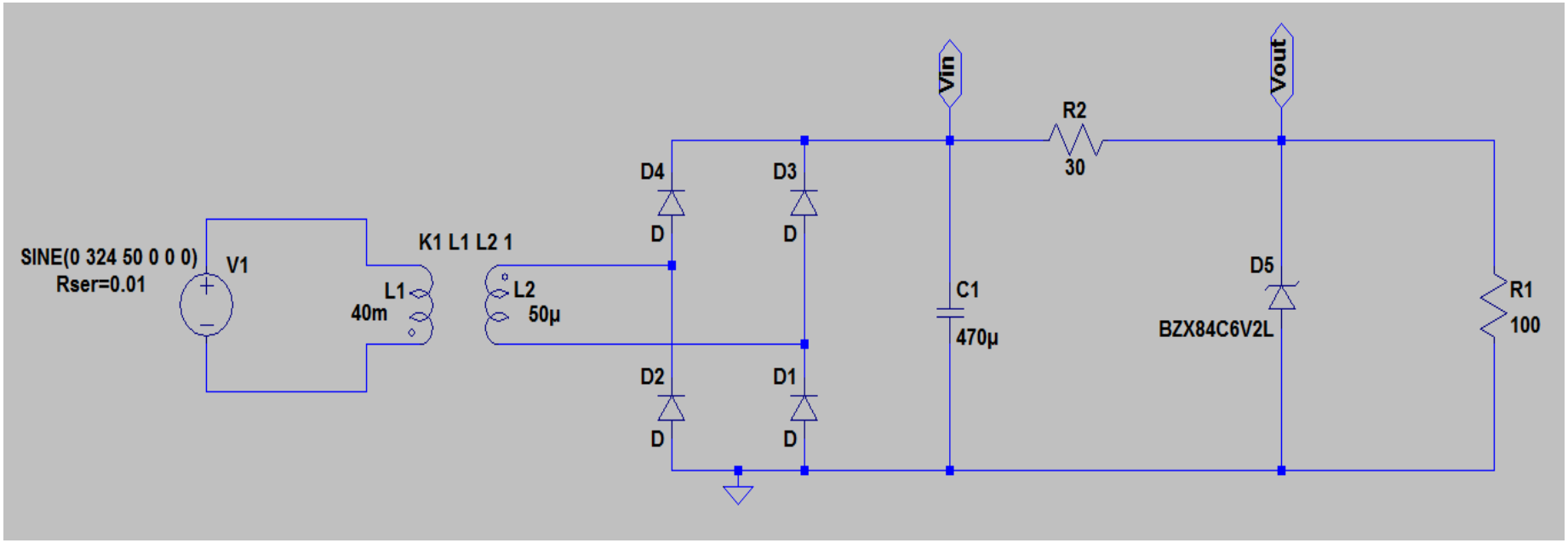
PRIMER 2

- $P_{z\_max} = I_{z\_max} \cdot V_z$
- $P_{z\_max} = 243mA \cdot 4V = 0{,}97W$
- $P_{R1\_max} = \frac{\left(V_{in\_max} - V_{out}\right)^2}{R_1}$
- $P_{R1\_max} = \frac{(6V - 4V)^2}{7{,}6\Omega} = 0{,}53W$

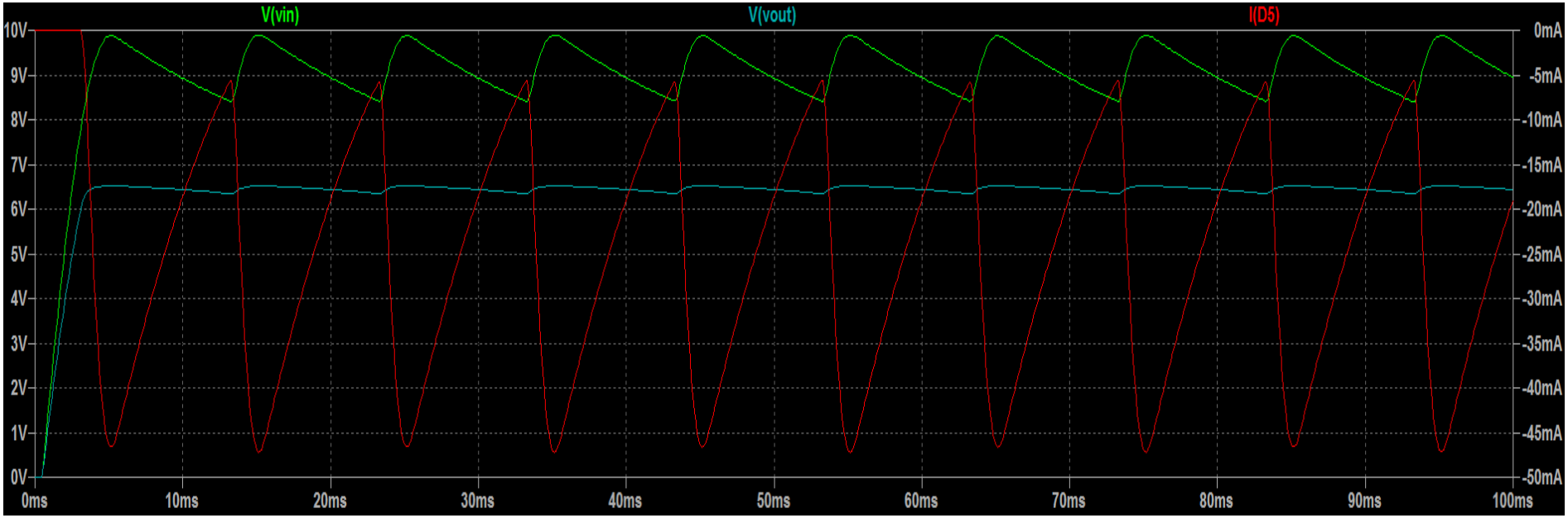
PRIMER 2


V(N005,N003)
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
0ms
10ms
20ms
30ms
40ms
50ms
60ms
70ms
80ms
90ms
100ms
V(n001)
7.0V
6.3V
5.6V
4.9V
4.2V
3.5V
2.8V
2.1V
1.4V
0.7V
0.0V
-0.7V
V(n001)
6.6V
6.0V
5.4V
4.8V
4.2V
3.6V
3.0V
2.4V
1.8V
1.2V
0.6V
0.0V
Napon na sekundaru
Napon nakon ispravljanja
Napon nakon filtriranja
Napon nakon stabilizatora

PRIMER 3


SINE(0 324 50 0 0 0)
Rser=0.01
V1
L1
40m
K1 L1 L2 1
L2
50µ
D4
D
D3
D
D2
D
D1
D
Vin
C1
470µ
R2
30
Vout
D5
BZX84C6V2L
R1
100

PRIMER 3


V(vin)
V(vout)
I(D5)
10V
9V
8V
7V
6V
5V
4V
3V
2V
1V
0V
0mA
-5mA
-10mA
-15mA
-20mA
-25mA
-30mA
-35mA
-40mA
-45mA
-50mA
0ms
10ms
20ms
30ms
40ms
50ms
60ms
70ms
80ms
90ms
100ms

- LTspice program za simulaciju elektronskih kola od Analog Devices
- Link: https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

- Download-ovati, instalirati i naučiti!