Bilich Stefan

Lucrarea 2

Circuite Liniare RC - Trece-sus

3.1.1. $R = 12K\Omega$ $C = 470pF$ cu amplitudine $= 5V$

a) $f_1 = 4 \cdot 10^5 Hz$

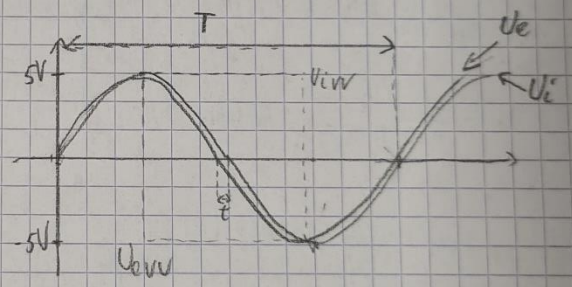
Rezultat teoretic: $\omega = 2\pi \cdot 4 \cdot 10^5 \Rightarrow \omega = 8 \cdot 10^5 \pi$

$$\Rightarrow A(\omega) = \frac{1}{\sqrt{1+\left(\frac{1}{\omega RC}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{8 \cdot 10^5 \pi \cdot 12 \cdot 10^3 \cdot 470 \cdot 10^{-12}}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{14,1749}\right)^2}}$$

$$= \frac{1}{\sqrt{1,005}} = \frac{1}{1,0025} = 0,998 \cong 1$$

$$\varphi(\omega) = \operatorname{arctg}\left(\frac{1}{\omega RC}\right) = \operatorname{arctg}\left(\frac{1}{14,1749}\right) = 4,035^\circ \cong 0,1 rad$$

Rezultat experimental



$T = 5 div$, $1 div = 500ms$ $\Rightarrow T = 5 \cdot 500ms = 2500ms = 2,5\mu s$

$$f = \frac{1}{T} = \frac{1}{2,5 \cdot 10^{-6}} = 400kHz$$

$1 div = 5V$ $U_{ivv} = 1 div + 1 div = 2 div \Rightarrow U_{ivv} = 2 \cdot 5 = 10V$

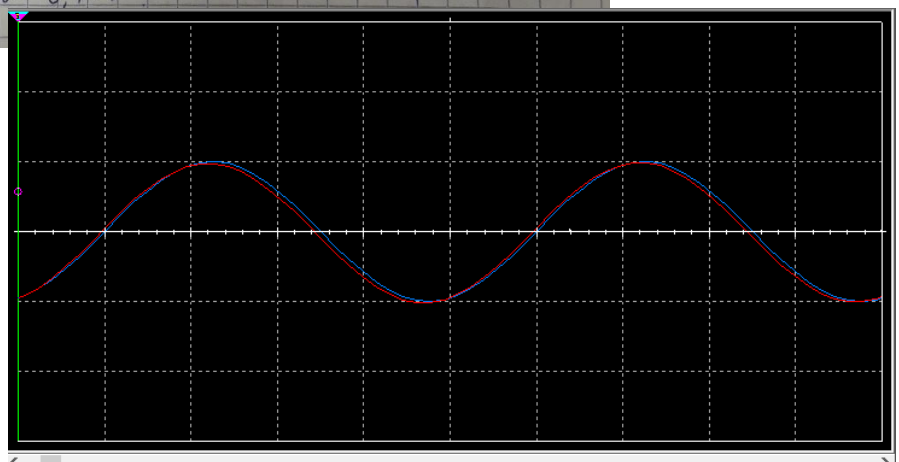
$U_{evv} = 1 div + 1 div = 2 div \Rightarrow U_{evv} = 2 \cdot 5 = 10V$ $\Rightarrow A = \frac{U_e}{U_i} = 1$

$1 div = 500ms$ $t = \frac{\frac{1}{5} div}{3} \Rightarrow t = \frac{\frac{1}{5} \cdot 500}{3} \Rightarrow t = \frac{100}{3} \cong 33ms$

$$\Rightarrow \varphi = \frac{t \cdot 360^\circ}{T} = \frac{33ms \cdot 360^\circ}{2500ms} = \frac{11880}{2500} \cong 4,752^\circ$$

Afișarea experimentală aproximativ egală cu cea teoretică

La defazaj am avut o eroare de $0,717^\circ$



	Time	Channel_A	Channel_B
T1	4.500 us	-4.732 V	-4.759 V
T2	4.500 us	-4.732 V	-4.759 V
T2-T1	0.000 s	0.000 V	0.000 V

Reverse | Save | Ext. trigger

Timebase — Scale: 500 ns/Div; X pos.(Div): 0

Channel A — Scale: 5 V/Div; Y pos.(Div): 0

Channel B — Scale: 5 V/Div; Y pos.(Div): 0

Trigger — Edge: A | B | Ext; Level: 0 V

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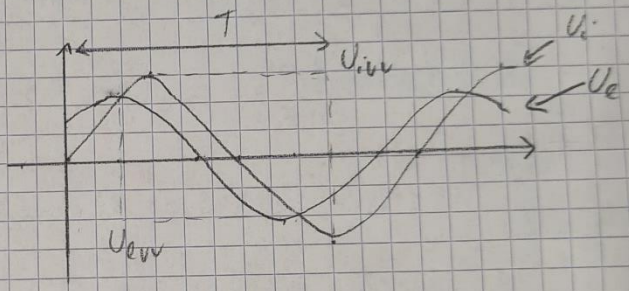
b) $f_2 = 4 \cdot 10^4 Hz = 40 kHz$ $\quad \omega = 2\pi f \Rightarrow \omega = 2\pi \cdot 4 \cdot 10^4 = 8 \cdot 10^4 \cdot \pi \ rad/s$

Rezultatul teoretic: $A(\omega) = \frac{1}{\sqrt{1+\left(\frac{1}{\omega RC}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{1,417}\right)^2}} = \frac{1}{\sqrt{1,498}} = \frac{1}{1,224}$

$\Rightarrow A(\omega) = 0,8169$

$\varphi(\omega) = arctg\left(\frac{1}{\omega RC}\right) = arctg\left(\frac{1}{1,41749}\right) = arctg\,(0,7055) = 35,2°$

Rezultat experimental



$T = 5 div$, $1 div = 5 \mu s$ $\Rightarrow T = 5 \cdot 5 \mu s = 25 \mu s$

sau $f = \frac{1}{T} = \frac{1}{25 \cdot 10^{-6}} = 40 kHz$

$1 div = 2V$ $\quad U_{i vv} = 4 div + 0,5 div \Rightarrow U_{i vv} = 4 \cdot 2 + 0,5 \cdot 2 \cdot 2 \Rightarrow U_{i vv} = 5V \cdot 2 \Rightarrow U_{i vv} = 10V$

$U_{e vv} = 4 div \Rightarrow U_{e vv} = 4 \cdot 2 = 8V$ $\quad \Rightarrow A = \frac{U_{e vv}}{U_{i vv}} = \frac{8}{10} = 0,8$

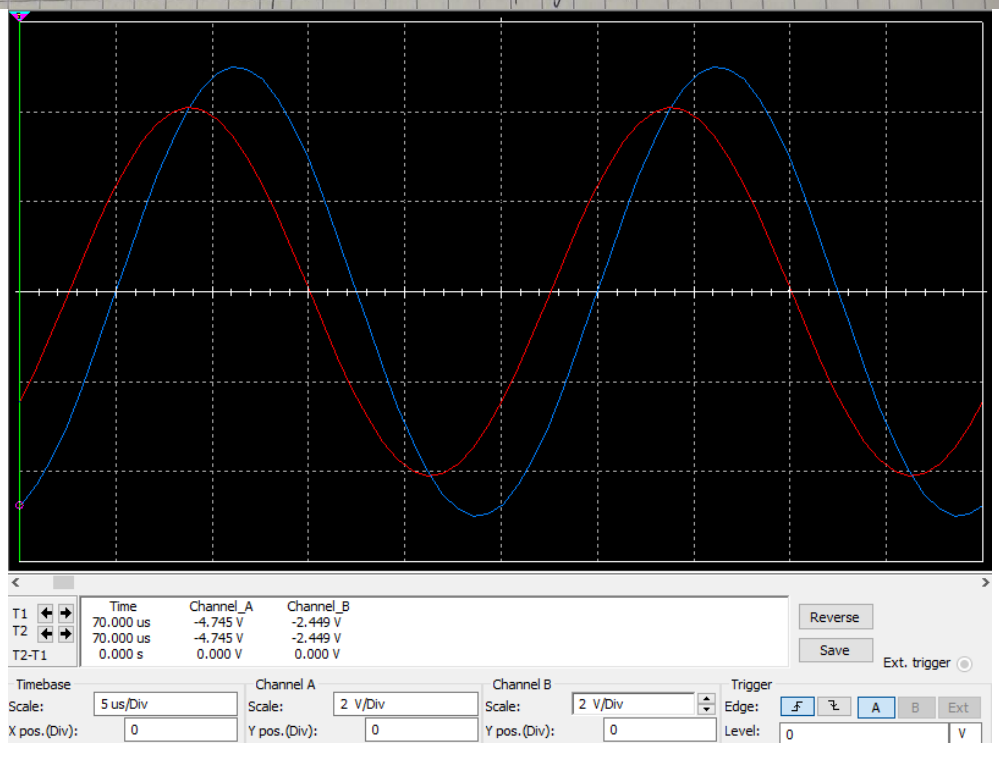
$1 div = 5 \mu s$ $\quad t = \frac{1}{2} div \Rightarrow t = \frac{5}{2} \mu s \Rightarrow t = 2,5 \mu s$

$\varphi = \frac{t \cdot 360°}{T} \Rightarrow \varphi = \frac{2,5 \cdot 360}{25} = 36°$

Rezultatele teoretice și cele experimentale sunt aproximativ egale (aremănătoare)

Diferența dintre atenuări $0,0169 \approx 0$

Diferența dintre defazaje $0,8°$



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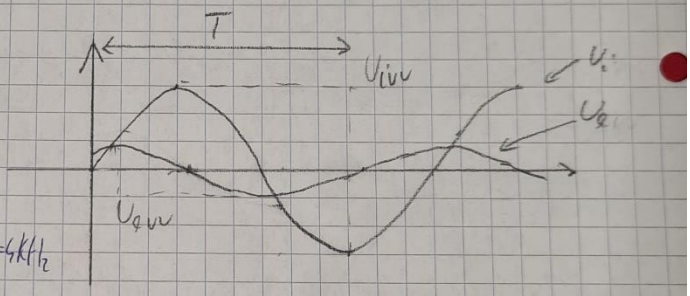
c) $f_3 = 4 \cdot 10^3 Hz = 4kHz \Rightarrow \omega = 2\pi f \Rightarrow \omega = 8 \cdot 10^3 \cdot \pi$ rad/s

Rezultat teoretic $A(\omega) = \frac{1}{\sqrt{1+\left(\frac{1}{\omega RC}\right)^2}} = \frac{1}{\sqrt{1+\left(\frac{1}{0,14175}\right)^2}} = \frac{1}{\sqrt{1+49,77}}$

$A(\omega) = \frac{1}{7.125} = 0,1403$

$\varphi(\omega) = \operatorname{arctg}\left(\frac{1}{\omega RC}\right) = \operatorname{arctg}\left(\frac{1}{0,14175}\right) = 81,93°$

Rezultat experimental:



$T = 5 div$ $\Rightarrow T = 5 \cdot 50 div = 250 \mu s$

$50 \mu s = 1 div$

$\Rightarrow f = \frac{1}{T} = \frac{1}{250 \cdot 10^{-6}} = 4000 Hz = 4kHz$

$1 div = 2V$ $U_{iVV} = 4 div + 2 \cdot 0,5 div \Rightarrow U_{iVV} = 4 \cdot 2 + 2 \cdot 0,5 \cdot 2 \Rightarrow U_{iVV} = 10V$

$U_{eVV} = 0,4 div = 0,4 \cdot 2 = 0,8 V \Rightarrow U_{eVV} = 0,8$

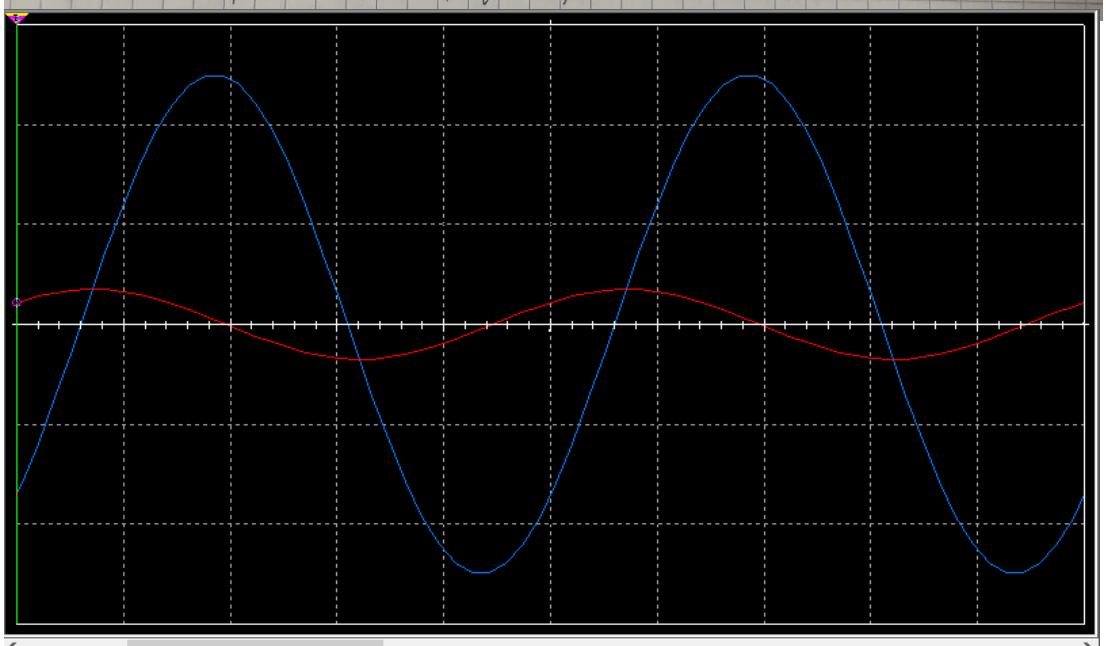
$\Rightarrow A = \frac{U_{eVV}}{U_{iVV}} = 0,08$

$1 div = 50 \mu s$ $t = 1 div + \frac{\frac{1}{5} div}{2} \Rightarrow t = 50 + \frac{\frac{1}{5} \cdot 50}{2} \Rightarrow t = 50 + \frac{10}{2} \Rightarrow t = 55$

$\Rightarrow \varphi = \frac{t \cdot 360°}{T} = \frac{55 \mu s \cdot 360°}{250} = 79,2°$

Diferența dintre atenuări 0,06

Diferența dintre defazaje 2,7°



	Time	Channel_A	Channel_B
T1	220.000 us	-3.408 V	438.420 mV
T2	220.000 us	-3.408 V	438.420 mV
T2-T1	0.000 s	0.000 V	0.000 V

Reverse | Save | Ext. trigger

Timebase — Scale: 50 us/Div; X pos.(Div): 0

Channel A — Scale: 2 V/Div; Y pos.(Div): 0

Channel B — Scale: 2 V/Div; Y pos.(Div): 0

Trigger — Edge: A; Level: 0 V

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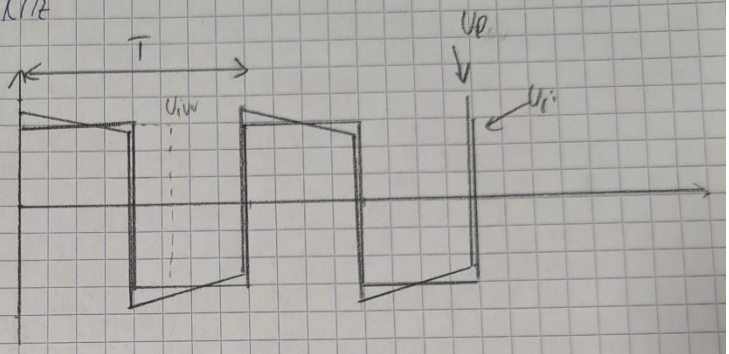
3.1.2

$R = 12k\Omega$ $C = 470pF$ amplitudine $= 5V$

a) $f_1 = 4 \cdot 10^5 Hz = 400kHz$



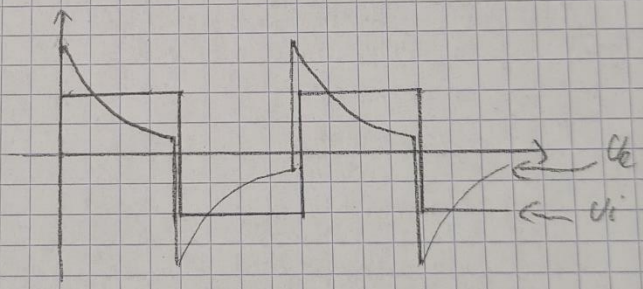
Rezultat teoretic: $t_c = 2,2 \cdot RC \Rightarrow t_c = 12,408\mu s$

Rez exper. $t_c = 2,5 \cdot div$ $\Rightarrow t_c = 2,5 \cdot 500 = 1,25\mu s$

$1 div = 500$

$t_{c\,teoretic} = t_{c\,exp} \cdot 10$

b) $f_2 = 4 \cdot 10^4 Hz = 40kHz$

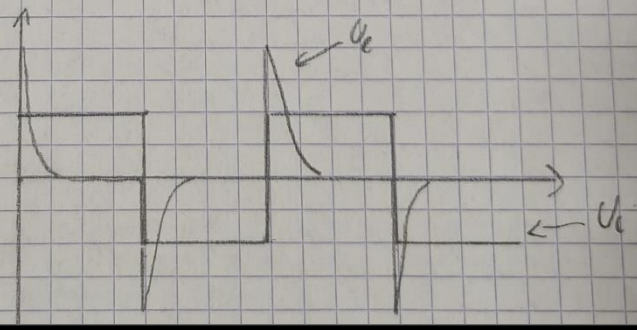


U_e val max $= 9V$

U_e val min $= +9V$

$t = 11,831\mu s$

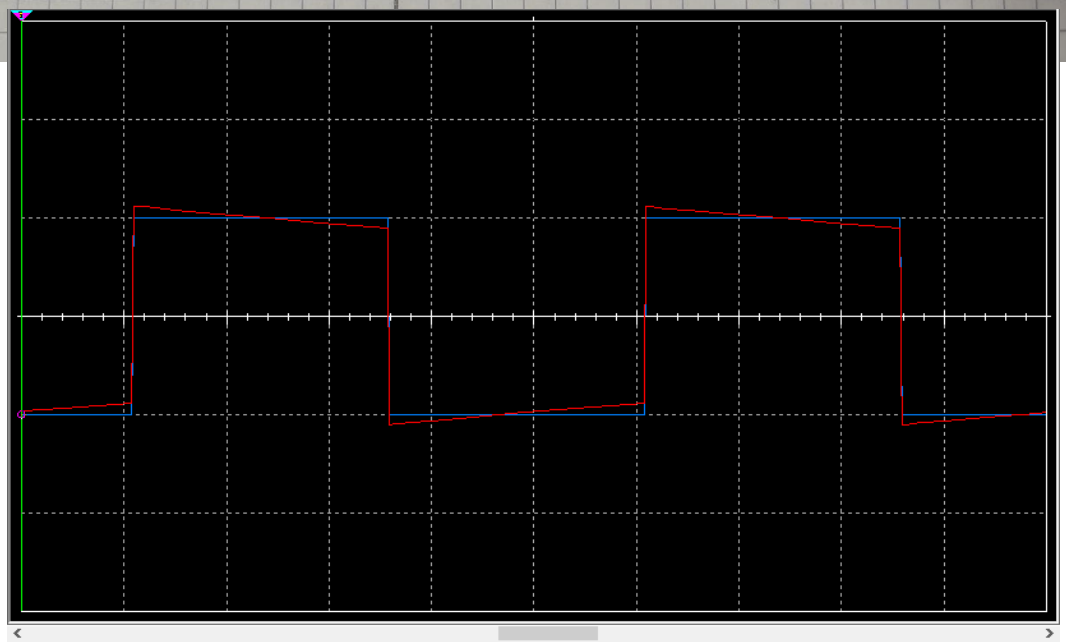
c) $f_3 = 4 \cdot 10^3 Hz = 4kHz$



U_e val max $= 10V$

U_e val min $= -5 + 10V$

$t = 122\mu s$



	Time	Channel_A	Channel_B
T1	24.464 us	-5.000 V	-4.838 V
T2	24.464 us	-5.000 V	-4.838 V
T2-T1	0.000 s	0.000 V	0.000 V

Reverse

Save

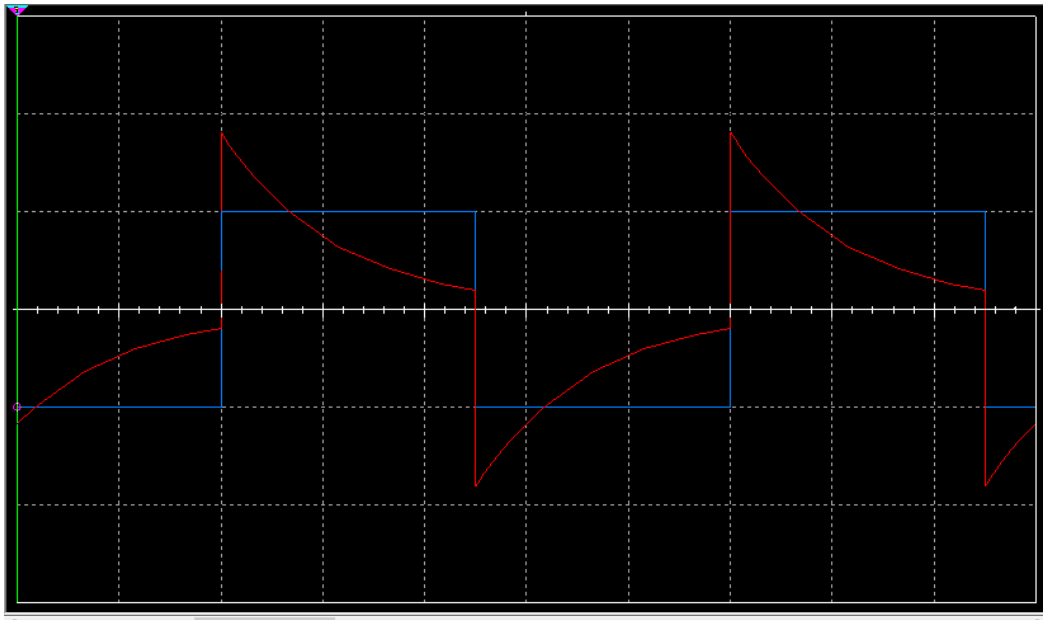
Ext. trigger

Timebase
Scale: 500 ns/Div
X pos.(Div): 0

Channel A
Scale: 5 V/Div
Y pos.(Div): 0

Channel B
Scale: 5 V/Div
Y pos.(Div): 0

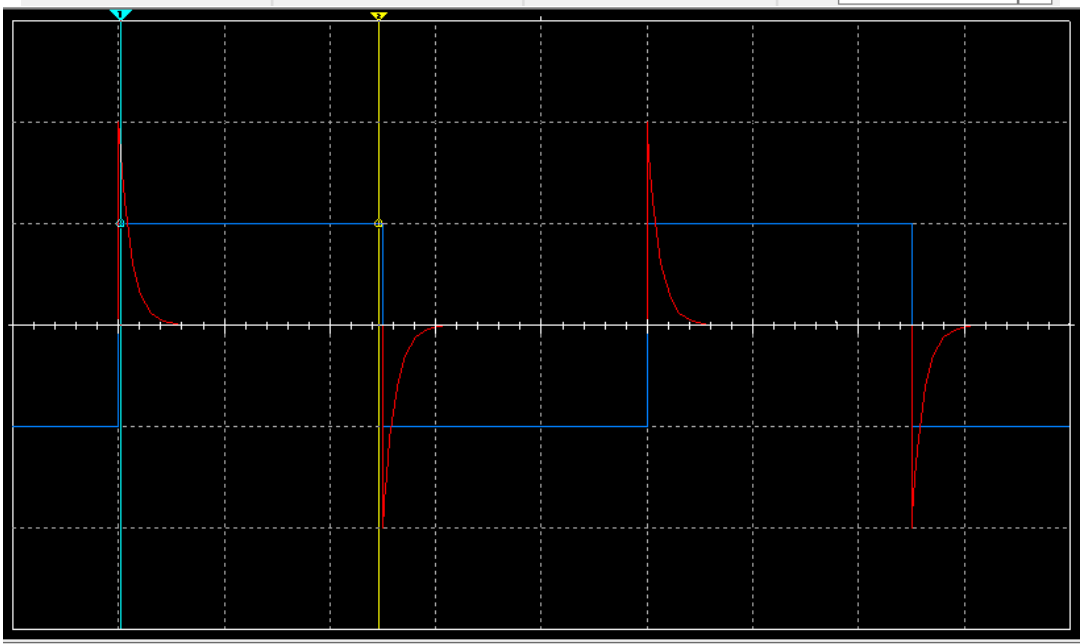
Trigger
Edge: A B Ext
Level: 0 V



	Time	Channel_A	Channel_B
T1	65.000 us	-5.000 V	-5.863 V
T2	65.000 us	-5.000 V	-5.863 V
T2-T1	0.000 s	0.000 V	0.000 V

Reverse
Save
Ext. trigger

Timebase	Channel A	Channel B	Trigger
Scale: 5 us/Div	Scale: 5 V/Div	Scale: 5 V/Div	Edge: A / B / Ext
X pos.(Div): 0	Y pos.(Div): 0	Y pos.(Div): 0	Level: 0 V



	Time	Channel_A	Channel_B
T1	251.059 us	5.000 V	8.313 V
T2	373.101 us	5.000 V	-113.788 nV
T2-T1	122.042 us	0.000 V	-8.313 V

Reverse
Save
Ext. trigger

Timebase	Channel A	Channel B	Trigger
Scale: 50 us/Div	Scale: 5 V/Div	Scale: 5 V/Div	Edge: A / B / Ext
X pos.(Div): 0	Y pos.(Div): 0	Y pos.(Div): 0	Level: 0 V