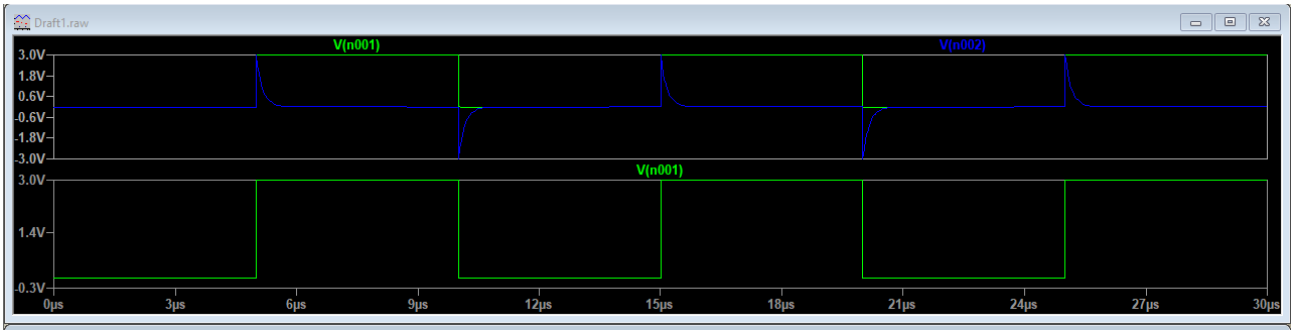
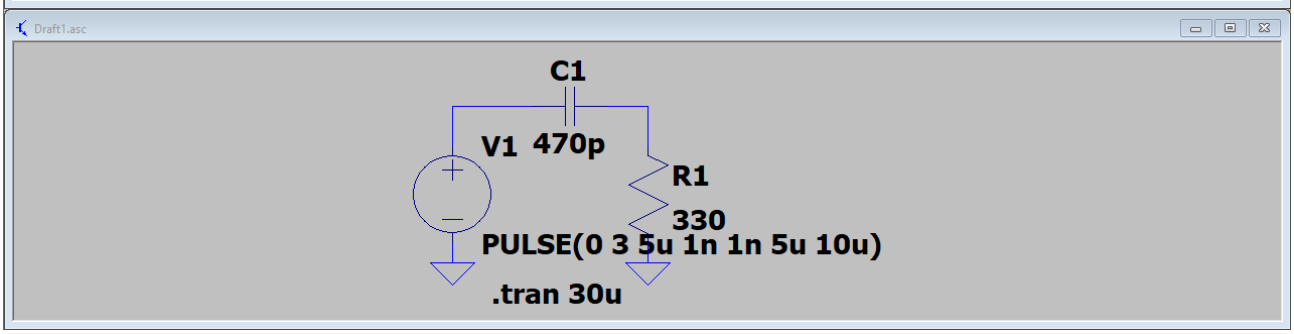
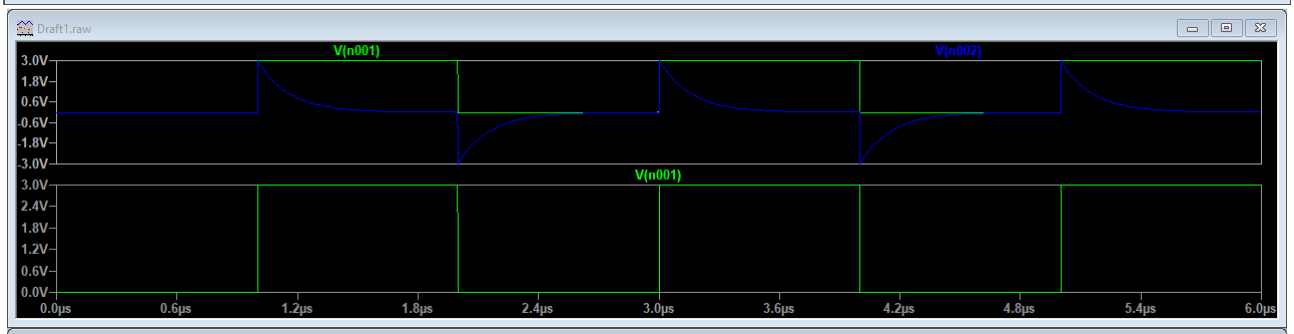
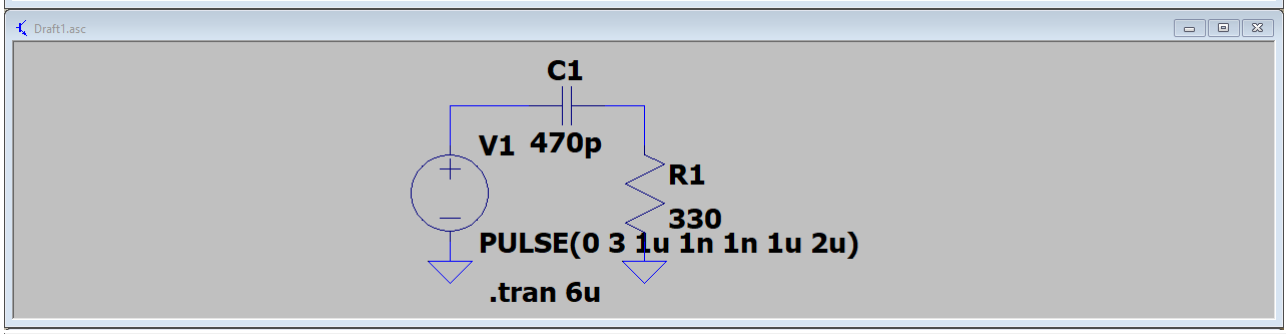
Tatu Bogdan – CTI EN 3.1

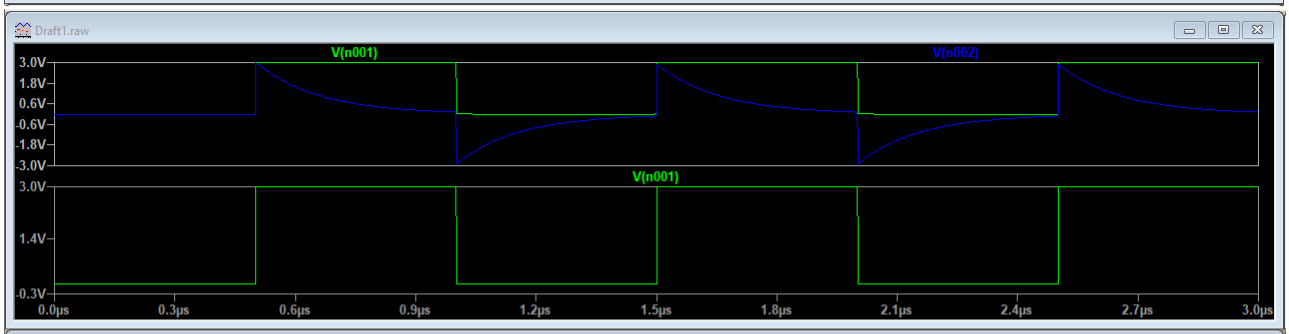
HIGH PASS RC CIRCUIT

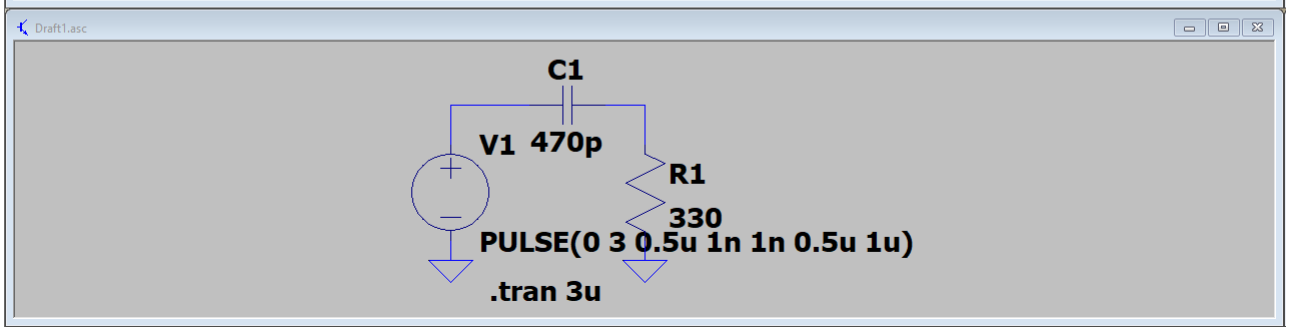


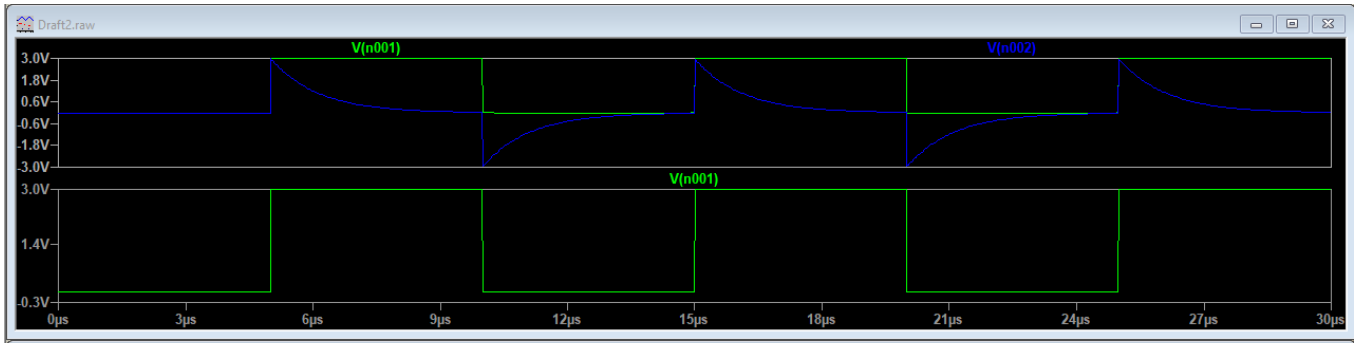








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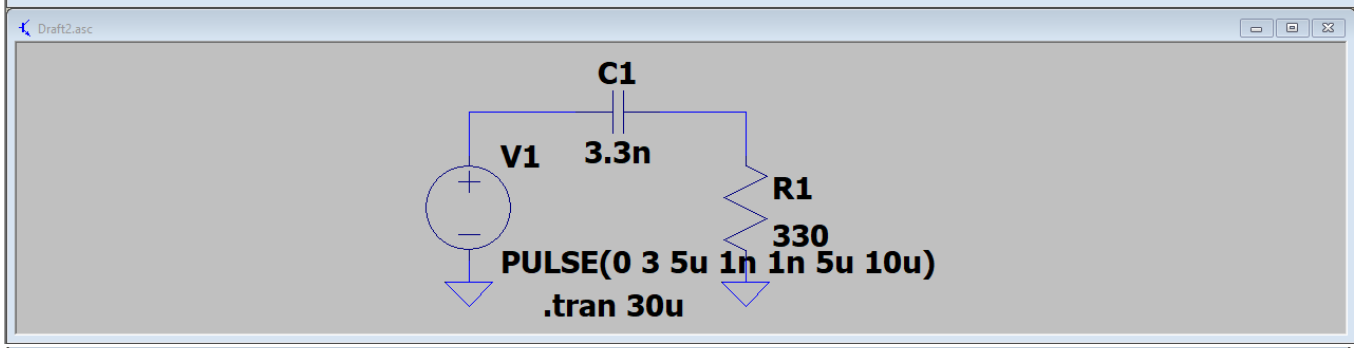
V(n001)
V(n002)
3.0V
1.8V
0.6V
-0.6V
-1.8V
-3.0V
V(n001)
3.0V
1.4V
-0.3V
0µs
3µs
6µs
9µs
12µs
15µs
18µs
21µs
24µs
27µs
30µs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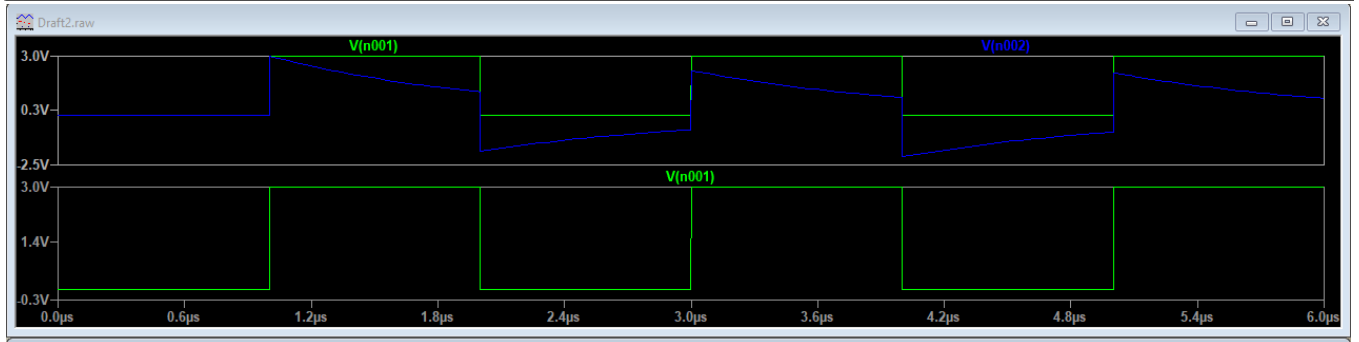
C1
V1
3.3n
R1
330
PULSE(0 3 5u 1n 1n 5u 10u)
.tran 30u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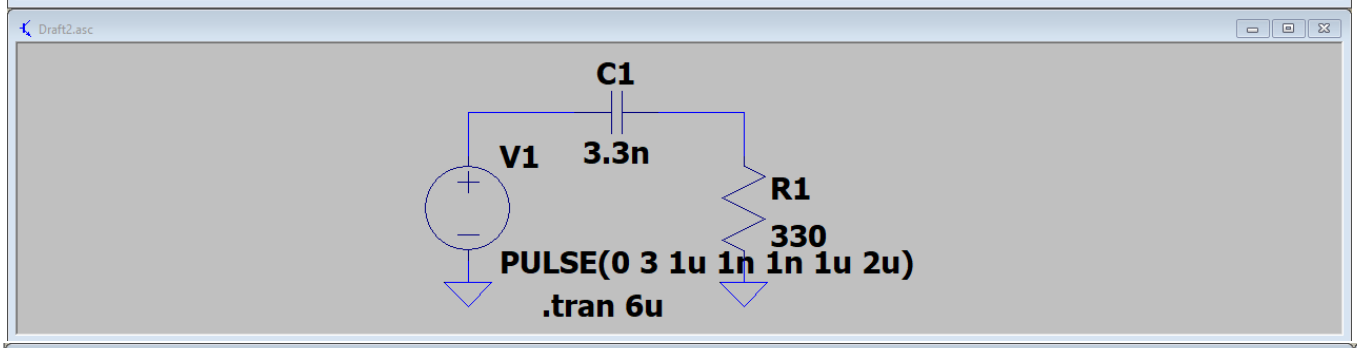
V(n001)
V(n002)
3.0V
0.3V
-2.5V
V(n001)
3.0V
1.4V
-0.3V
0.0µs
0.6µs
1.2µs
1.8µs
2.4µs
3.0µs
3.6µs
4.2µs
4.8µs
5.4µs
6.0µs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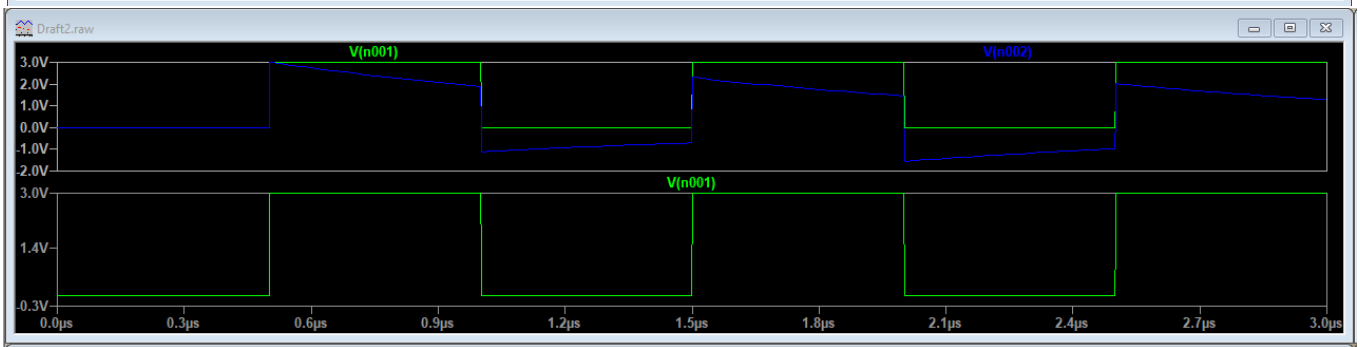
C1
V1
3.3n
R1
330
PULSE(0 3 1u 1n 1n 1u 2u)
.tran 6u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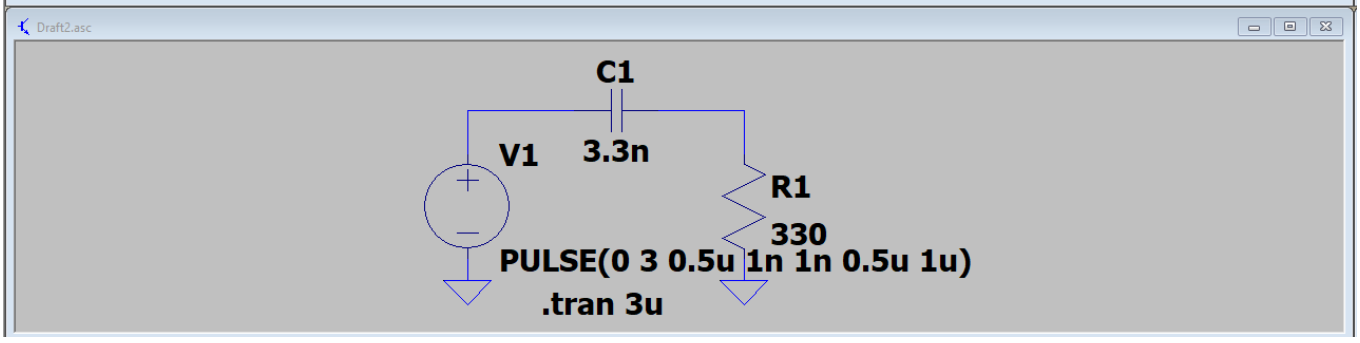
V(n002)
3.0V
2.0V
1.0V
0.0V
-1.0V
-2.0V
V(n001)
3.0V
1.4V
-0.3V
0.0µs
0.3µs
0.6µs
0.9µs
1.2µs
1.5µs
1.8µs
2.1µs
2.4µs
2.7µs
3.0µs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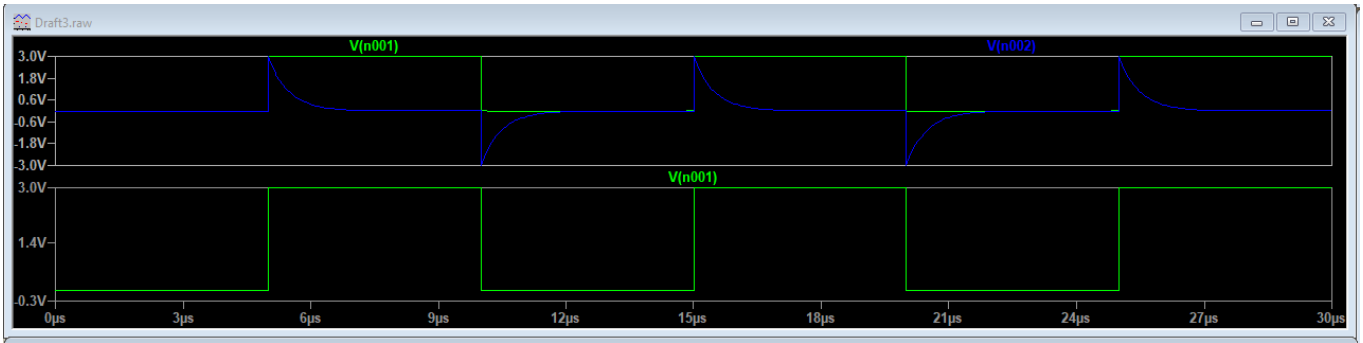
V1
3.3n
R1
330
PULSE(0 3 0.5u 1n 1n 0.5u 1u)
.tran 3u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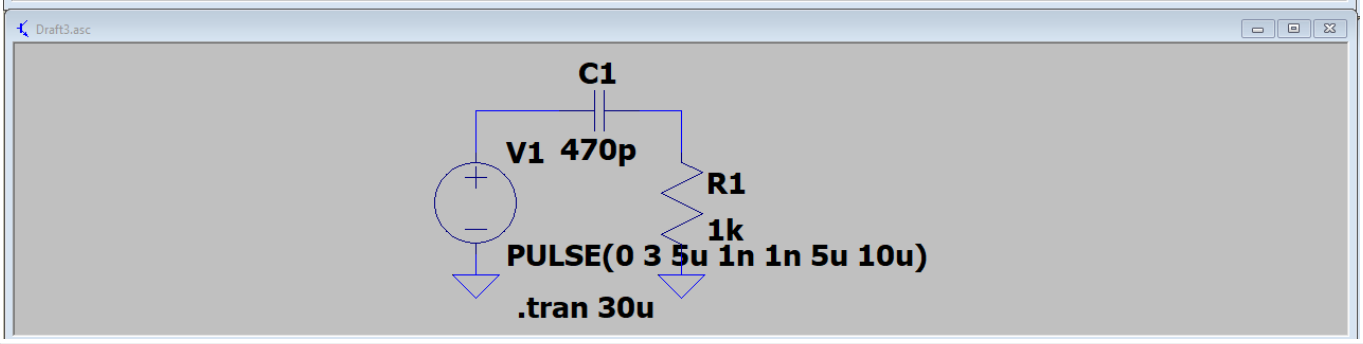
V(n001)
V(n002)
3.0V
1.8V
0.6V
-0.6V
-1.8V
-3.0V
V(n001)
3.0V
1.4V
-0.3V
0μs
3μs
6μs
9μs
12μs
15μs
18μs
21μs
24μs
27μs
30μs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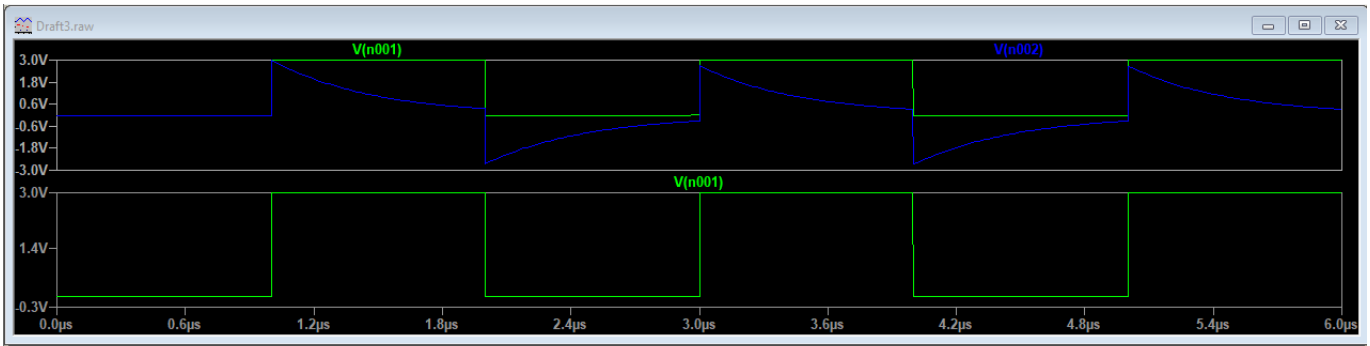
C1
V1
470p
R1
1k
PULSE(0 3 5u 1n 1n 5u 10u)
.tran 30u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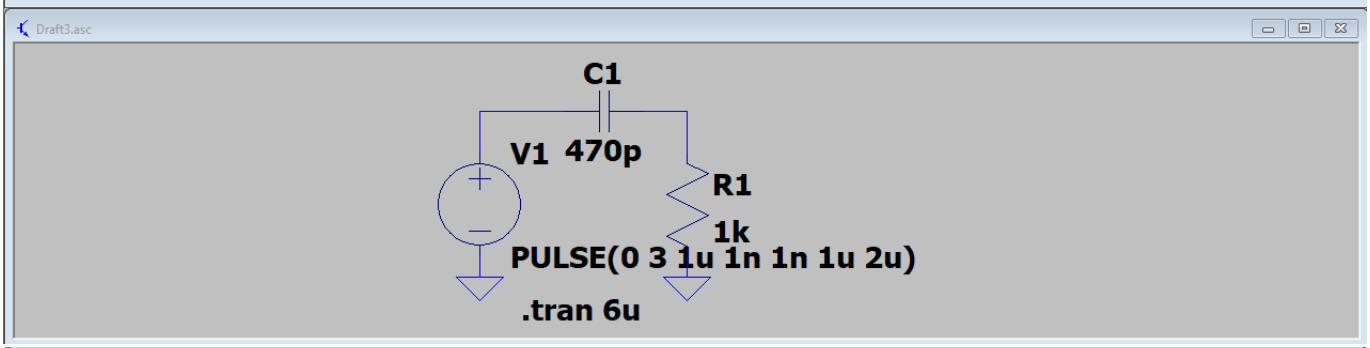
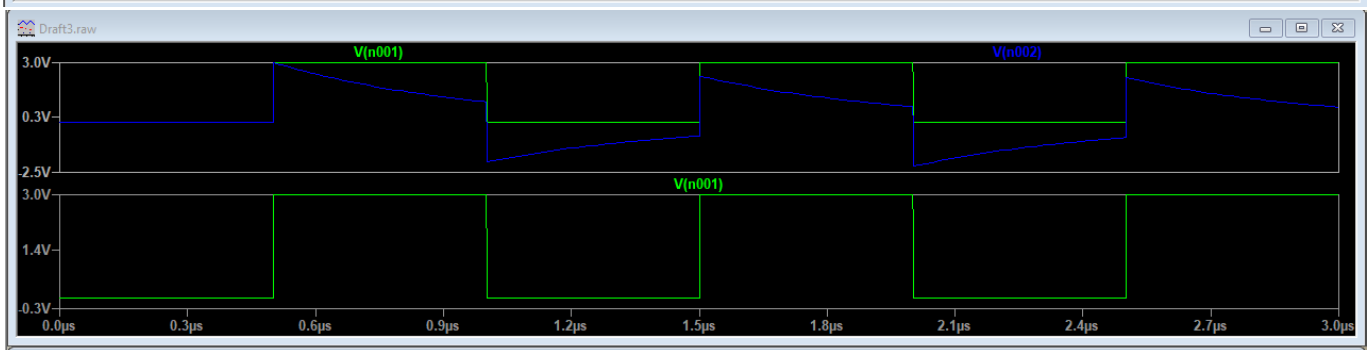
V(n001)
V(n002)
3.0V
1.8V
0.6V
-0.6V
-1.8V
-3.0V
V(n001)
3.0V
1.4V
-0.3V
0.0μs
0.6μs
1.2μs
1.8μs
2.4μs
3.0μs
3.6μs
4.2μs
4.8μs
5.4μs
6.0μs


Draft3.asc
C1
V1
470p
R1
1k
PULSE(0 3 1u 1n 1n 1u 2u)
.tran 6u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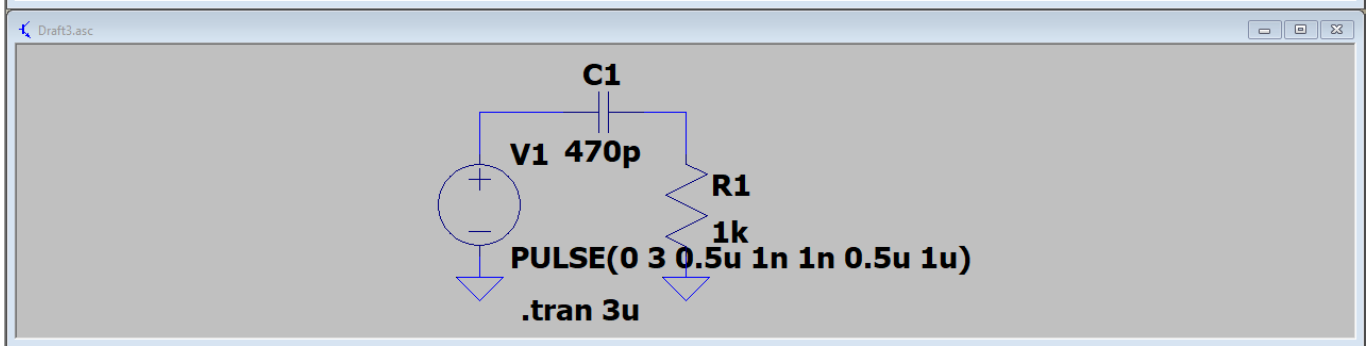
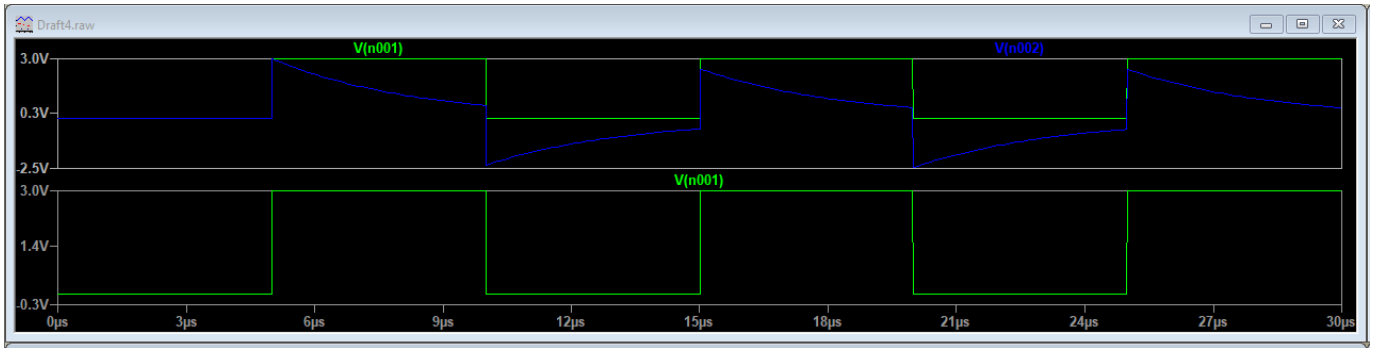
V(n001)
V(n002)
3.0V
0.3V
-2.5V
V(n001)
3.0V
1.4V
-0.3V
0.0μs
0.3μs
0.6μs
0.9μs
1.2μs
1.5μs
1.8μs
2.1μs
2.4μs
2.7μs
3.0μs


Draft3.asc
C1
V1
470p
R1
1k
PULSE(0 3 0.5u 1n 1n 0.5u 1u)
.tran 3u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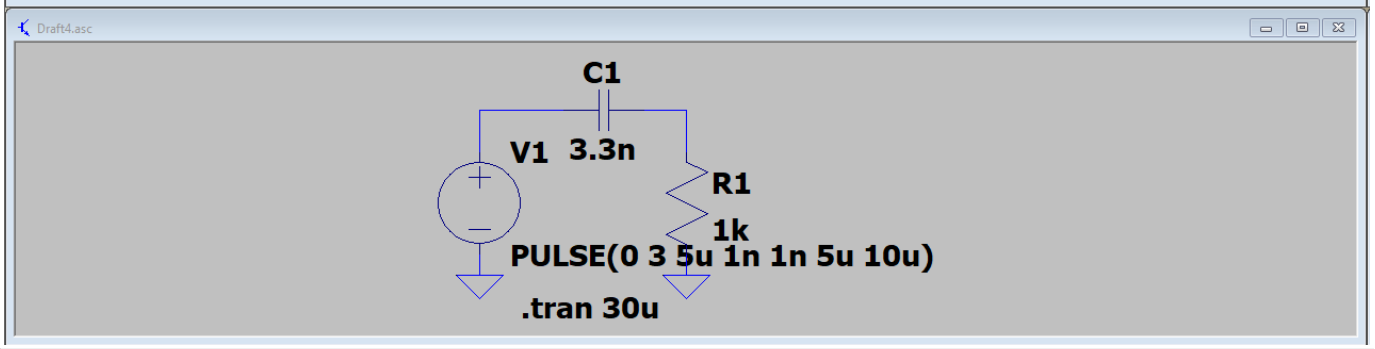
V(n001)
V(n002)
3.0V
0.3V
-2.5V
V(n001)
3.0V
1.4V
-0.3V
0µs
3µs
6µs
9µs
12µs
15µs
18µs
21µs
24µs
27µs
30µs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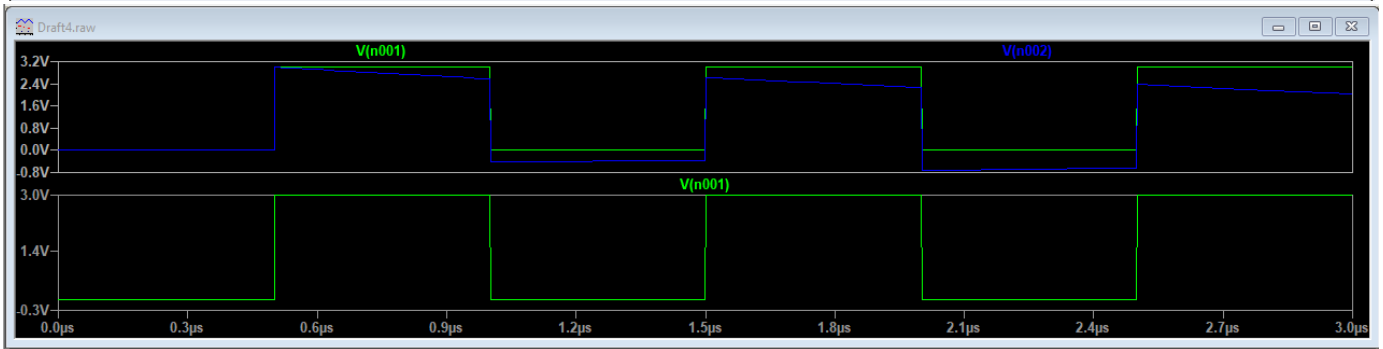
C1
V1
3.3n
R1
1k
PULSE(0 3 5u 1n 1n 5u 10u)
.tran 30u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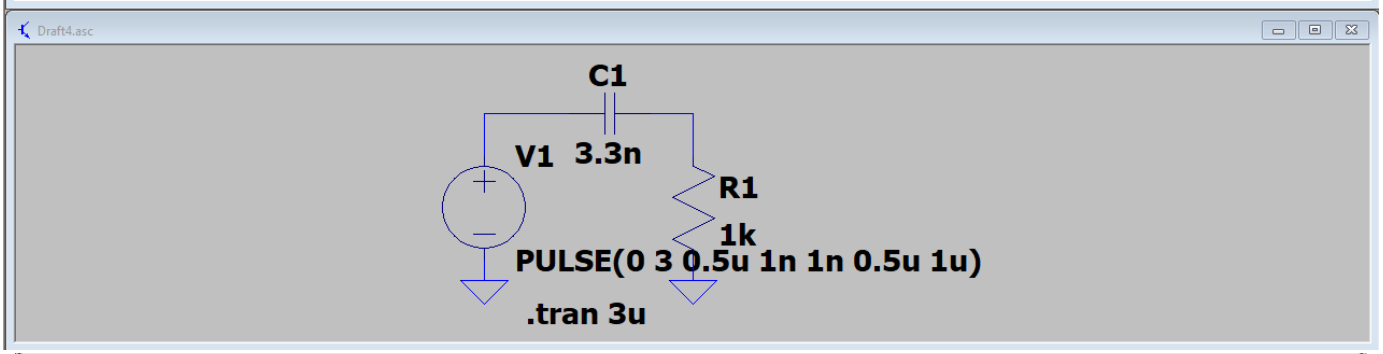
V(n001)
V(n002)
3.2V
2.4V
1.6V
0.8V
0.0V
-0.8V
V(n001)
3.0V
1.4V
-0.3V
0.0µs
0.3µs
0.6µs
0.9µs
1.2µs
1.5µs
1.8µs
2.1µs
2.4µs
2.7µs
3.0µs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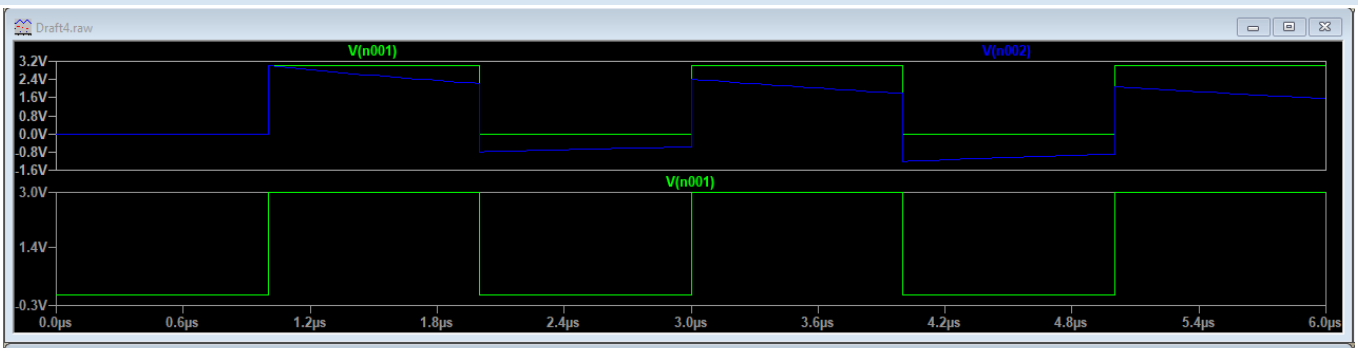
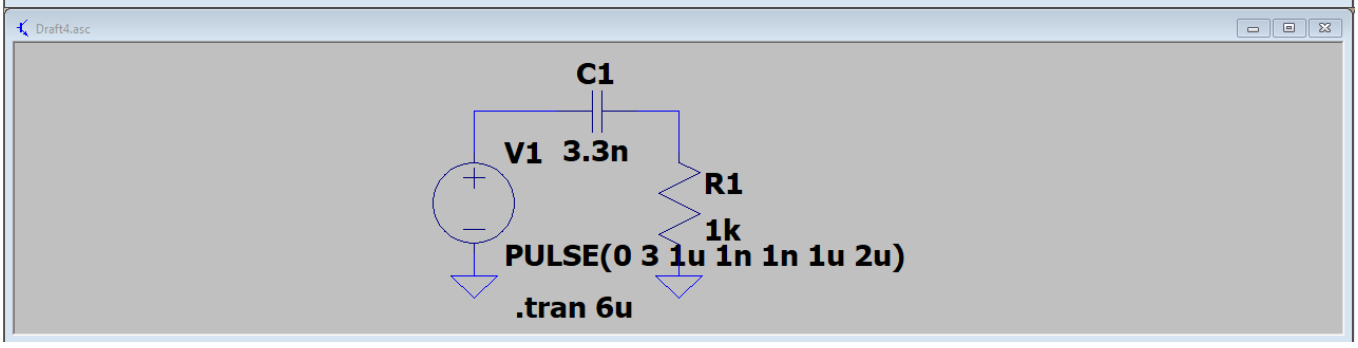
V1
3.3n
R1
1k
PULSE(0 3 0.5u 1n 1n 0.5u 1u)
.tran 3u


Draft4.raw
V(n001)
V(n002)
3.2V
2.4V
1.6V
0.8V
0.0V
-0.8V
-1.6V
V(n001)
3.0V
1.4V
-0.3V
0.0µs
0.6µs
1.2µs
1.8µs
2.4µs
3.0µs
3.6µs
4.2µs
4.8µs
5.4µs
6.0µs


Draft4.asc
C1
V1
3.3n
R1
1k
PULSE(0 3 1u 1n 1n 1u 2u)
.tran 6u

3. $\tau = R \cdot C$

- $R = 330\Omega \quad C = 470pF$

  $\Rightarrow \tau = 330 \cdot 470 \cdot 10^{-12} = 1.551 \cdot 10^{-7} s = 0.15 \mu s$
- $R = 330\Omega \quad C = 3.3nF$

  $\Rightarrow \tau = 330 \cdot 3.3 \cdot 10^{-9} = 1.089 \cdot 10^{-6} s = 1.08 \mu s$
- $R = 1K\Omega \quad C = 470pF$

  $\Rightarrow \tau = 1000 \cdot 470 \cdot 10^{-12} = 4.7 \cdot 10^{-7} s = 0.47 \mu s$
- $R = 1K\Omega \quad C = 3.3nF$

  $\Rightarrow \tau = 1000 \cdot 3.3 \cdot 10^{-9} = 3.3 \cdot 10^{-6} s = 3.3 \mu s$

Periods

- $F1 = 100KHz \Rightarrow T1 = 5\mu s \quad T = 10\mu s$
- $F2 = 500KHz \Rightarrow T1 = 1\mu s \quad T = 2\mu s$
- $F3 = 1MHz \Rightarrow T1 = 0.5\mu s \quad T = 1\mu s$

Trise / Tfall

- $R = 330\Omega \quad C = 470pF$

  $Tfall = 2.2 \cdot 0.155\mu s = 0.34\mu s$
- $R = 330\Omega \quad C = 3.3nF$

  $Tfall = 2.2 \cdot 1.08\mu s = 2.37\mu s$
- $R = 1K\Omega \quad C = 470pF$

  $Tfall = 2.2 \cdot 0.47\mu s = 1.03\mu s$
- $R = 1K\Omega \quad C = 3.3nF$

  $Tfall = 2.2 \cdot 3.3\mu s = 7.26\mu s$

- $R = 330\ \Omega$ $C = 470\ pF$
- $F1 = 100\ KHz \Rightarrow T1 > T_{fall} \Rightarrow U_{max} = 0V$
- $F2 = 500\ KHz \Rightarrow T1 > T_{fall} \Rightarrow U_{max} = 0V$
- $F3 = 1\ MHz \Rightarrow T1 > T_{fall} \Rightarrow U_{max} = 0V$
- $R = 330\ \Omega$ $C = 3.3\ nF$
- $F1 = 100\ KHz \Rightarrow T1 > T_{fall} \Rightarrow U_{max} = 0V$
- $F2 = 500\ KHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(1\mu s)$

  $U_{max} = U_0(1\mu s) = 3 \cdot e^{-\frac{1\cdot10^{-6}}{1.03\cdot10^{-6}}} = 1.19\ V$
- $F3 = 1\ MHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(0.5\mu s)$

  $U_{max} = U_0(0.5\mu s) = 3 \cdot e^{-\frac{0.5\cdot10^{-6}}{1.03\cdot10^{-6}}} = 1.89\ V$
- $R = 1\ K\Omega$ $C = 470\ pF$
- $F1 = 100\ KHz \Rightarrow T1 > T_{fall} \Rightarrow U_{max} = 0V$
- $F2 = 500\ KHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(1\mu s)$

  $U_{max} = U_0(1\mu s) = 3 \cdot e^{-\frac{1\cdot10^{-6}}{0.47\cdot10^{-6}}} = 0.35\ V$
- $F3 = 1\ MHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(0.5\mu s)$

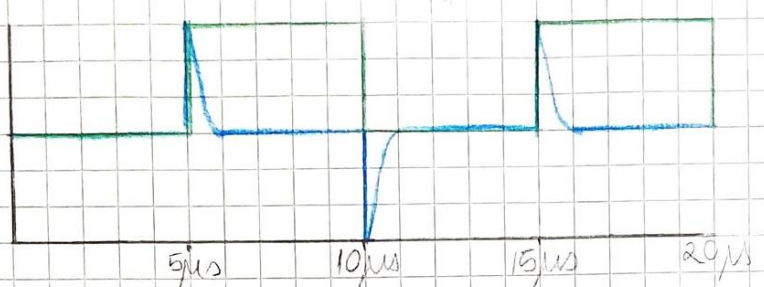
  $U_{max} = U_0(0.5\mu s) = 3 \cdot e^{-\frac{0.5\cdot10^{-6}}{0.47\cdot10^{-6}}} = 1.03\ V$
- $R = 1\ K\Omega$ $C = 3.3\ nF$
- $F1 = 100\ KHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(5\mu s)$

  $U_{max} = U_0(5\mu s) = 3 \cdot e^{-\frac{5\cdot10^{-6}}{3.3\cdot10^{-6}}} = 0.65\ V$
- $F2 = 500\ KHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(1\mu s)$

  $U_{max} = U_0(1\mu s) = 3 \cdot e^{-\frac{1\cdot10^{-6}}{3.3\cdot10^{-6}}} = 2.21\ V$
- $F3 = 1\ MHz \Rightarrow T1 < T_{fall} \Rightarrow U_{max} = U_0(0.5\mu s)$

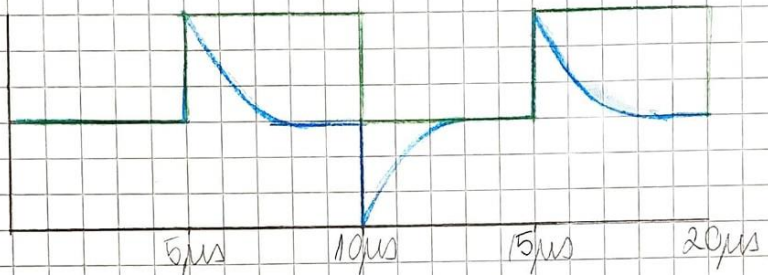
  $U_{max} = U_0(0.5\mu s) = 3 \cdot e^{-\frac{0.5\cdot10^{-6}}{3.3\cdot10^{-6}}} = 2.57\ V$

- R = 330 Ω C = 470 pF F1 = 100 KHz



A = 2.93V (3V)

- R = 330 Ω C = 3.3 nF F1 = 100 KHz

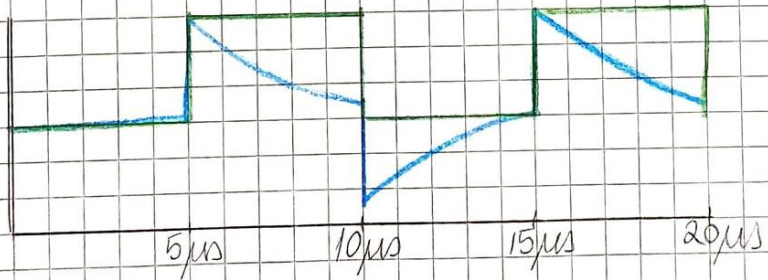


A = 2.92V (3V)

- R = 1 KΩ C = 470 pF F1 = 100 KHz

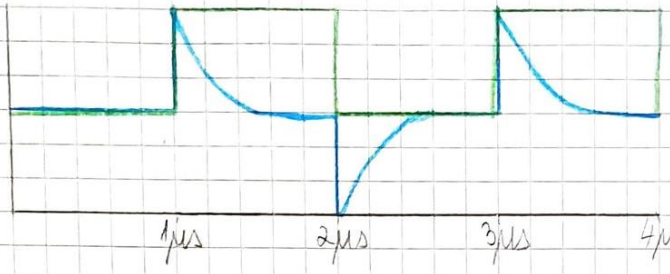
A = 2.97V (3V)

- R = 1 KΩ C = 3.3 nF F1 = 100 KHz



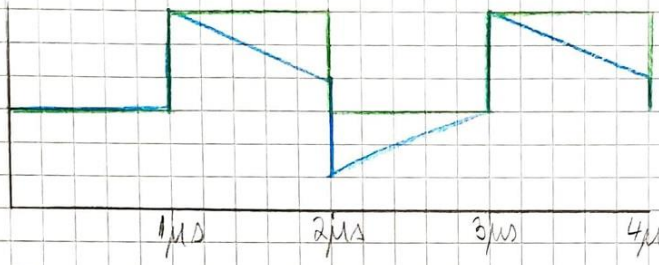
A = 2.33V

- R = 330Ω C = 470pF F2 = 500KHz



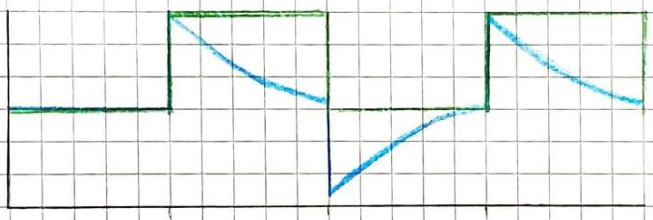
A = 2.91V (3V)

- R = 330Ω C = 3.3nF F2 = 500KHz



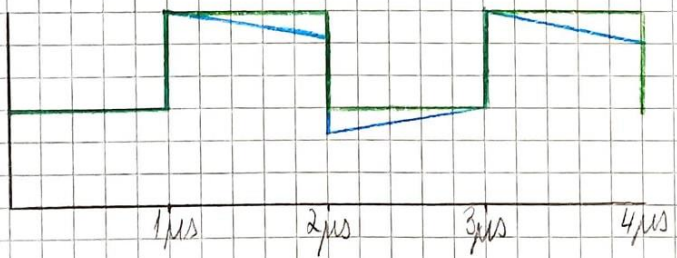
A = 1.78V

- R = 1KΩ C = 470pF F2 = 500KHz



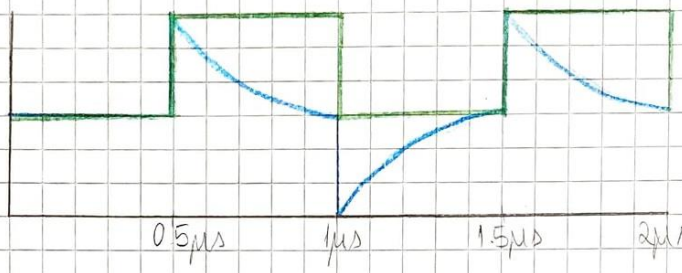
A = 2.61V

- R = 1kΩ C = 3.3nF F2 = 500KHz



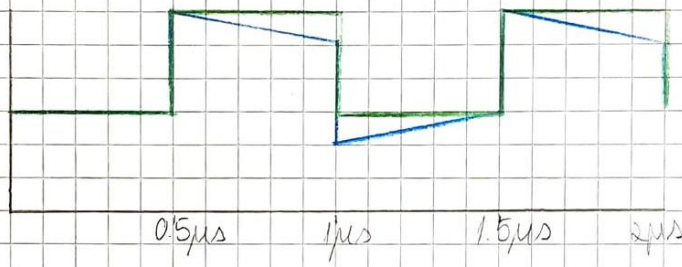
A = 0.77V

- R= 330Ω C = 470pF F3 = 1MHz



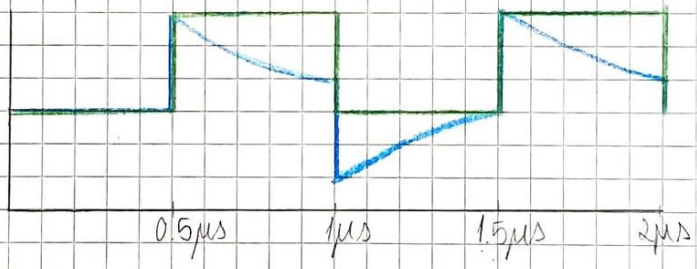
A = 2.85V(3V)

- R = 330Ω C = 3.3nF F3 = 1MHz



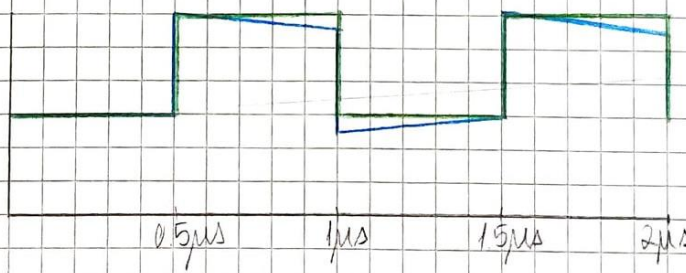
A = 1.09V

- R = 1KΩ C = 470pF F3 = 1MHz



A = 1.94V

- R = 1KΩ C = 3.3nF F3 = 1MHz



A = 0.42V