Faculty of Engineering & Technology
Department of Electrical & Computer Engineering
ENEE2103-Circuit And Electronics Laboratory
PreLab#2

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Contents

Figure:

A- KVL,KCL:

Consider Rx=R1=R4=1kΩ , R5=3.3kΩ,R6=4.7kΩ

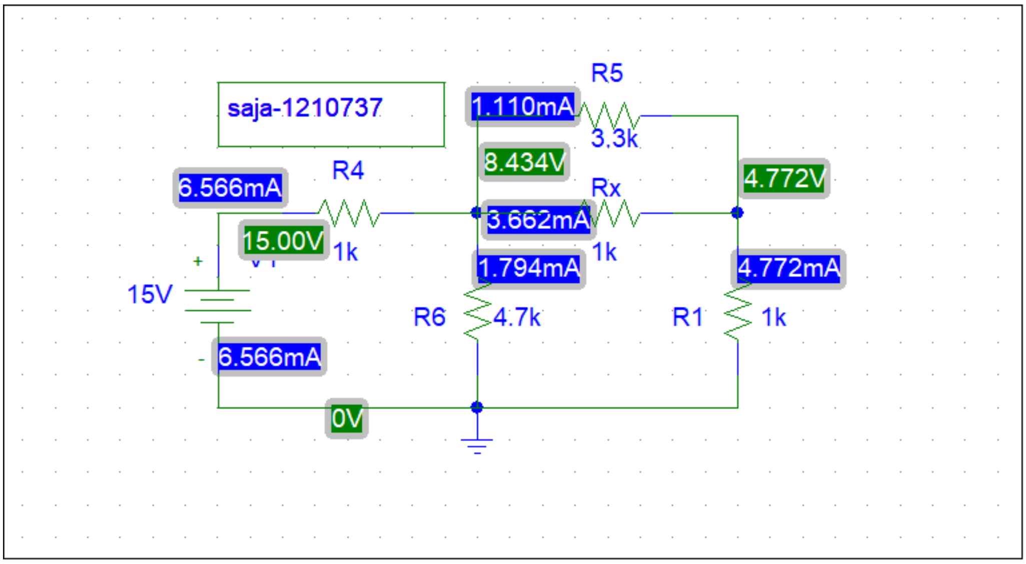

Figure1 :Kvl,Kcl with Rx=1k

For voltage:

V1=4.772volt

V6=8.434volt

By KVL:

V4=15-8.434=6.566volt

V5=Vx=8.434-4.772=3.662volt(in parallel).

Test For current:

I4=6.566mA

By KCl:

I4=I5+Ix+I6

1.110+3.662+1.794=6.566mA

I5+Ix=I1

1.110+3.662=4.772mA

Change the value of Rx to the half of the first value.

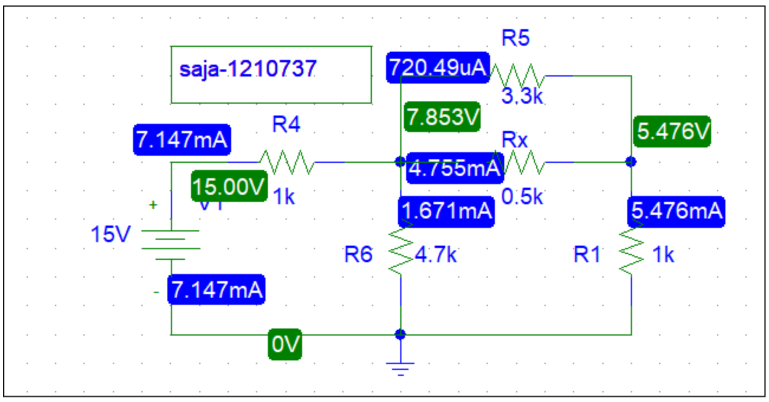

Figure 2:Kvl,Kcl with Rx=0.5k

For voltage:
V1=5.476volt
V6=7.853volt
By KVl:
V4=15-7.853=7.147volt
V5=Vx=7.853-5.476=2.377volt

Test For current:
I4=7.147mA
By KCl:
I4=I5+Ix+I6
0.72049+4.755+1.671=7.14649mA
I5+Ix=I1
0.72049+4.755=5.47549mA

In two case the simulation result match the expected result.

B-Voltage & current Division:

I. Voltage division:

Consider Rx=R1=R4=1kΩ , R6=4.7kΩ

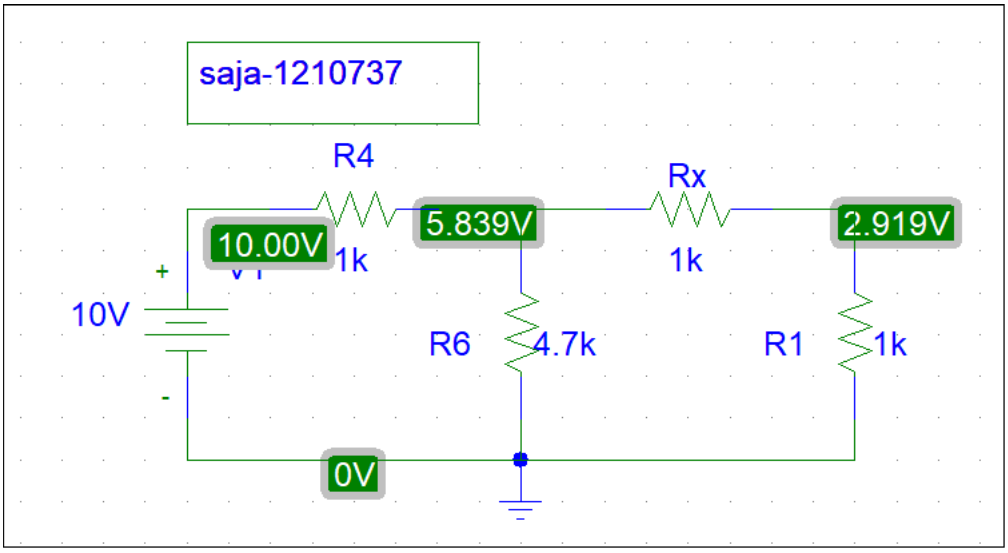

Figure3 :voltage division circuit with Rx=1k

Vs=10volt
Rx+R1=2k
2k//R6=1.402k
V6=Vs*1.402/(1.402+1)=5.836volt by voltage divider rule.
V4=Vs*1/(1.402+1)=4.163volt
Vx=V6*Rx/(R1+Rx)=2.918volt
V1=V6*R1/(R1+Rx)=2.918volt

Consider Rx=0.5k ,R1=R4=1kΩ , R6=4.7kΩ

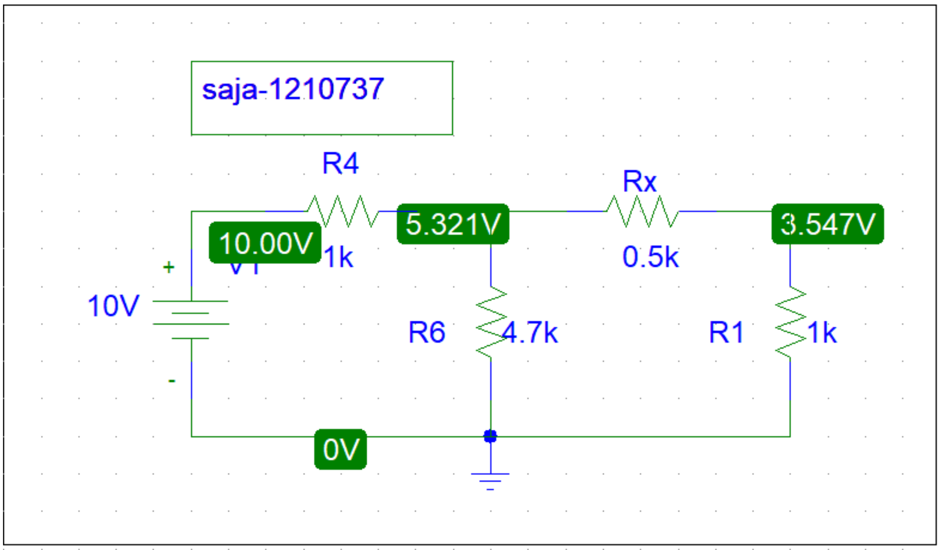

Figure4 : voltage division circuit with Rx=0.5k

Vs=10volt

Rx+R1=1.5k

1.5k//R6=1.137k

V6=Vs*1.137/(1.137+1)=5.321volt by voltage divider rule.

V4=Vs*1/(1.137+1)=4.679volt

Vx=V6*Rx/(R1+Rx)=1.774volt

V1=V6*R1/(R1+Rx)=3.547volt

The result in simulation is match the expected result .

II. Current division:

When Rx=1k:

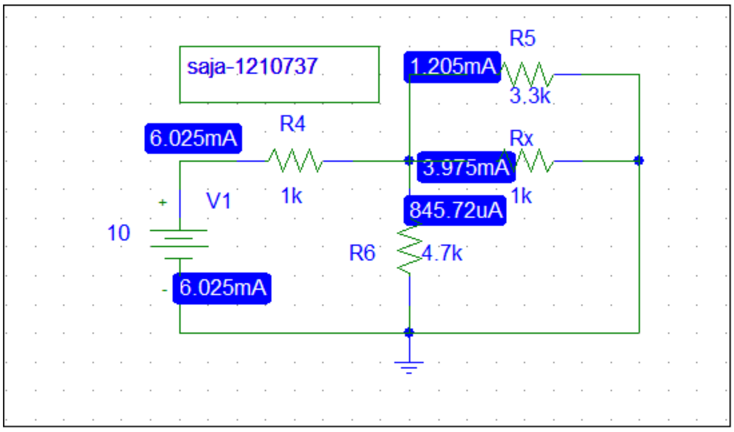

Figure 5: current division with Rx=1k

Req=R4+[R5//R6//Rx]=1.66k

I4=Vs/Req=6.024mA

Rx//R6=0.824k
I5=I4*0.824/(0.824+3.3)=1.204mA

Rx//R5=0.767k
I6=I4*0.767/(0.767+4.7)=0.845mA

R5//R6=1.939k
Ix=I4*1.939/(1.939+1)=3.974mA

When Rx=0.5k

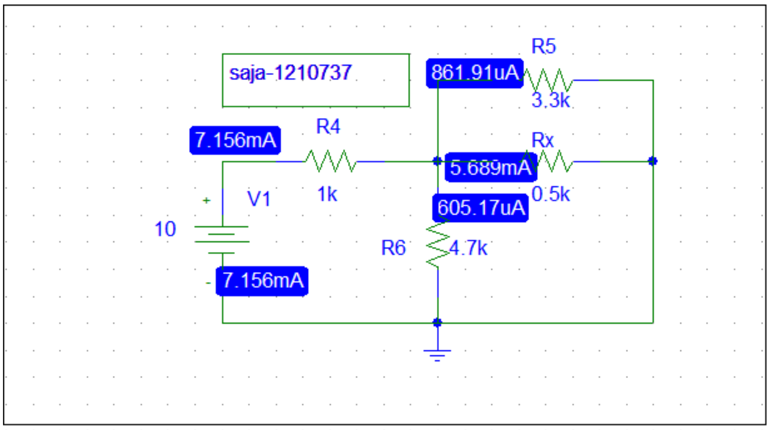

Figure 6: current division when Rx=0.5k

Req=R4+[R5//R6//Rx]=1.397k

I4=Vs/Req=7.158mA

Rx//R6=0.452k
I5=I4*0.452/(0.452+3.3)=0.862mA

Rx//R5=0.434k
I6=I4*0.434/(0.434+4.7)=0.605mA

R5//R6=1.939k
Ix=I4*1.939/(1.939+0.5)=5.690mA

The result in simulation is match the expected result .

c. superposition:

when Vs1=5volt and vs2=10volt

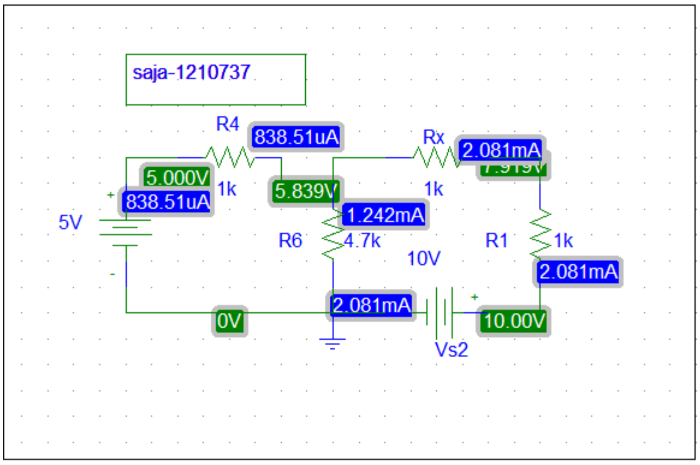

Figure7 :superposition circuit with vs1=5 & vs2=10

When Vs1=0 and Vs2=10

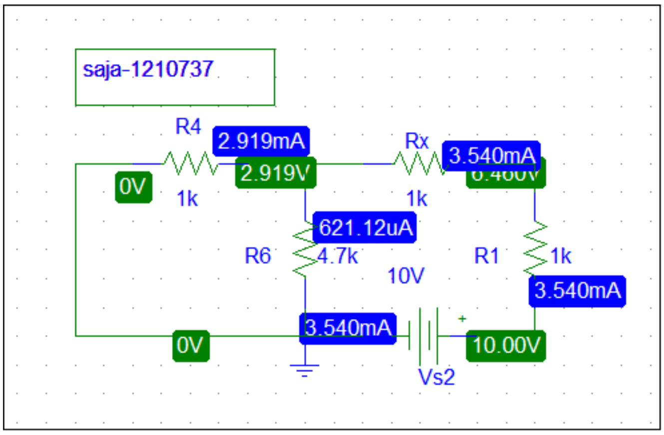

Figure 8:superposition when kill Vs1

R4//R6=0.825k

V6'=Vs2*0.825/(0.825+Rx+R1)=2.92volt

I6'=V6/R6=0.621mA

When Vs1=5 & Vs2=0:

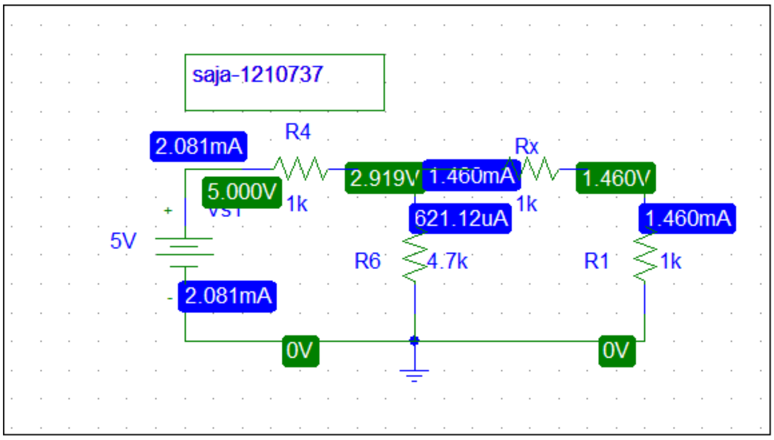

Figure 9:superposition when kill vs2

[Rx+R1]//R6=1.403k

V6''=Vs1*1.403/(1.403+R4)=2.919volt

I6''=V6''/R6=0.621mA

V6=V6'+V6''=2.92+2.919=5.839volt

I6=I6'+I6''=0.621+0.621=1.242mA

The result in simulation is match the expected result .

D-Thevinin and Norton equivalent circuits:

1. Set the Vs1 to 5volts and Vs2 to 10 volts and measure voltage across R1.

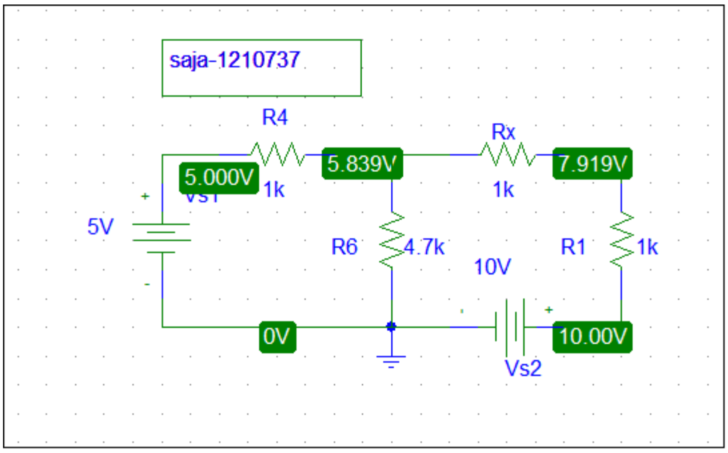

Figure 10:circuit to find VR1

VR1=VS2-VRx=10-7.919=2.081volt

2. Disconnect R1 and measure the voltage on the terminals (a,b) .[Voc- open circuit voltage]

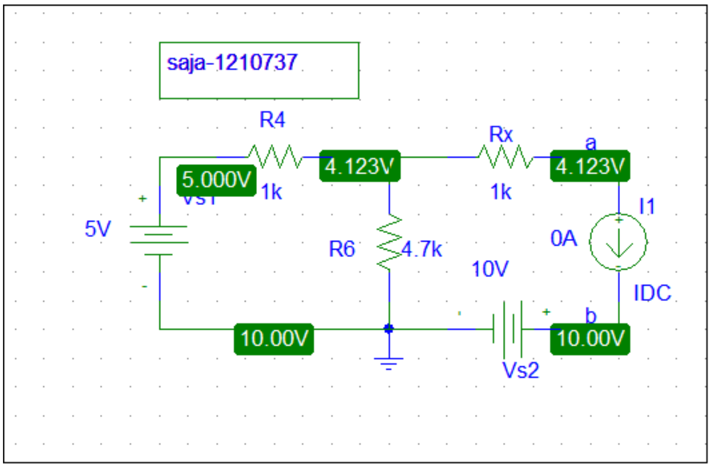

Figure 11:circuit to find Voc

Voc=10-4.123=5.877volt

3. Short circuit the terminals (a, b) and measure the current in the short circuit (Isc)

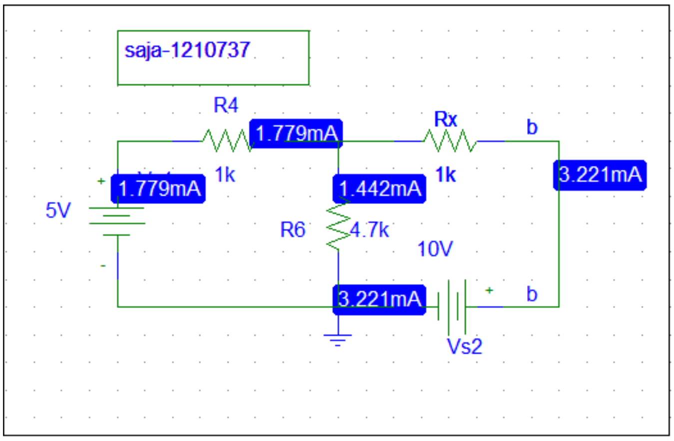

Figure 12:circuit to find Isc

Isc=Ix=3.221mA

4. Disconnect the voltage sources and short circuit the terminals where each source was connected and Measure the resistance from the terminals (a,b) (Rab=Rth).

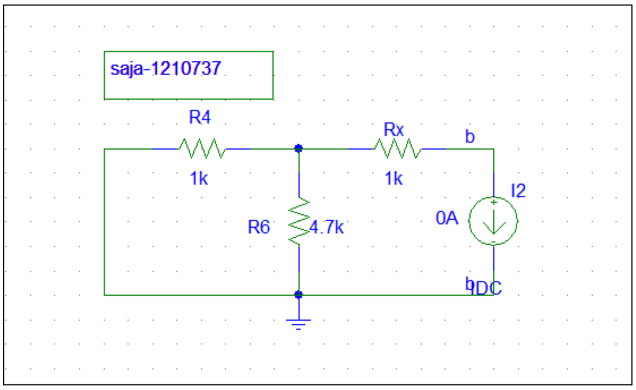

Figure 13:circuit to find Rth

Rth=[Rx//R6]+R4=1.825k

5. connect the thevinin equivalent circuit:

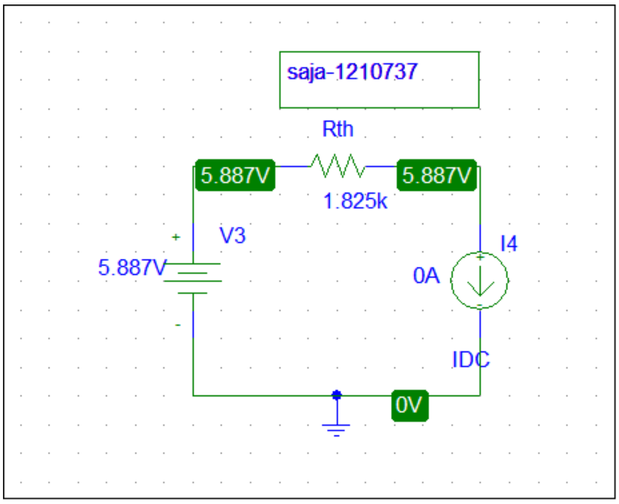

Figure 14:thevinin equivelant circuit

Vab=Voc+VRth=5.887+0=5.887volt

6- . Short circuit the terminals of the series connection and measure the current in the short circuit

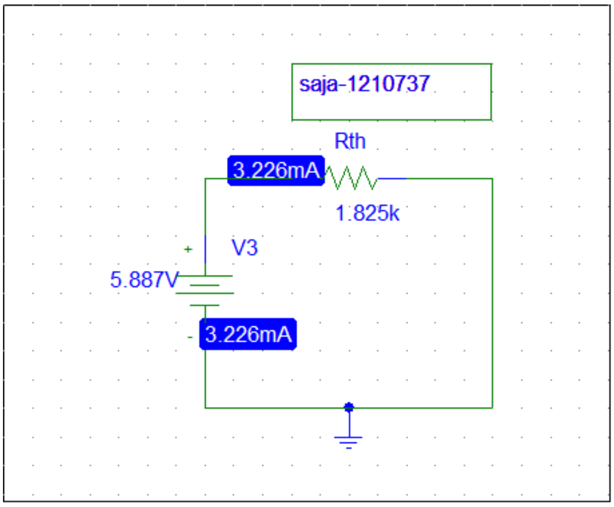

Figure 15: circuit to find Iab from thevinin

Iab=Voc/Rth=3.226mA

the relation between the voltage values measured in steps (2,5)-→ they are equal.

the relation between the voltage values measured in steps (3,6) → they are equal.

7. Connect the resistance R1 across terminal a-b and measure the voltage across it

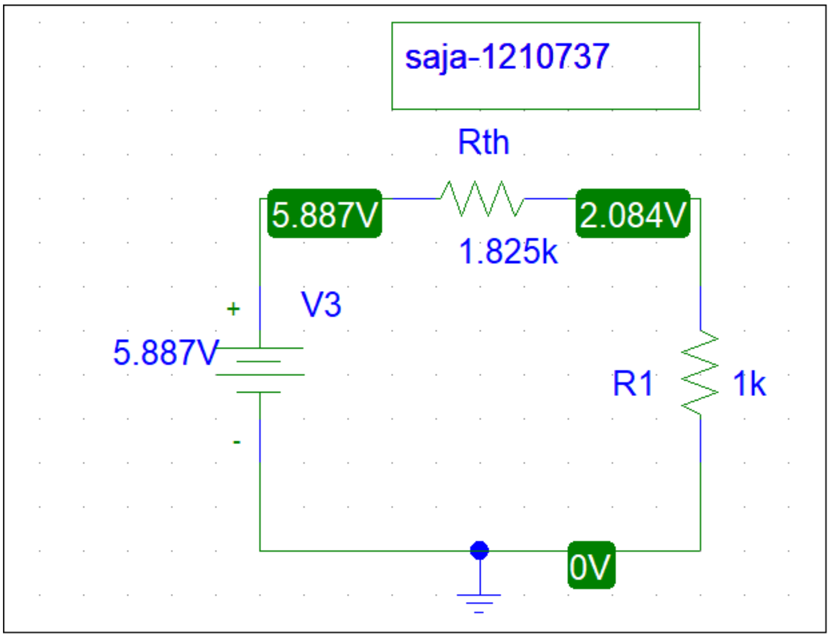

Figure 16:connect R1 to thevinin equivelant circuit

VR1=Voc*R1/[R1+Rth]=2.084V

The value in this step is equal the value in step 1

The result in simulation is match the expected result .

8. Compare the short circuit current value with the Norton current source determined by computation

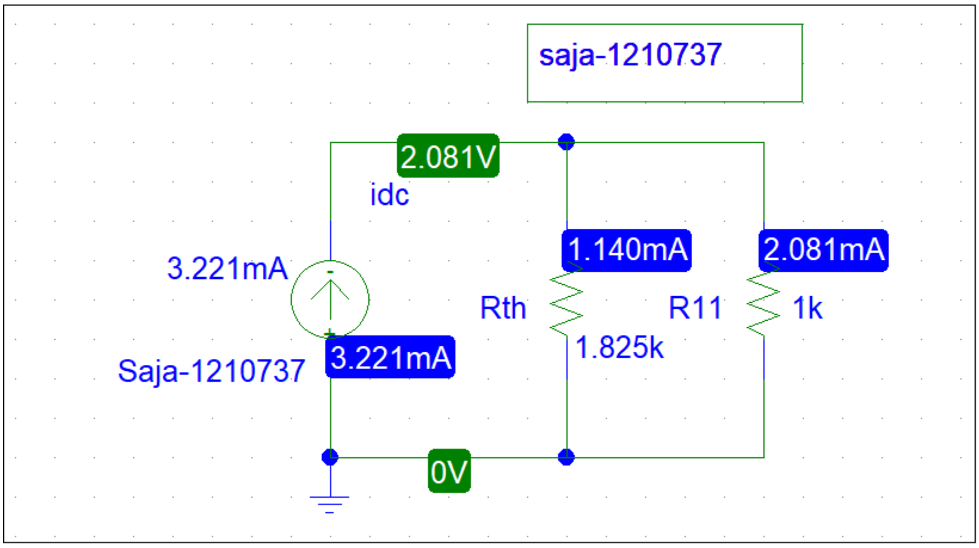

Figure17 : Nortan equivelant circuit