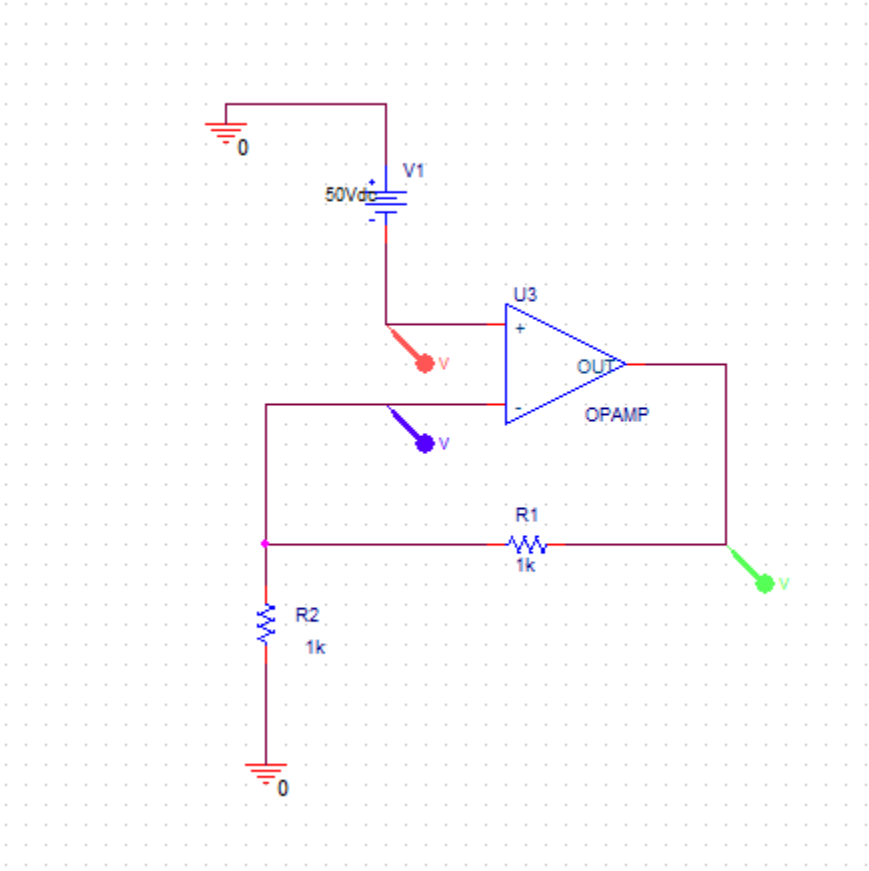
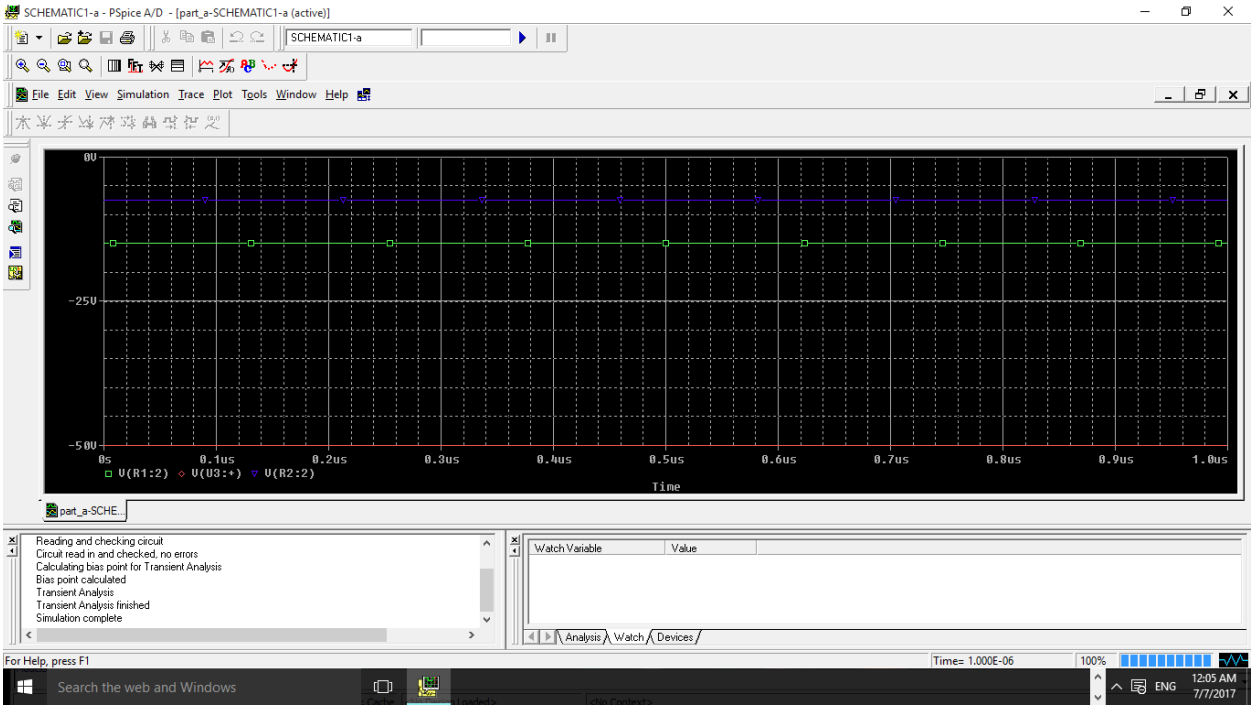
هدف : کنترل یک متغیر انالوگ در یک سیستم دیجیتال (مدارهایDAC)

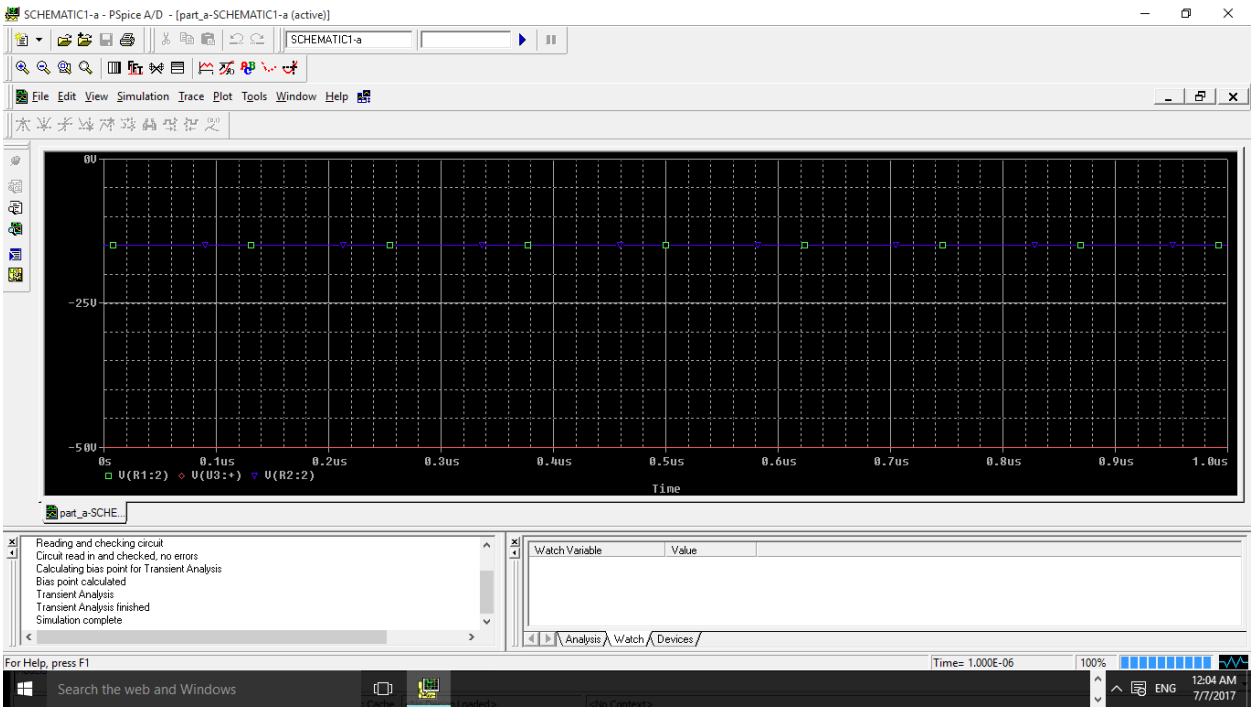
A)

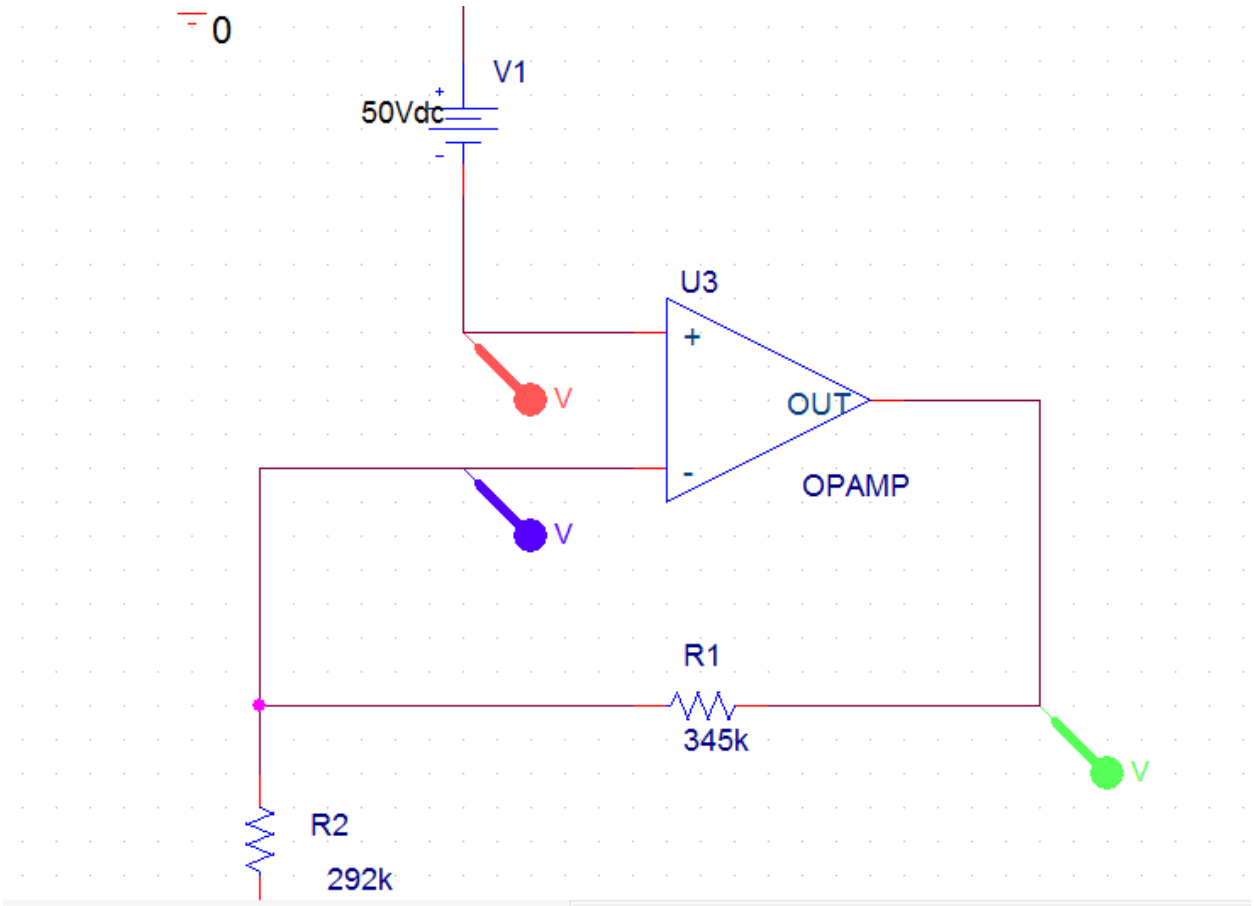


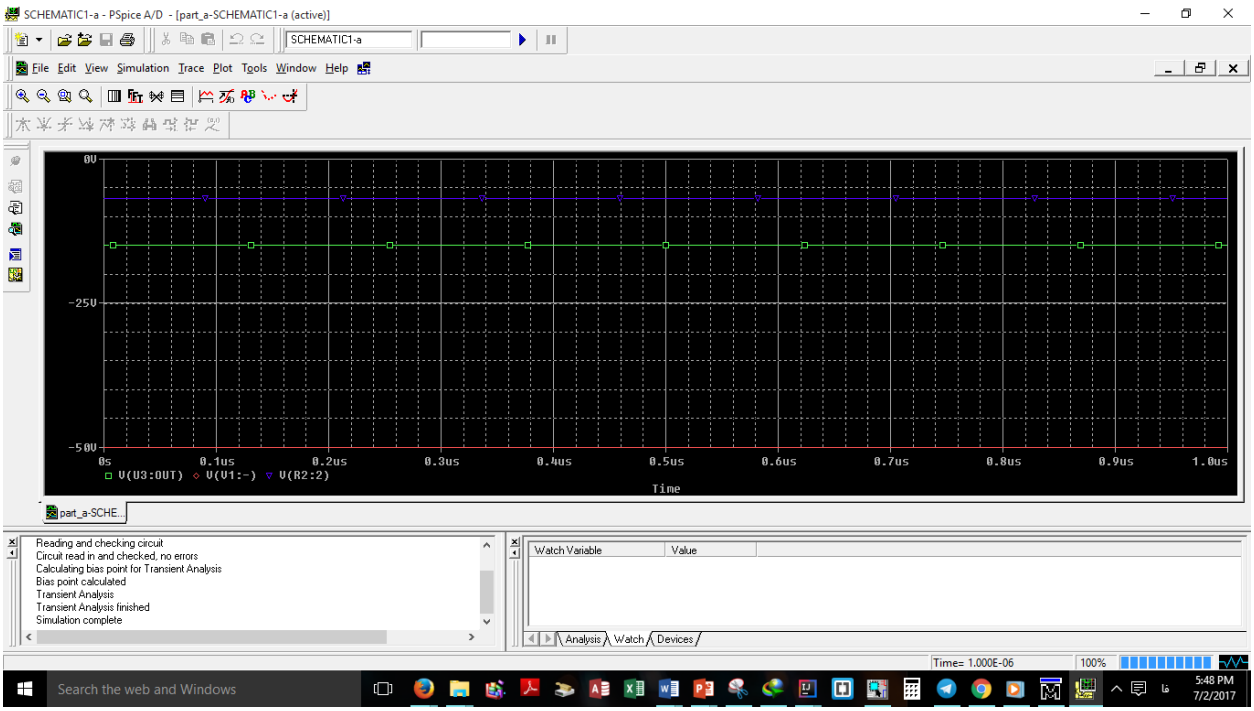
V=50 , r1,r2=1k



V=50 , r1=1 , r2=1000000k


SCHEMATIC1-a - PSpice A/D - [part_a-SCHEMATIC1-a (active)]
File Edit View Simulation Trace Plot Tools Window Help
0V
-25V
-50V
0s 0.1us 0.2us 0.3us 0.4us 0.5us 0.6us 0.7us 0.8us 0.9us 1.0us
V(R1:2) V(U3:+) V(R2:2)
Time
Reading and checking circuit
Circuit read in and checked, no errors
Calculating bias point for Transient Analysis
Bias point calculated
Transient Analysis
Transient Analysis finished
Simulation complete
Watch Variable
Value
Analysis Watch Devices
For Help, press F1
Time= 1.000E-06
100%
Search the web and Windows
ENG
12:04 AM
7/7/2017


0
V1
50Vdc
U3
+
-
OUT
OPAMP
V
V
R1
345k
R2
292k
V



B)

با استفاده از ترانزیستور های N P N ، P N P ، دیود ، مقاومت و تنها یک opAmp ، مدار یک DAC ده بیتی را طراحی کنید.

نکته ۱ : این مدار باید دارای ۱۰ ورودی دیجیتال باشید.

نکته ۲ : فرض کنید بخش دیجیتال مدار بین ۰ تا ۵ولت کار میکند.

نکته ۳ : خروجی مدار باید به صورت زیر باشد :

$$V_{out} = \frac{Value\ of\ Digital\ Input}{2^{(Number\ of\ Digital\ Inputs)}} \times (Circuit's\ Operational\ Digital\ Voltage)$$

اولین ایده ای که به ذخن میرسد احتمالا استفاده از خازن خواهد بود .

ولی در طراحی مدارات واقعی سعی میشود از خازن استفاده نشود . به دلیل نویز پذیری خیلی بالا و تغییر خاصیت فیزیکی آنها با گذشت زمان .

its simply a circuit that will take as input a digital 10-bit number from 0 (0000000000) to 1023(1111111111), and output the relative value on a scale from 0 to 5v.

The maths that describe this process is very simple, an 10bit converter will divide the 5 volts into 1023 steps, each step having a value of:

5/1023= 0.0048 V

Then the output voltage for the converter should be equal to the binary input multiplied by the step value, e.g. for an input of 129 (001000 0001 in binary) the output voltage should be:

129 X 0.0048 = 0.6192V

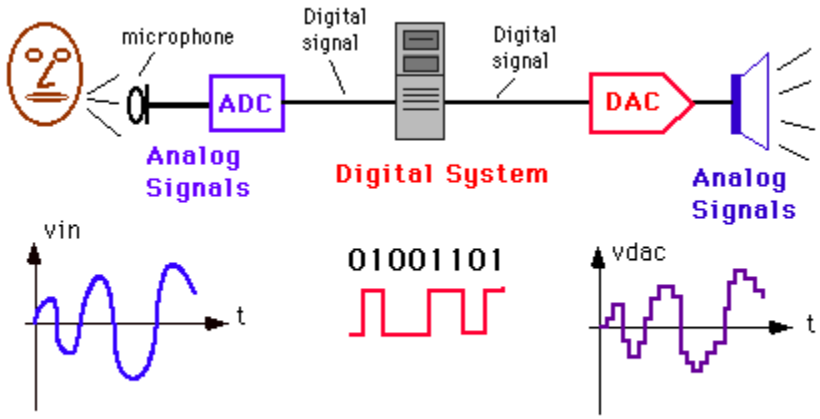


Figure 1: Digital processing system with an ADC at the input and a DAC at the output

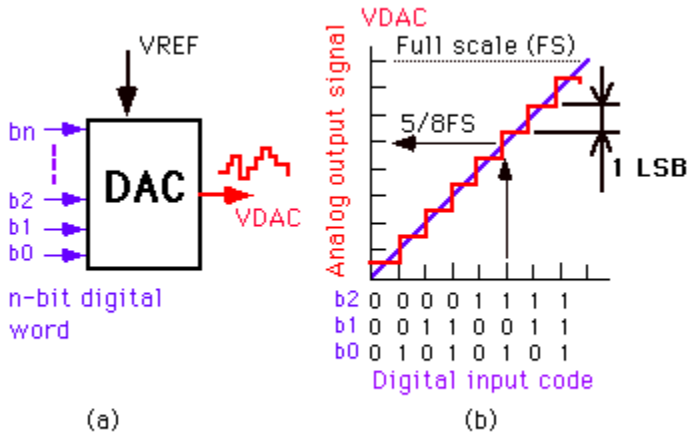
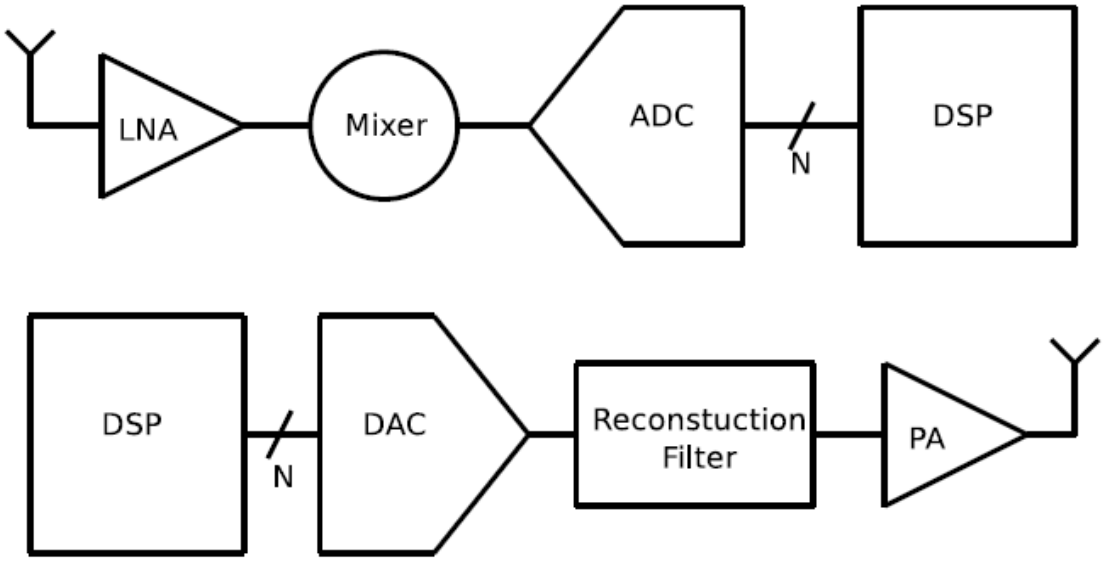


Figure 3: (a) DAC block diagram; (b) input-output characteristic of a DAC



A DAC with a resolution of N will need to produce 2^N reference voltages. The binary word input D of the DAC can be characterized as:

$$D = \sum_{m=0}^{N-1} 2^m (b_m)$$

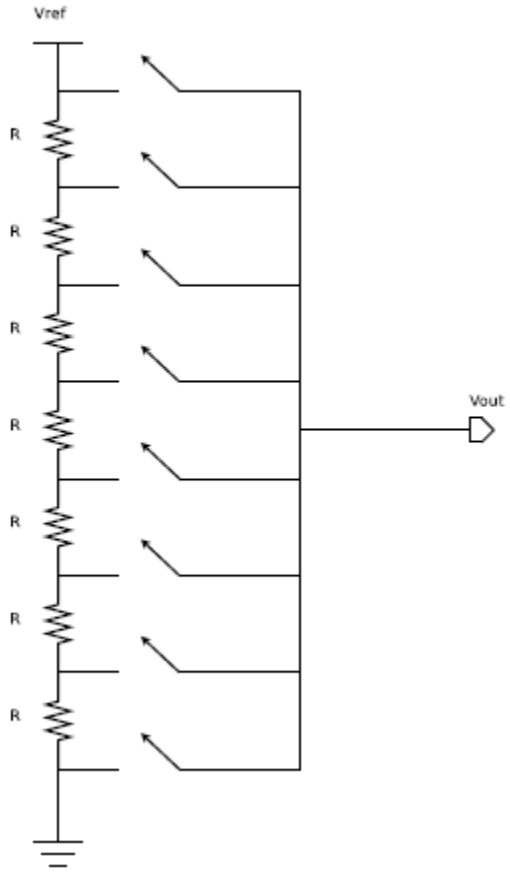
With this reference voltage V_{ref}, the analog output at any given digital input can be determined by:

$$v_{out} = V_{ref}\left(\frac{D}{2^N}\right)$$

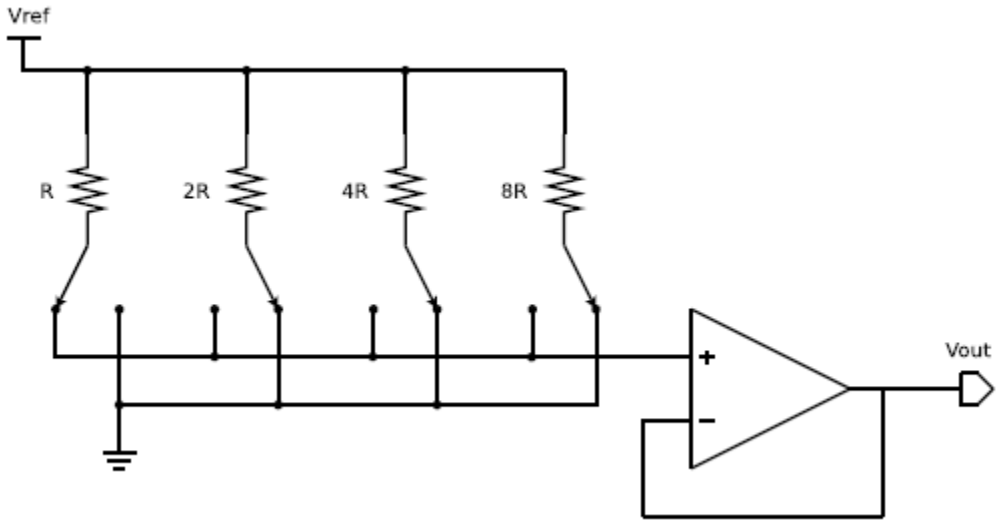
Number of digital input is : 10

***The main building block in every DAC is a component that creates an appropriate analog output level by dividing a reference voltage. Elements such as resistors split the reference voltage into smaller voltage or current levels.**
=>Transistor current sources can also create output currents that are converted to the analog output voltage by the load resistors.
Capacitors are also used in some architectures to store charge from the reference voltage and discharge it to the output.

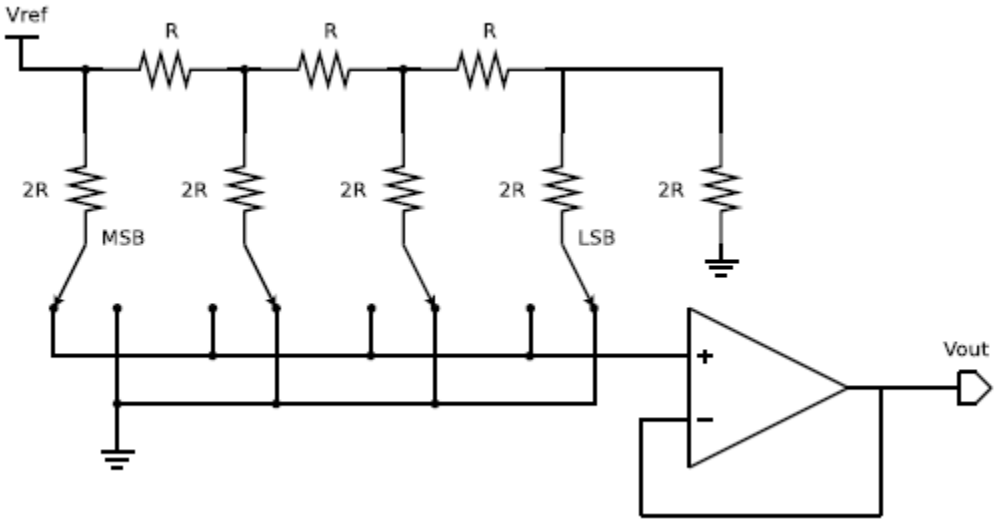
1.2.1 Resistor String DAC

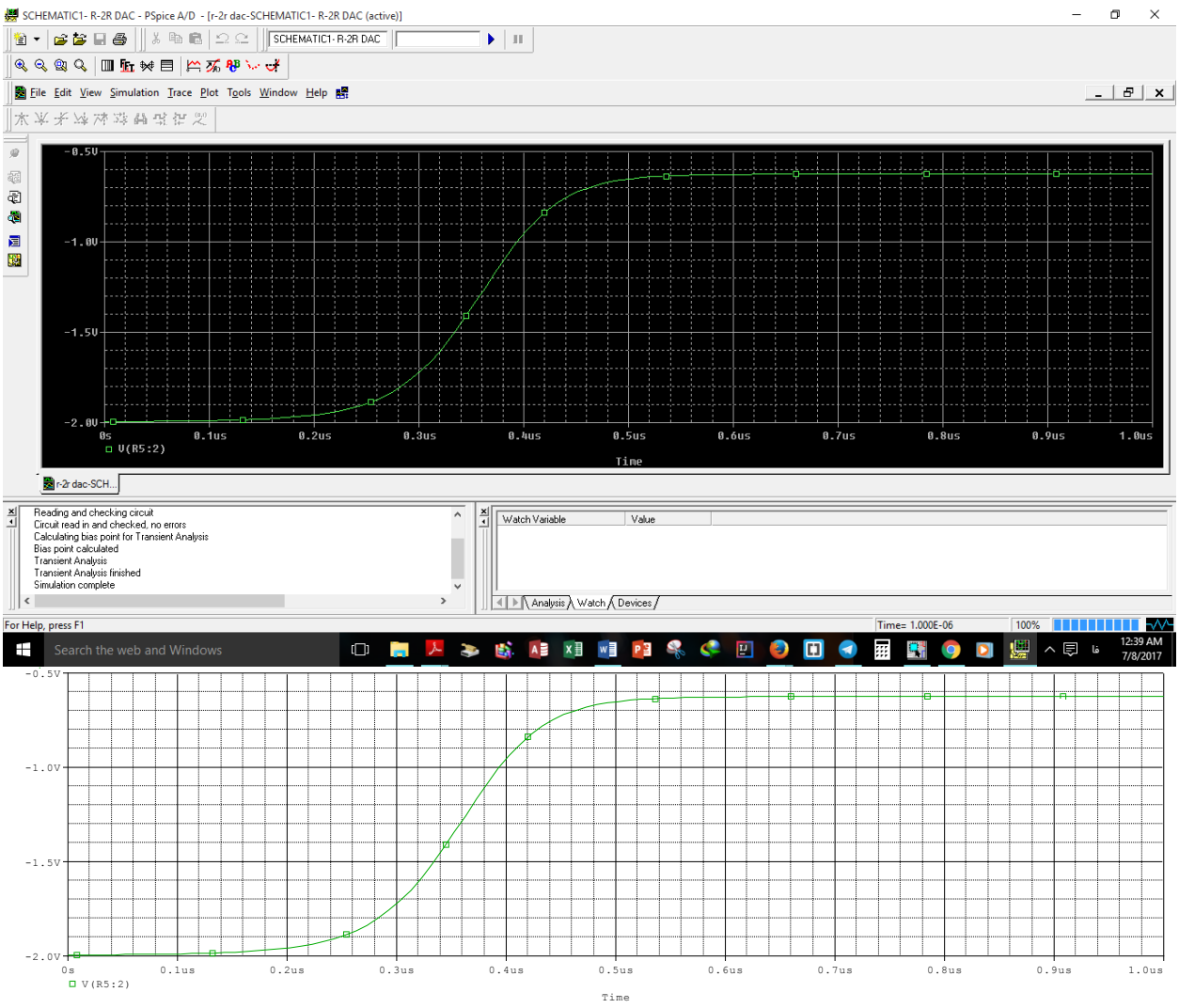


1.2.2 BinaryWeighted Resistor Ladder DAC



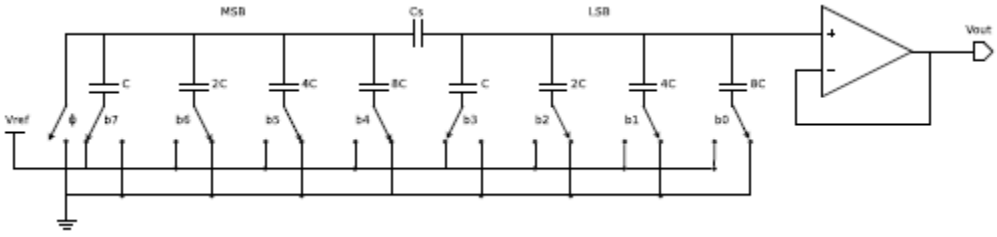
1.2.3 R-2R DAC



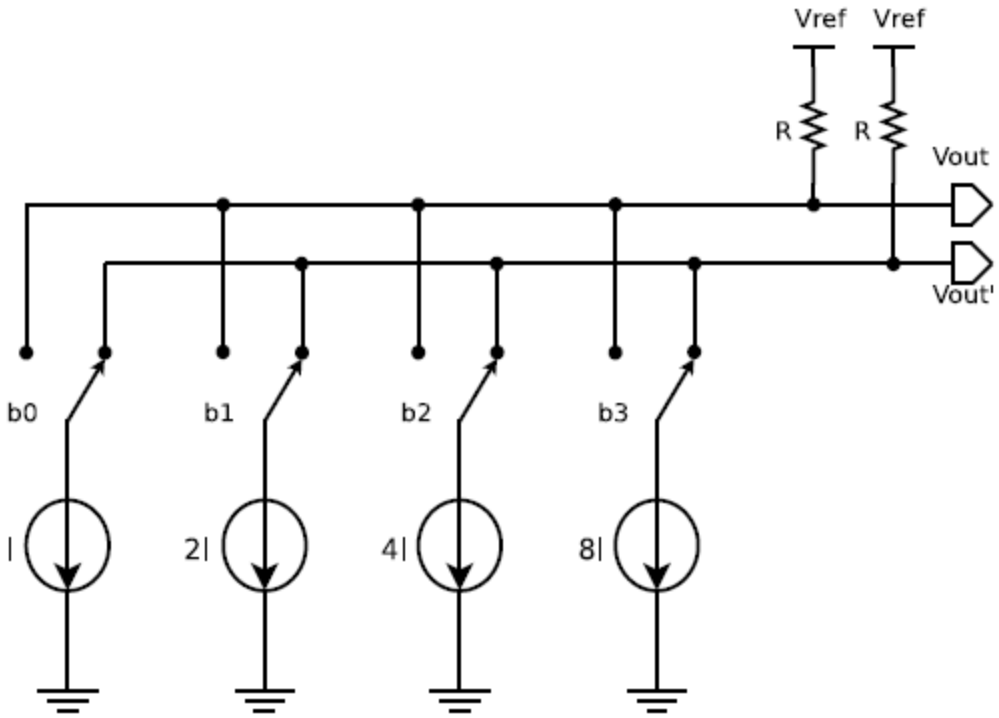


Vout = 10/1024 * (5-0) =0.048S

1.2.4 Charge Scaling DAC



1.2.5 Current Steering


Vref
Vref
R
R
Vout
Vout'
b0
b1
b2
b3
I
2I
4I
8I