# ANALOG VS. DIGITAL

where can you stand on each side?

# where can you stand on each side?

# where can you stand on each side?

# where can you stand on each side?

# where can you stand on each side?

CONTINUOUS

any level is possible

DISCRETE

only four different levels

# analog and digital clocks

Image source: Wikipedia

Image source: Wikipedia

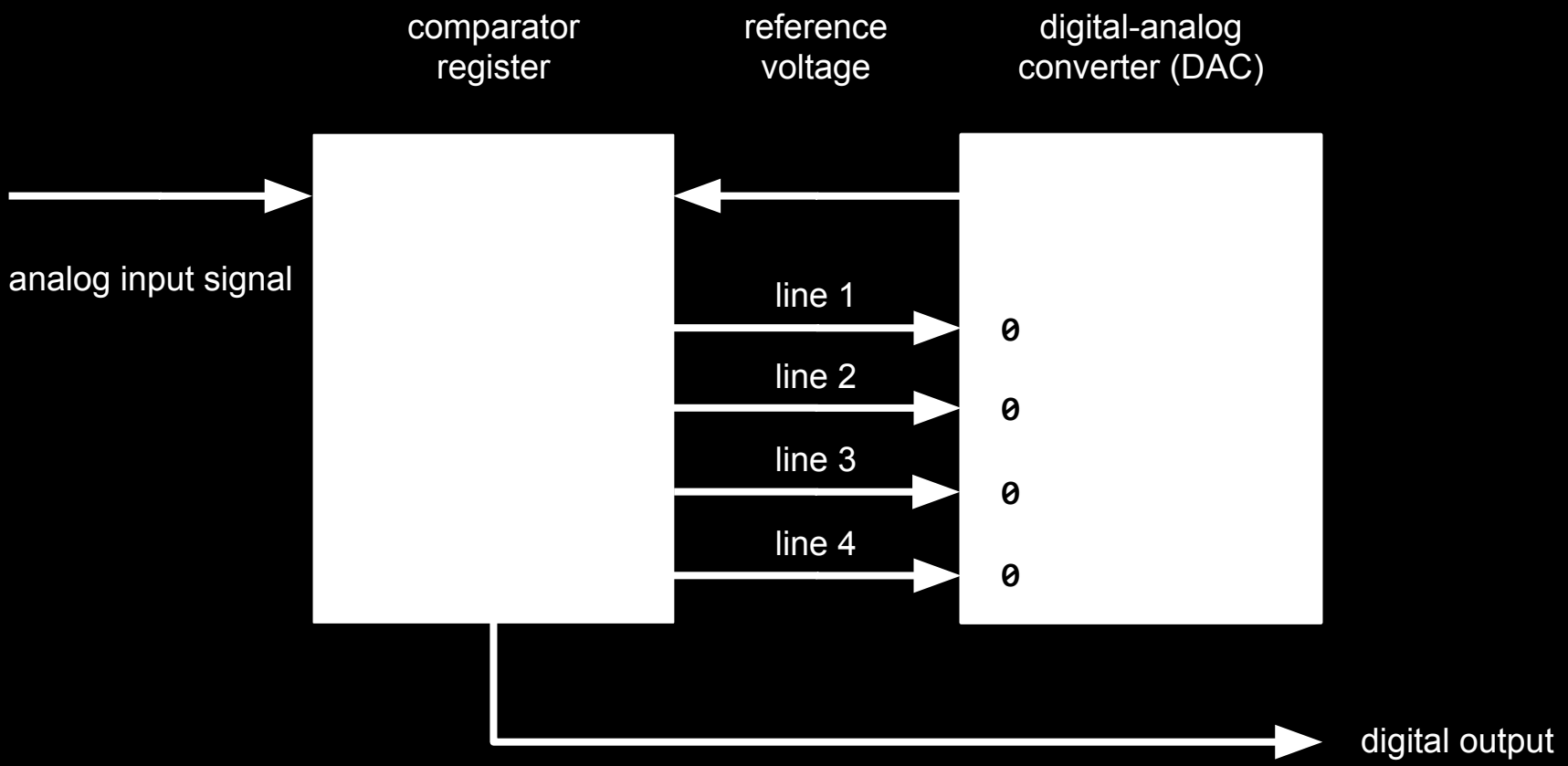
“Digitization is the representation of an object, image, sound, document or signal by generating a series of numbers that describe a discrete set of its points or samples”

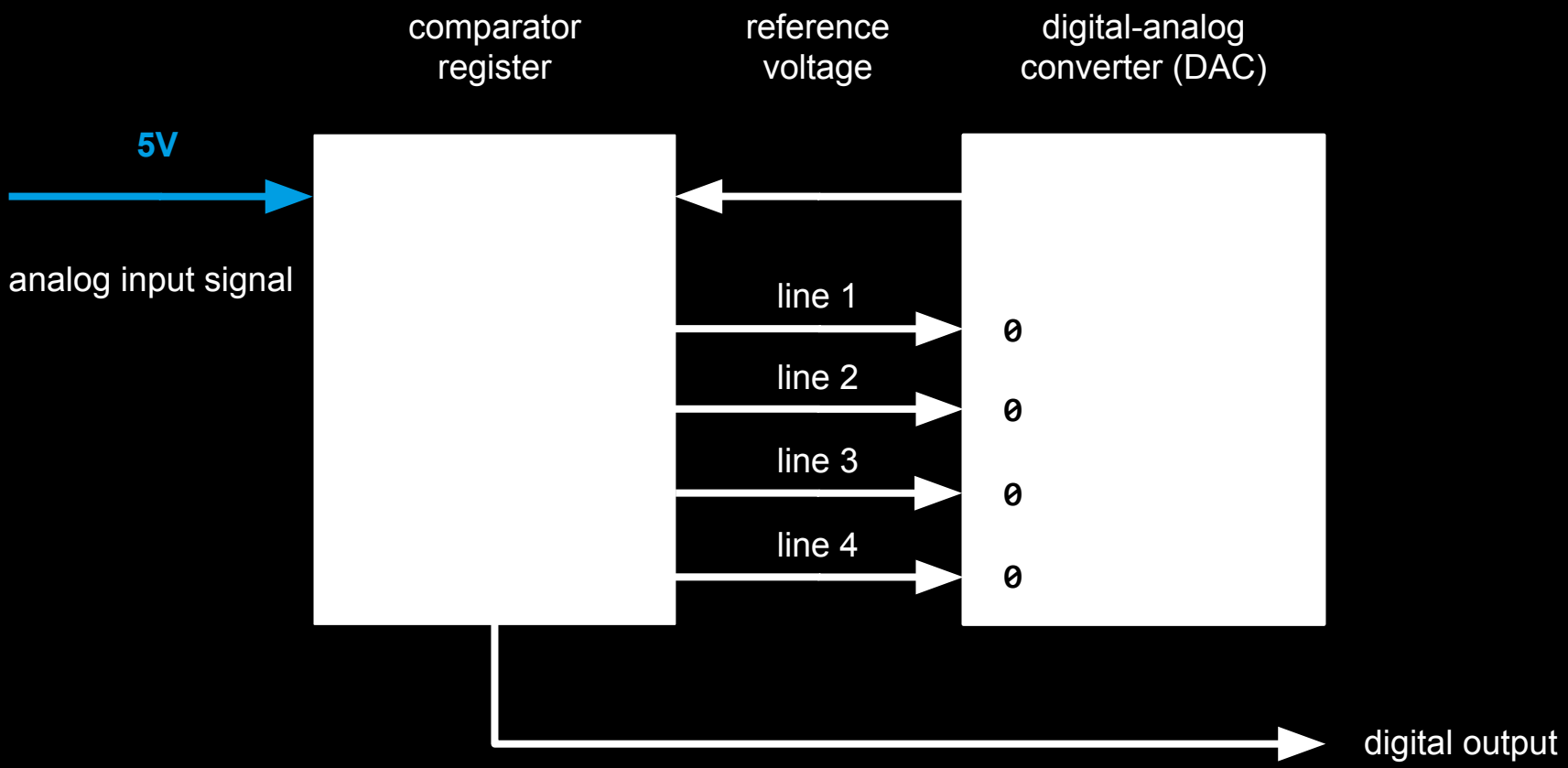
analog-to-digital converter (ADC)

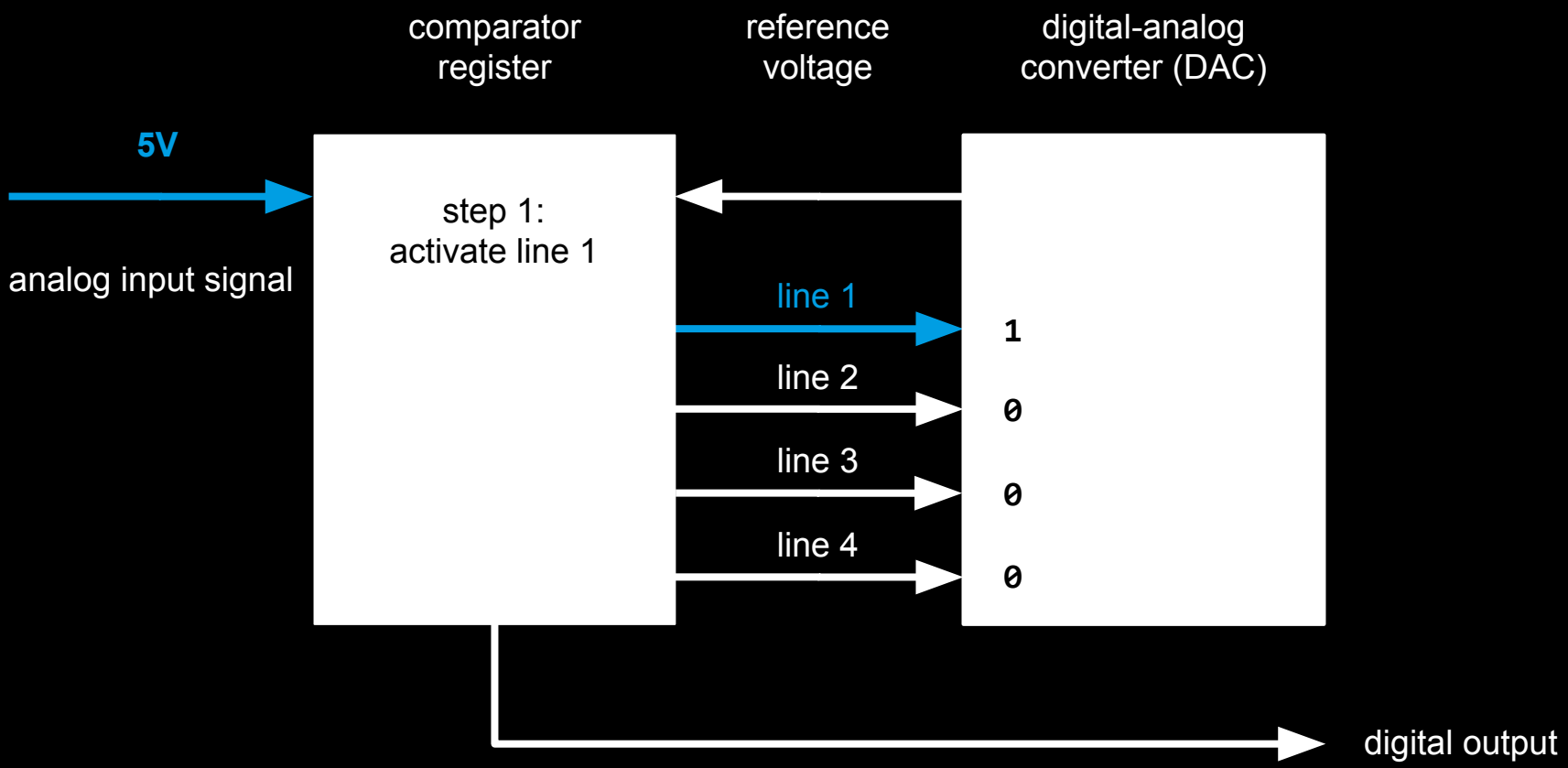
measuring of the analog signal

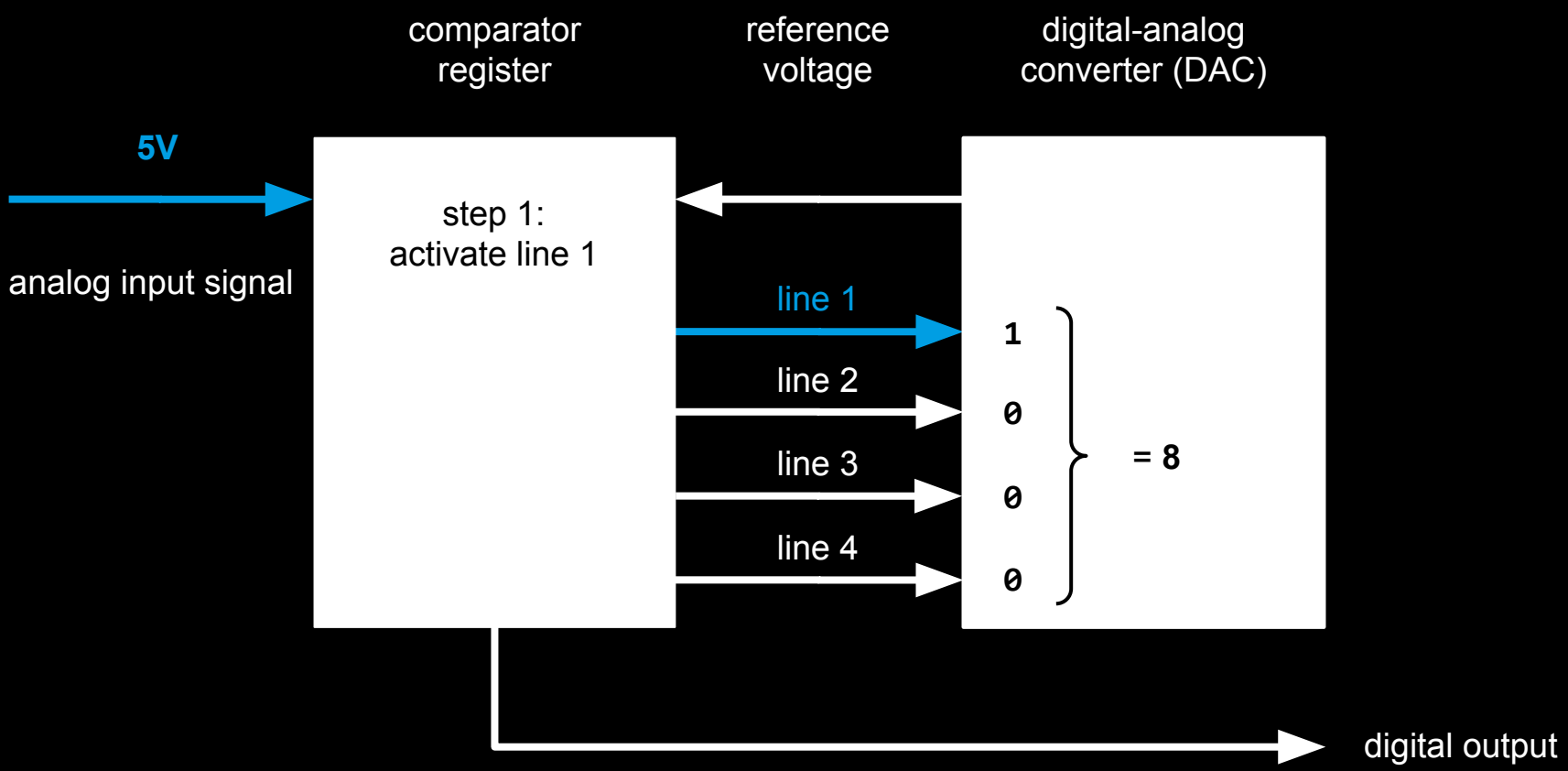
turning the measurement into a series of 1 and 0

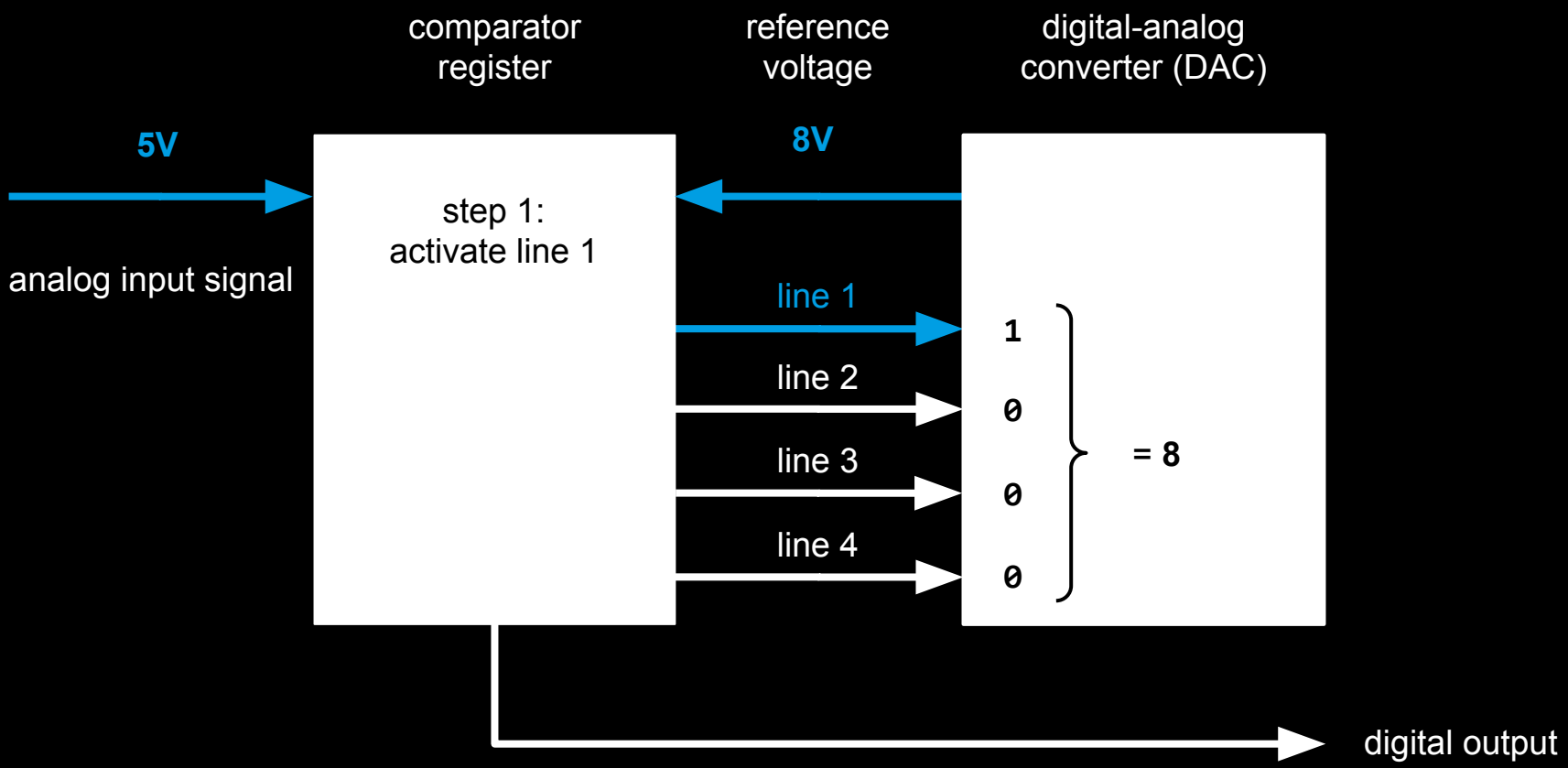
encoding the series of numbers in binary and assign meaning

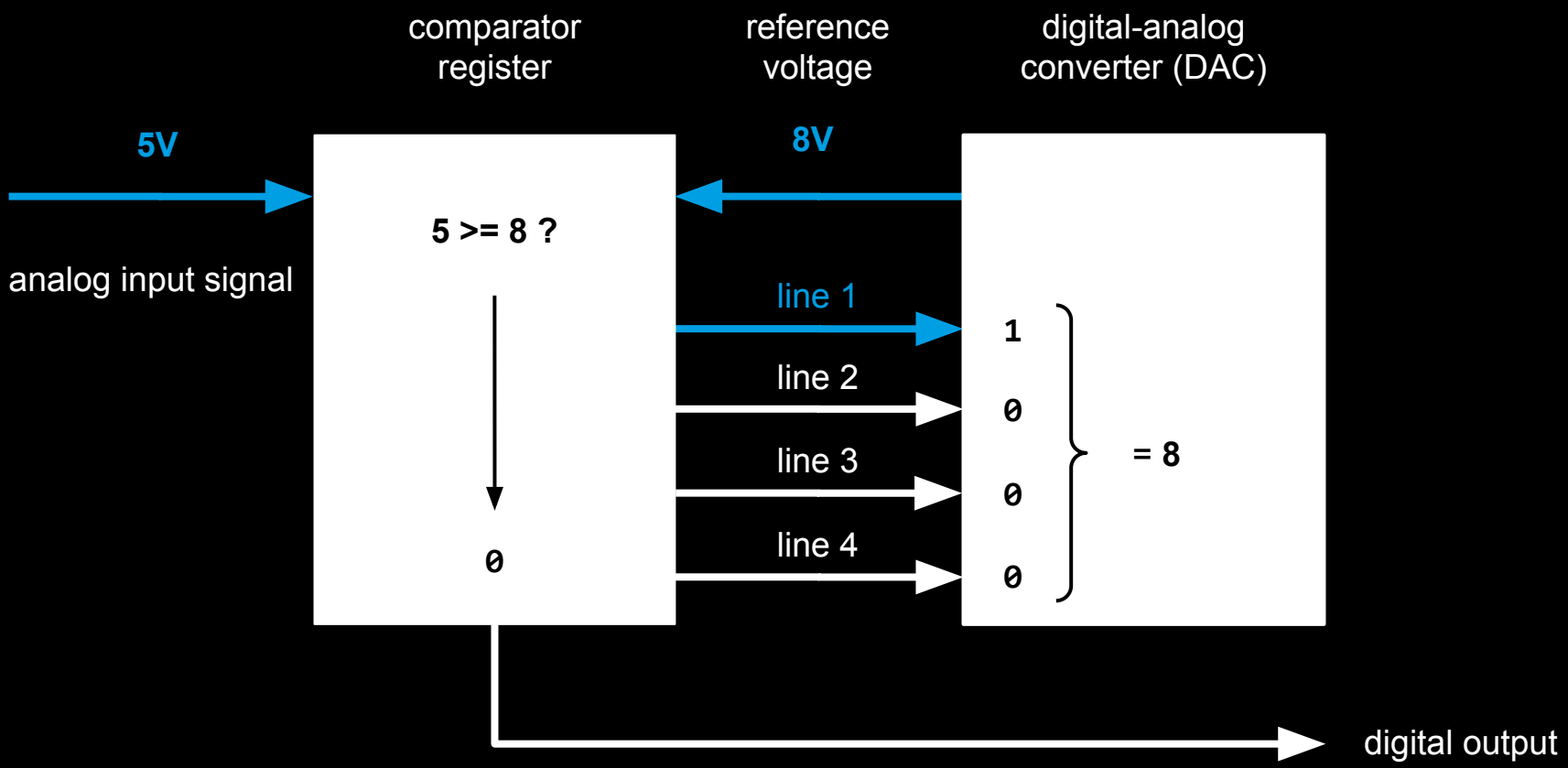

comparator register
reference voltage
digital-analog converter (DAC)
analog input signal
line 1
line 2
line 3
line 4
0
0
0
0
digital output

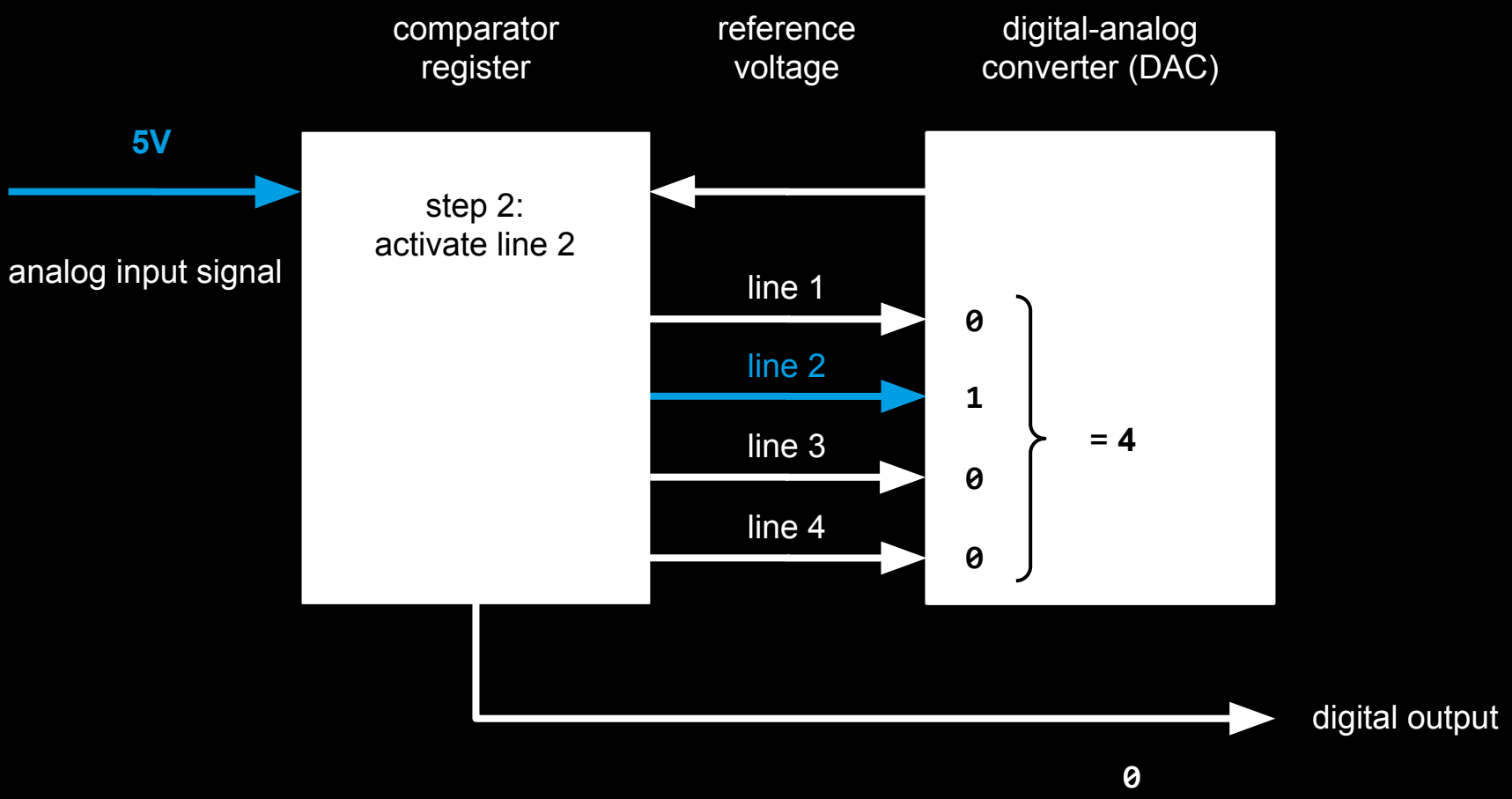

comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
line 1
line 2
line 3
line 4
0
0
0
0
digital output

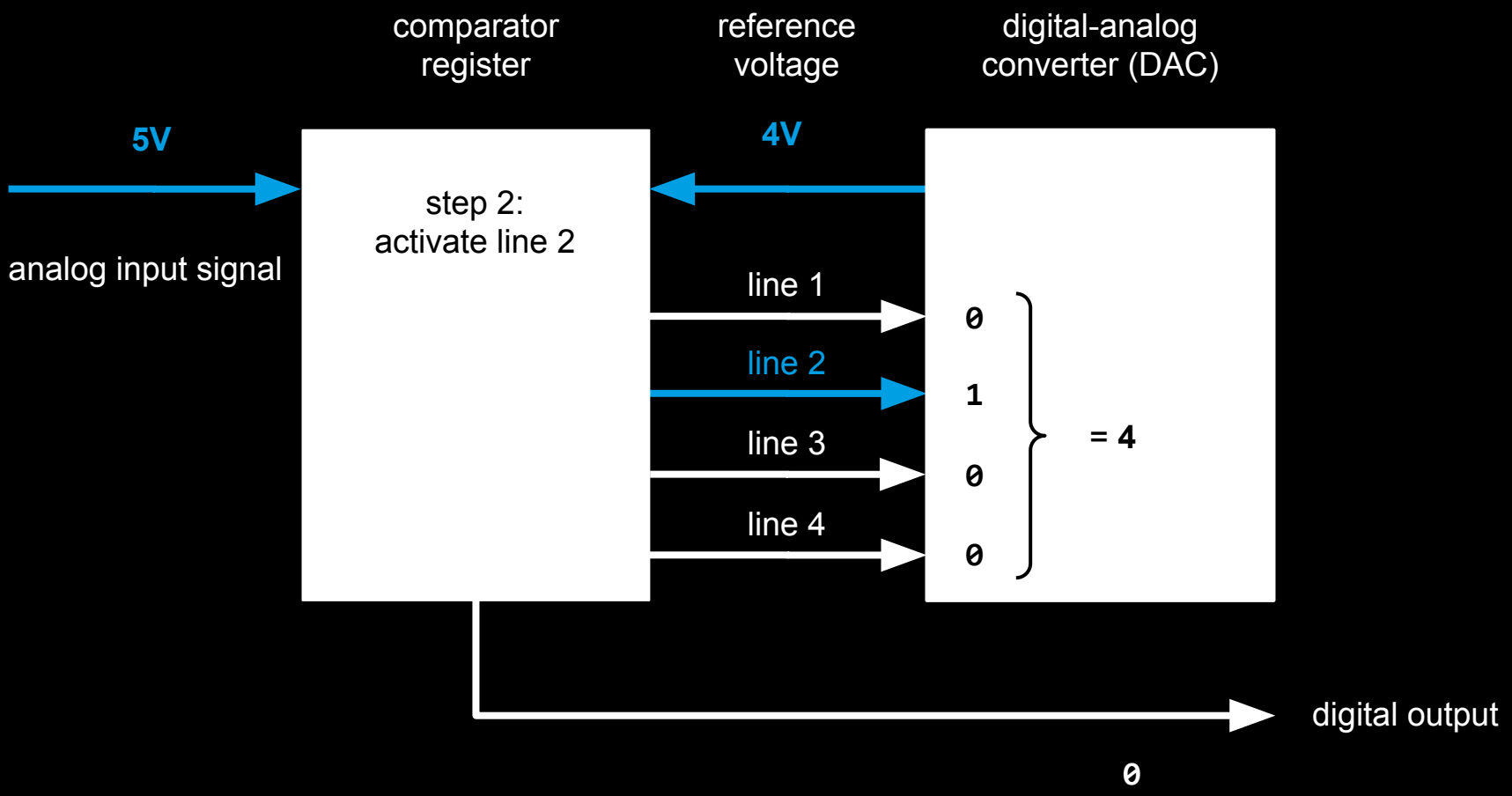

comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
step 1: activate line 1
line 1
line 2
line 3
line 4
1
0
0
0
digital output

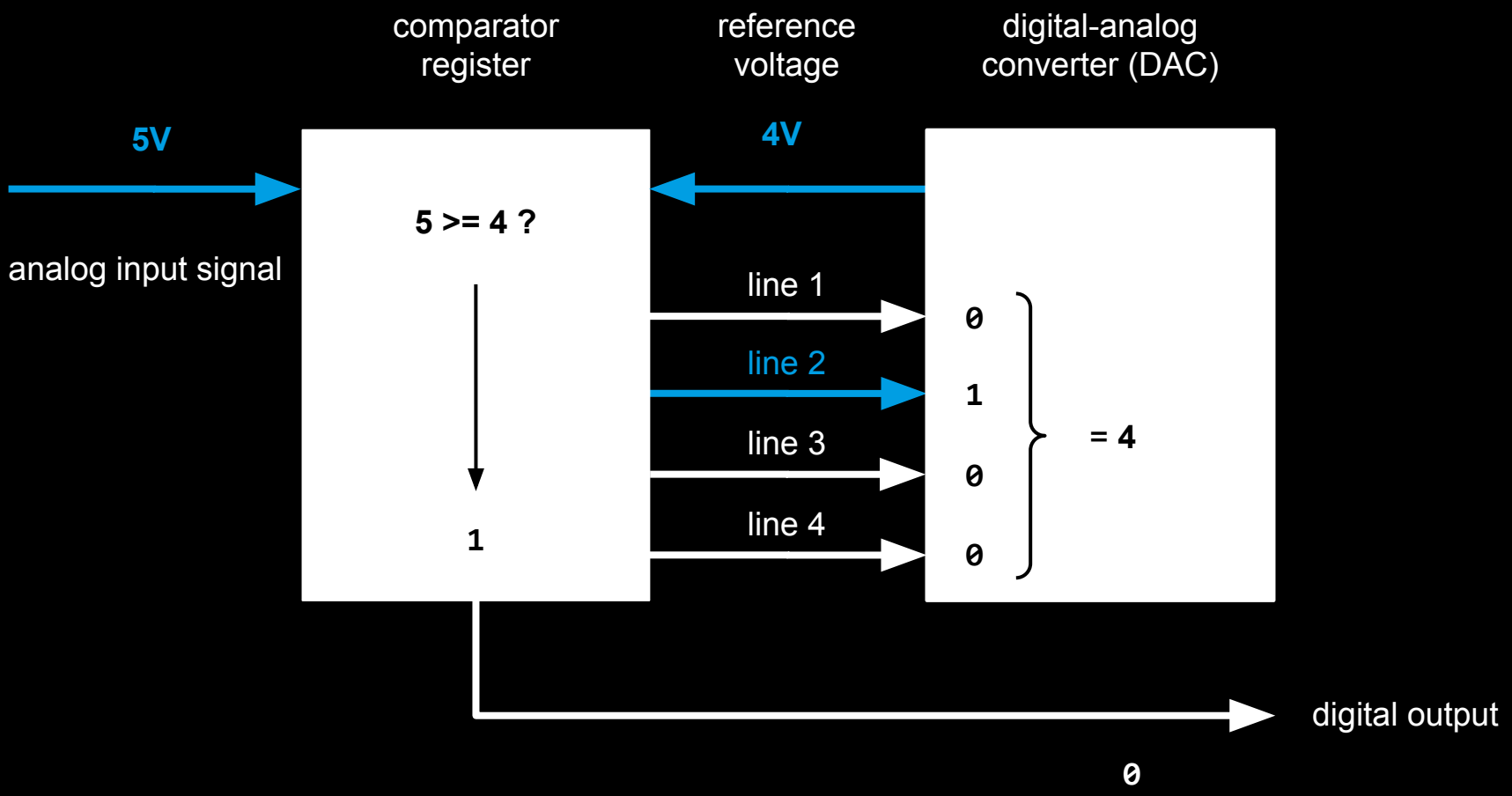

comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
step 1: activate line 1
line 1
line 2
line 3
line 4
1
0
0
0
= 8
digital output

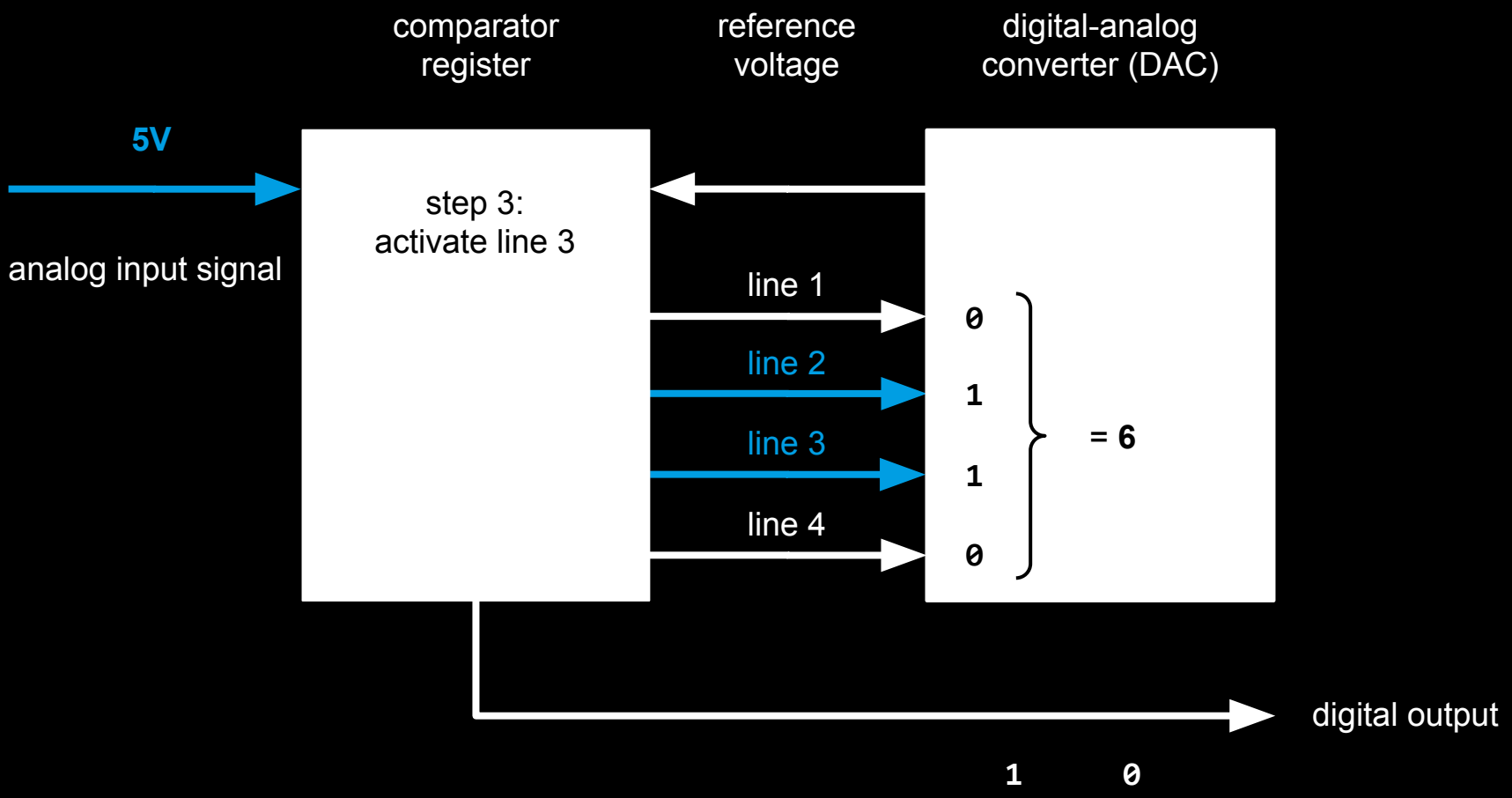

comparator register
reference voltage
digital-analog converter (DAC)
5V
8V
analog input signal
step 1: activate line 1
line 1
line 2
line 3
line 4
1
0
0
0
= 8
digital output

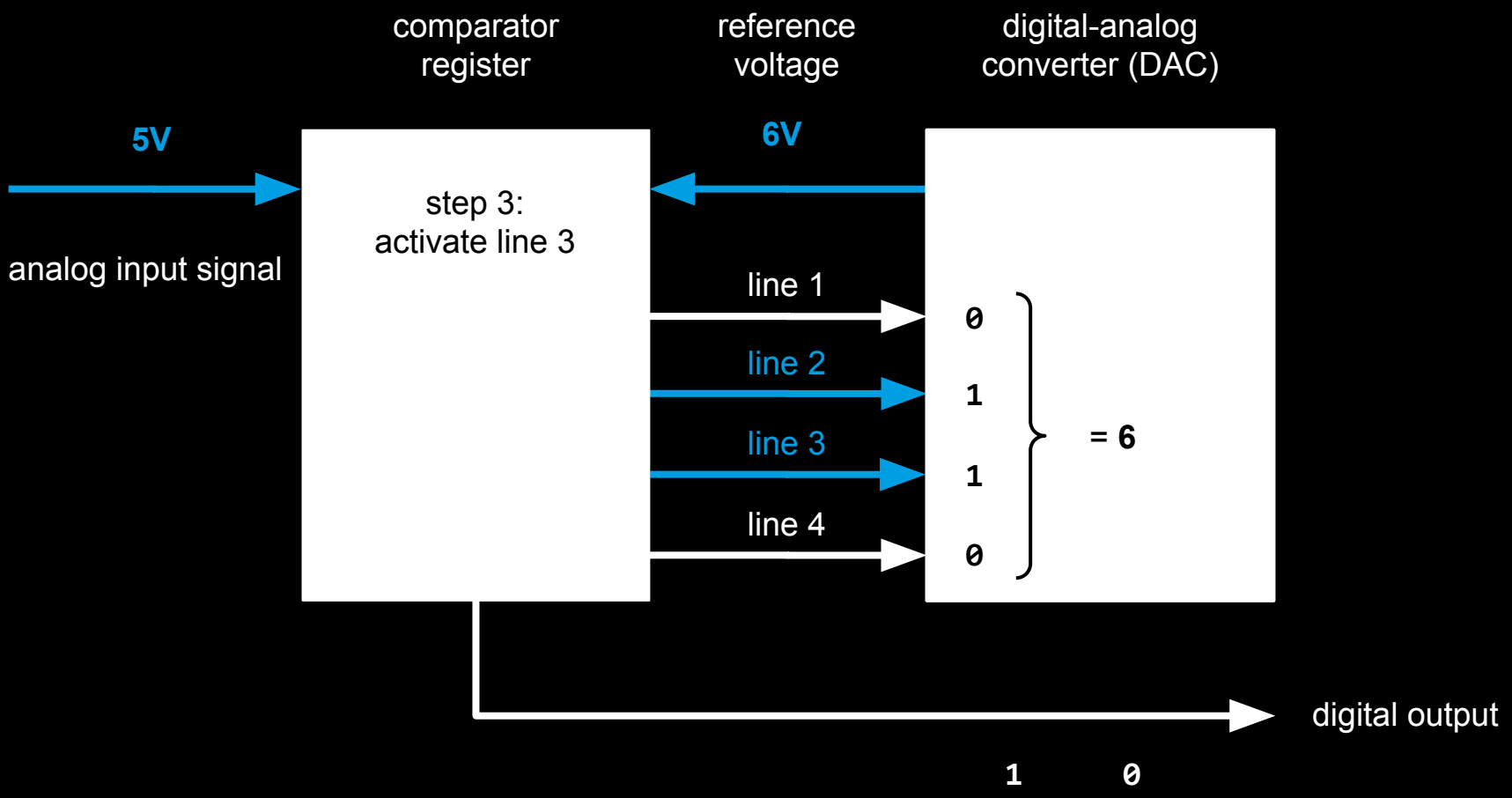

comparator
register
reference
voltage
digital-analog
converter (DAC)
5V
8V
5 >= 8 ?
analog input signal
line 1
line 2
line 3
line 4
1
0
0
0
= 8
0
digital output

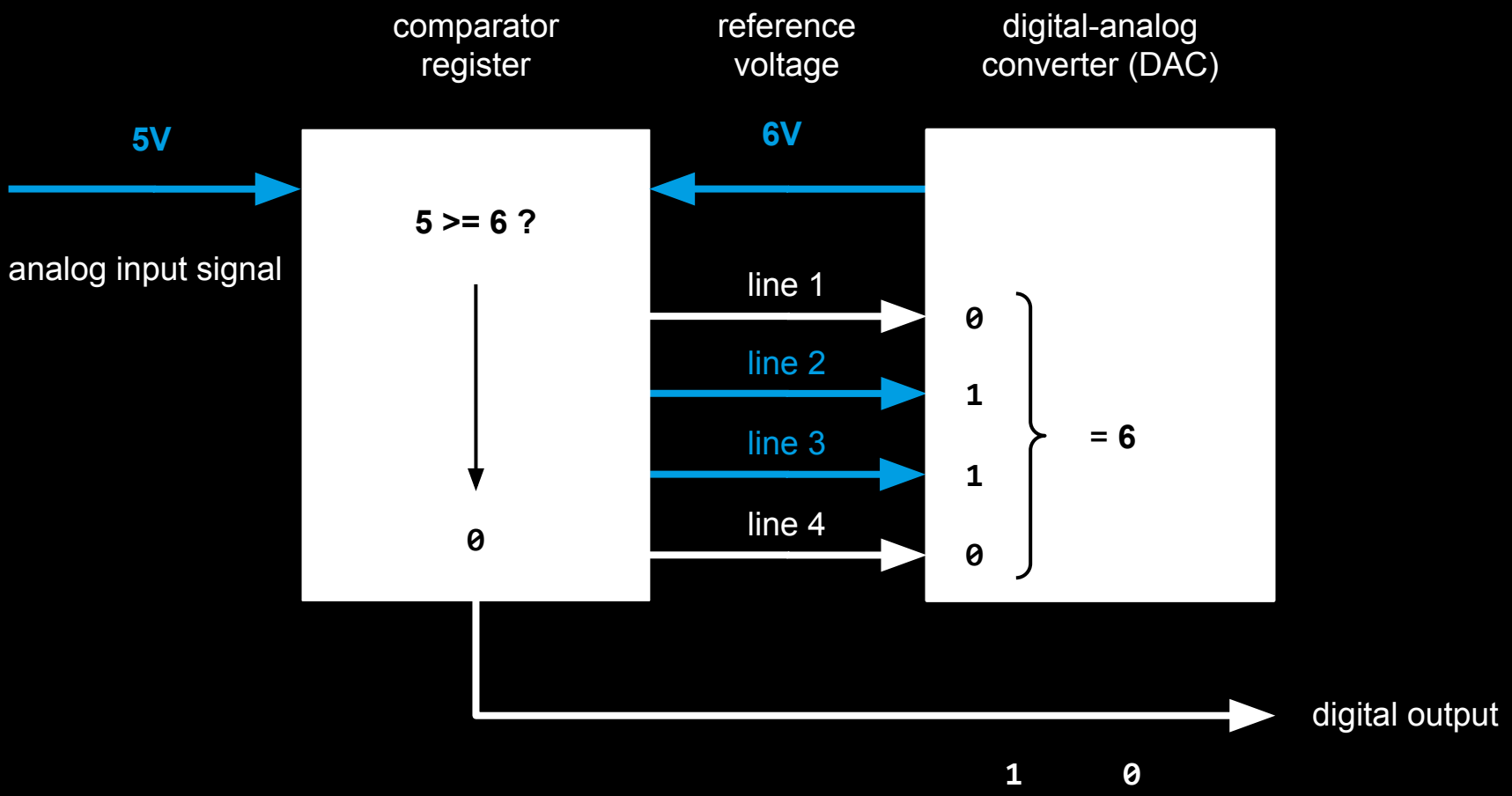

comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
step 2: activate line 2
line 1
line 2
line 3
line 4
0
1
0
0
= 4
digital output
0

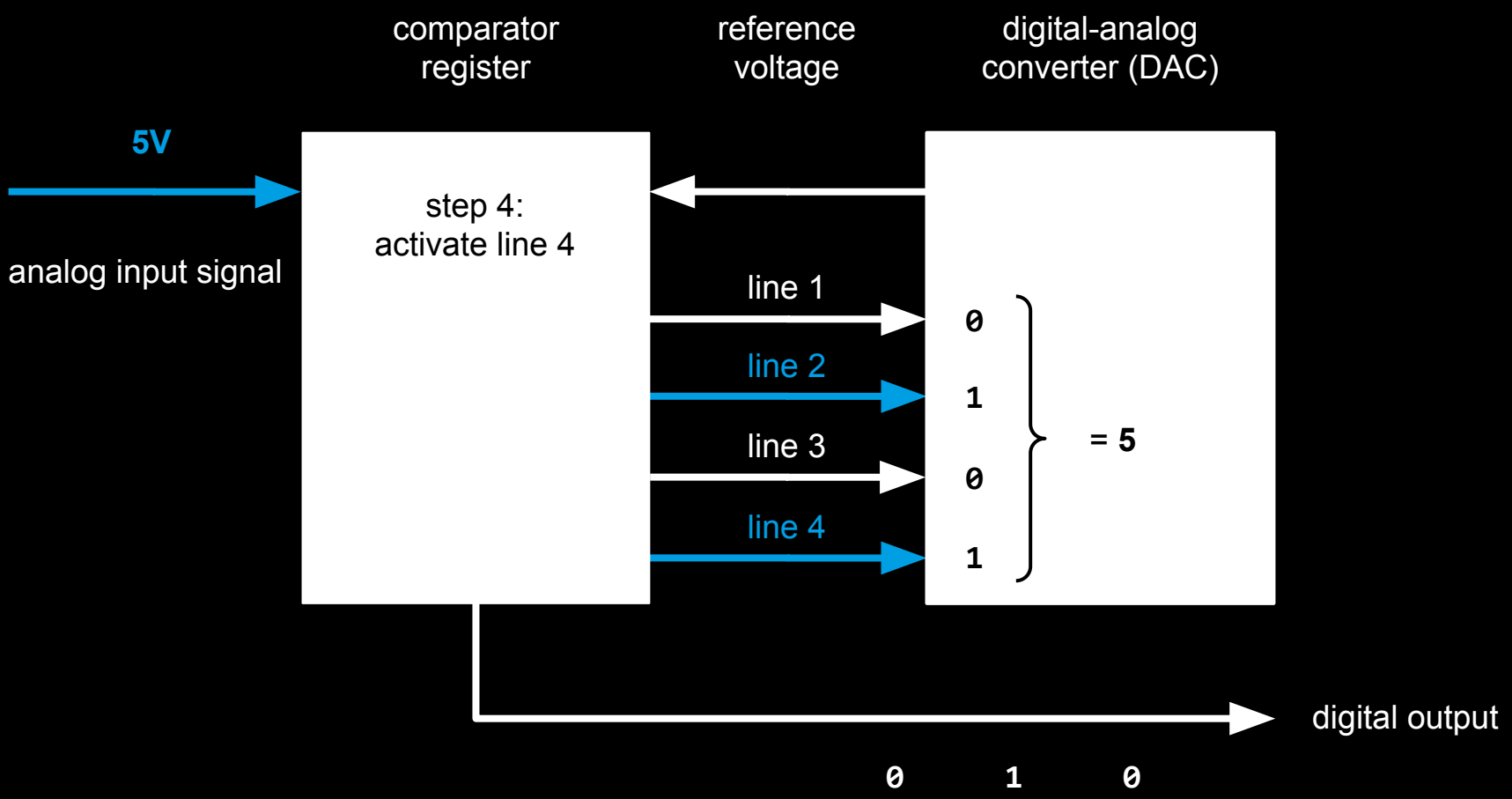

comparator register
reference voltage
digital-analog converter (DAC)
5V
4V
step 2: activate line 2
analog input signal
line 1
line 2
line 3
line 4
0
1
0
0
= 4
digital output
0

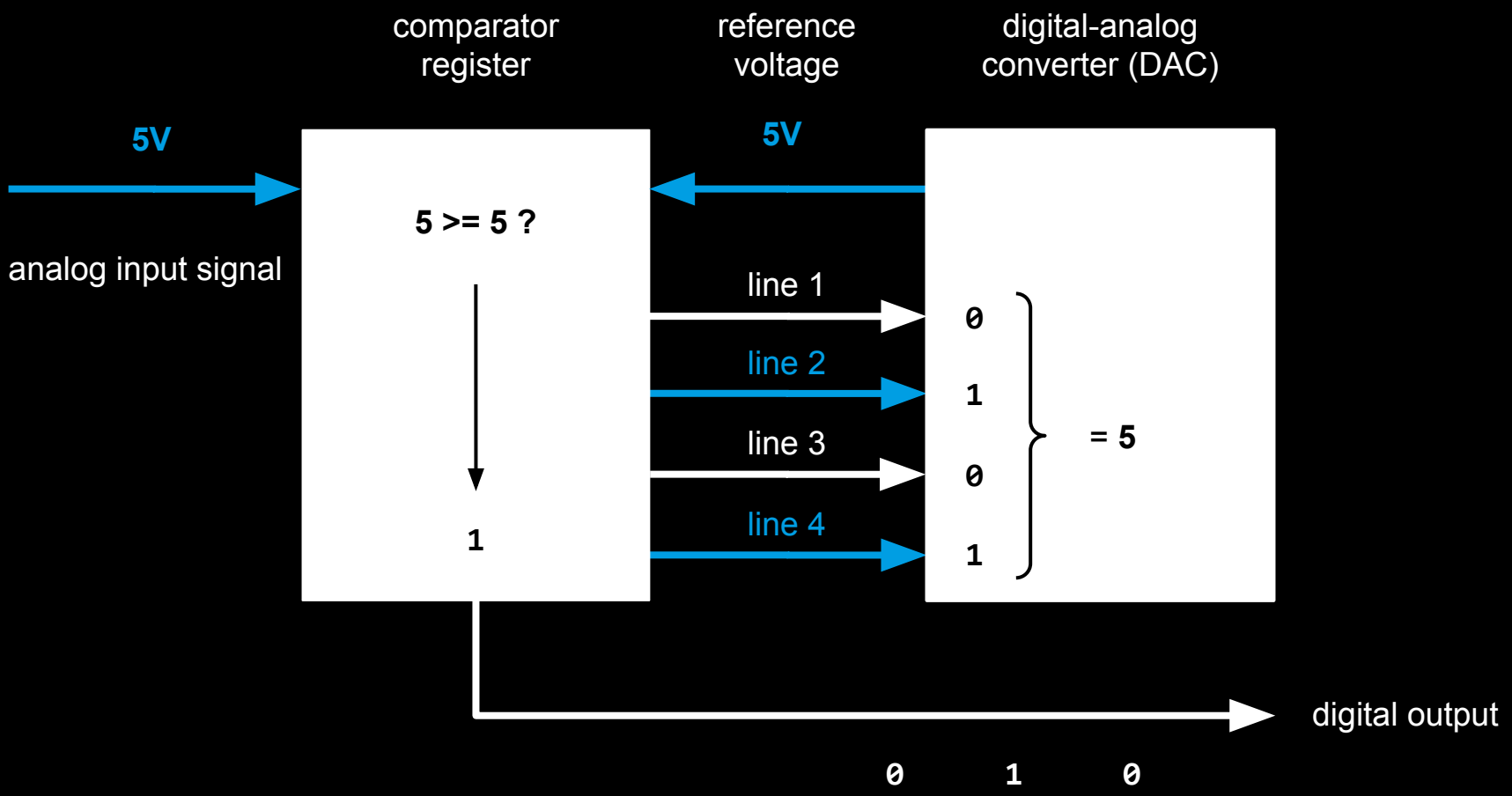

comparator register
reference voltage
digital-analog converter (DAC)
5V
4V
5 >= 4 ?
analog input signal
line 1
line 2
line 3
line 4
0
1
0
0
= 4
1
digital output
0

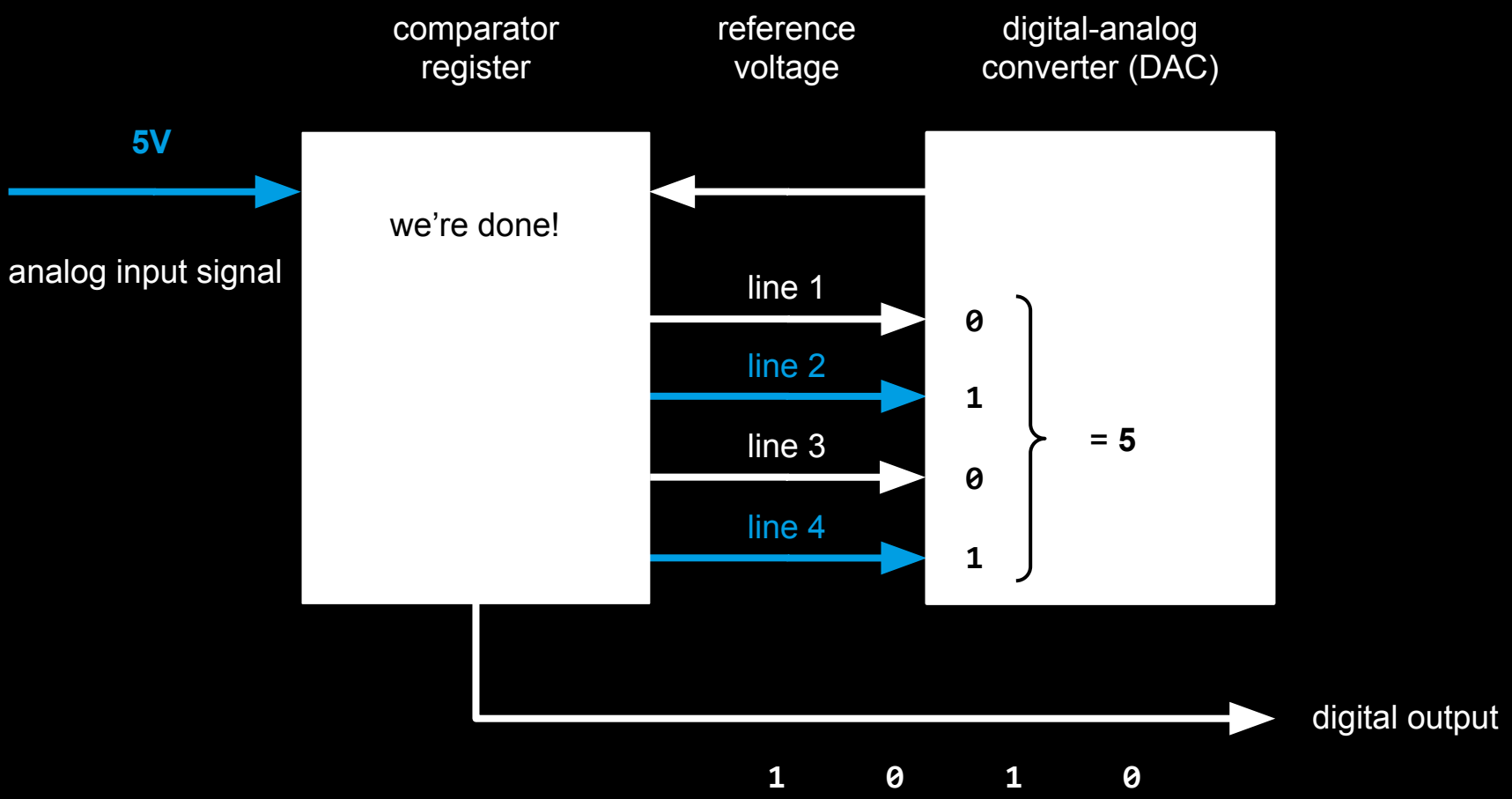

comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
step 3: activate line 3
line 1
line 2
line 3
line 4
0
1
1
0
= 6
digital output
1 0


comparator register
reference voltage
digital-analog converter (DAC)
5V
6V
step 3: activate line 3
analog input signal
line 1
line 2
line 3
line 4
0
1
1
0
= 6
digital output
1 0

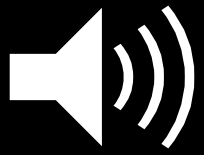

comparator register
reference voltage
digital-analog converter (DAC)
5V
6V
5 >= 6 ?
analog input signal
line 1
line 2
line 3
line 4
0
1
1
0
= 6
0
digital output
1
0


comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
step 4: activate line 4
line 1
line 2
line 3
line 4
0
1
0
1
= 5
digital output
0 1 0

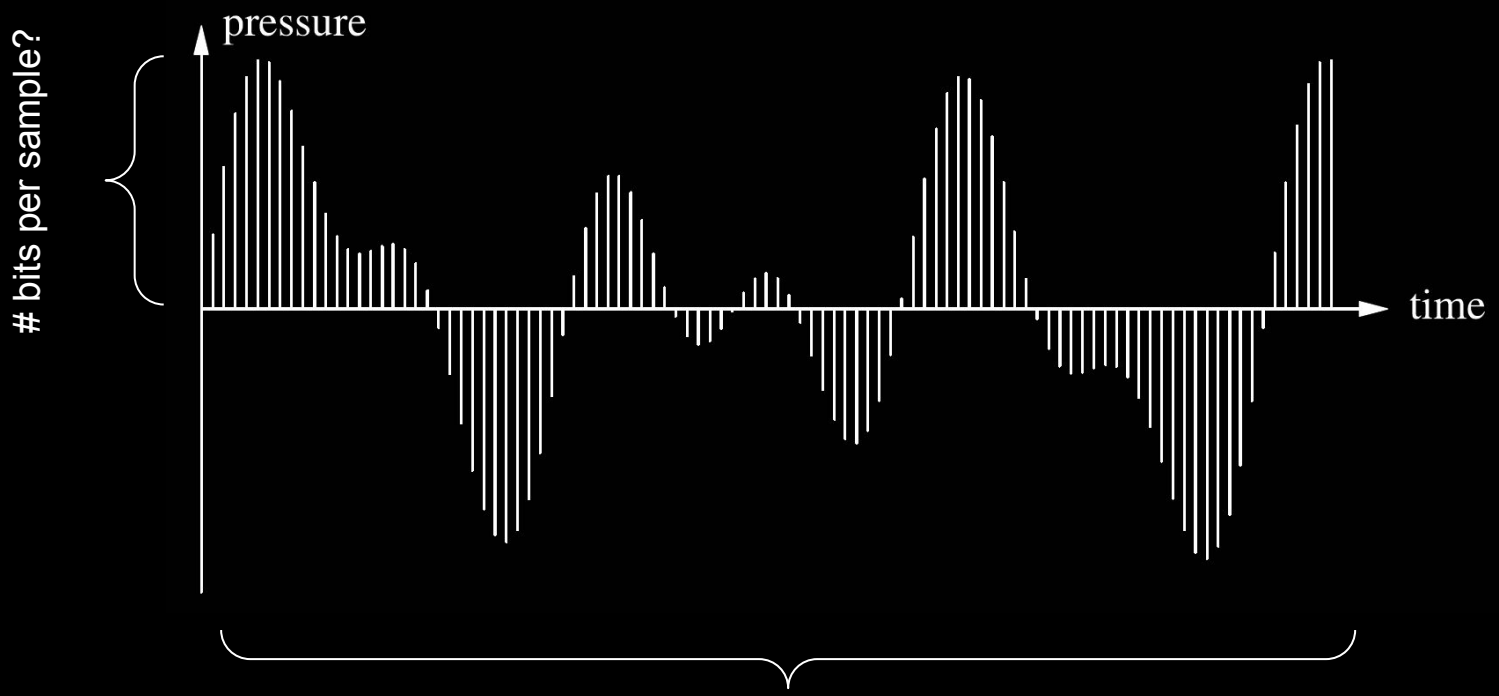

comparator register
reference voltage
digital-analog converter (DAC)
5V
5V
analog input signal
5 >= 5 ?
1
line 1
line 2
line 3
line 4
0
1
0
1
= 5
digital output
0 1 0


comparator register
reference voltage
digital-analog converter (DAC)
5V
analog input signal
we're done!
line 1
line 2
line 3
line 4
0
1
0
1
= 5
digital output
1 0 1 0

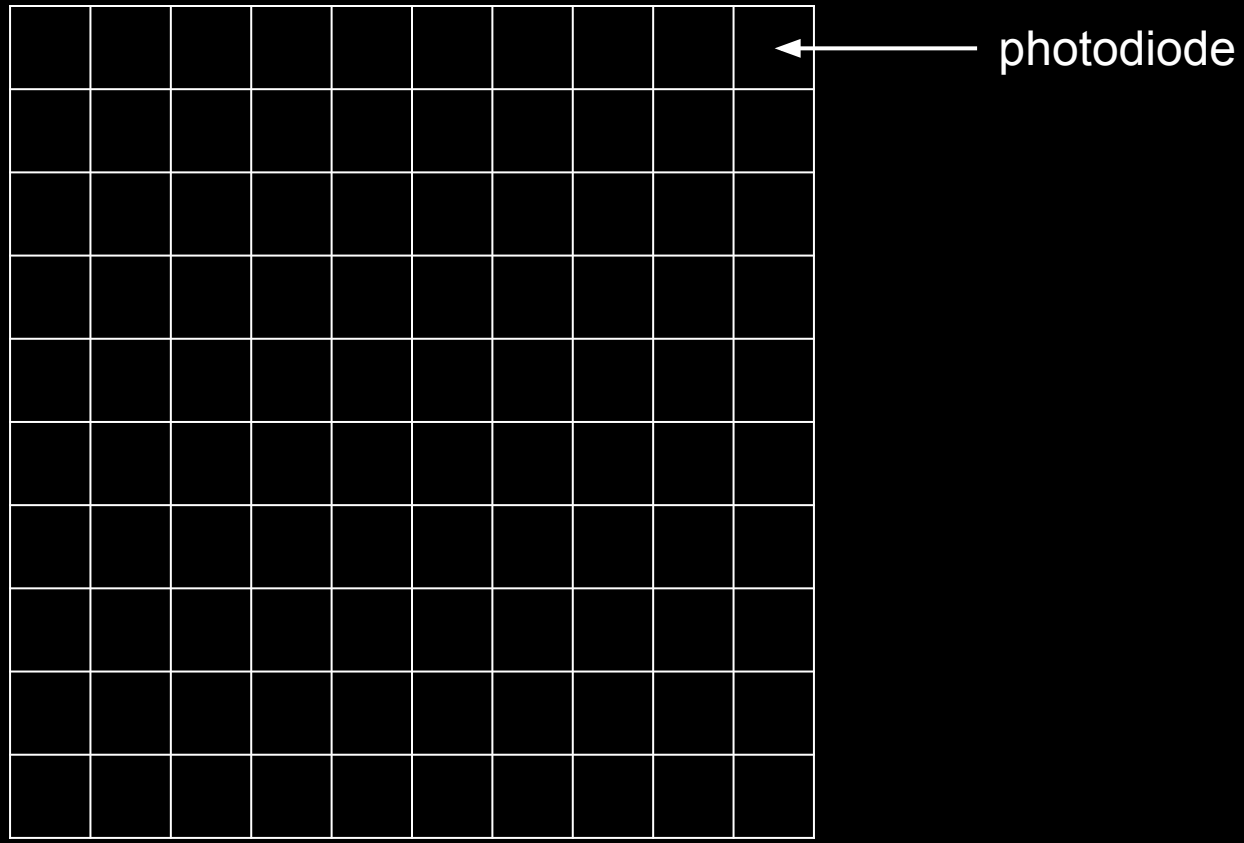
so, what analog signal is measured?



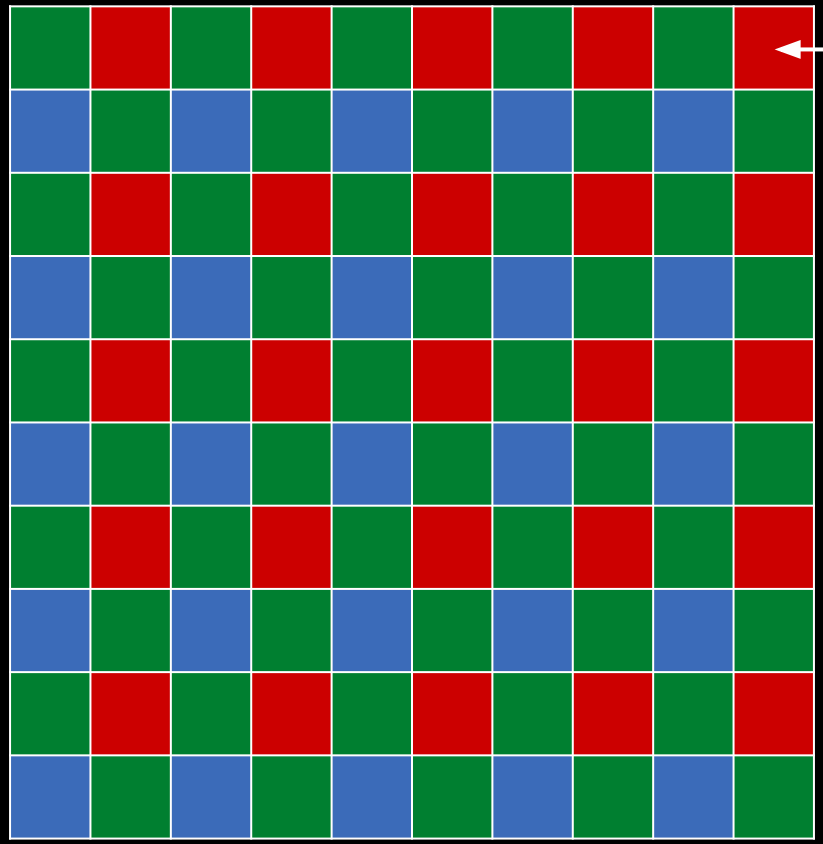
A **continuous** wave is transformed into an array of **discrete numbers** representing pressure.



# image sensor

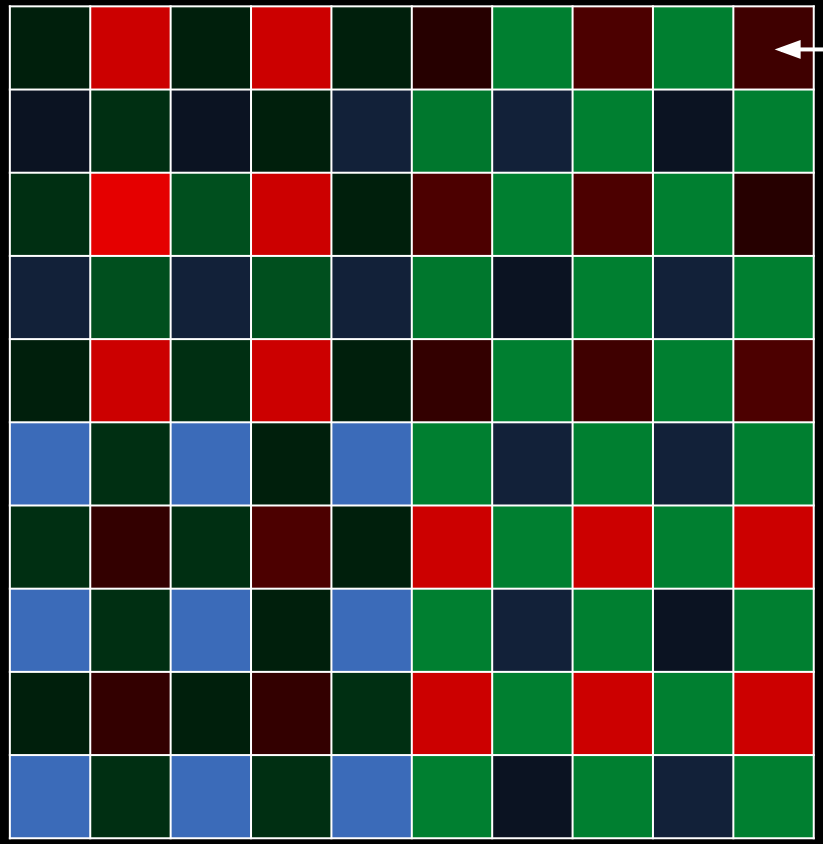


# image sensor



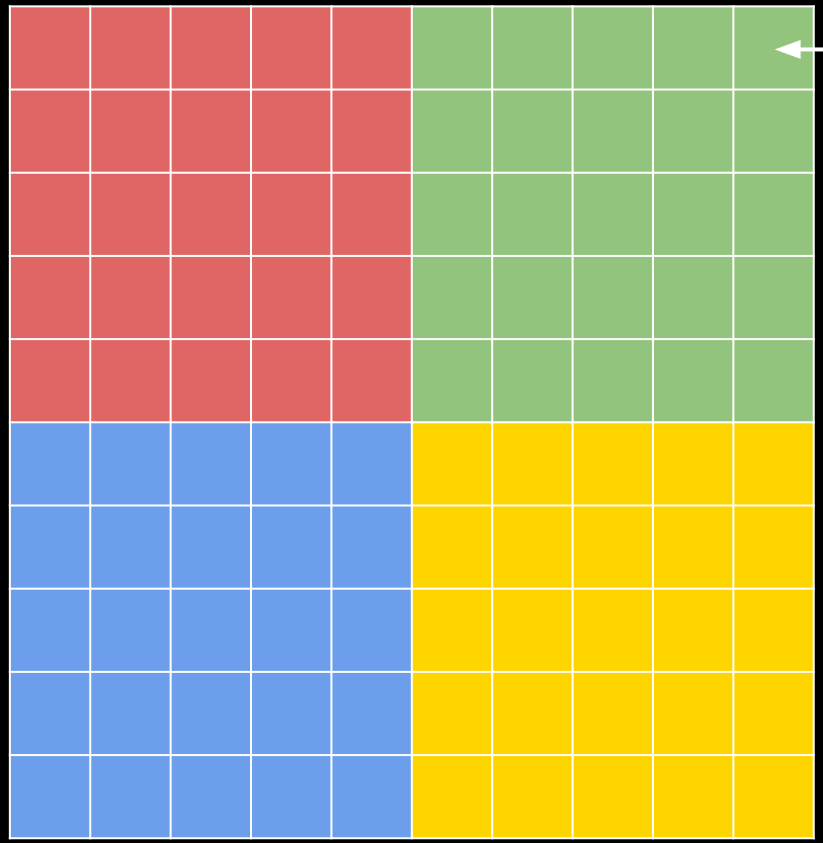
color filter on top of photo-diodes

# image sensor



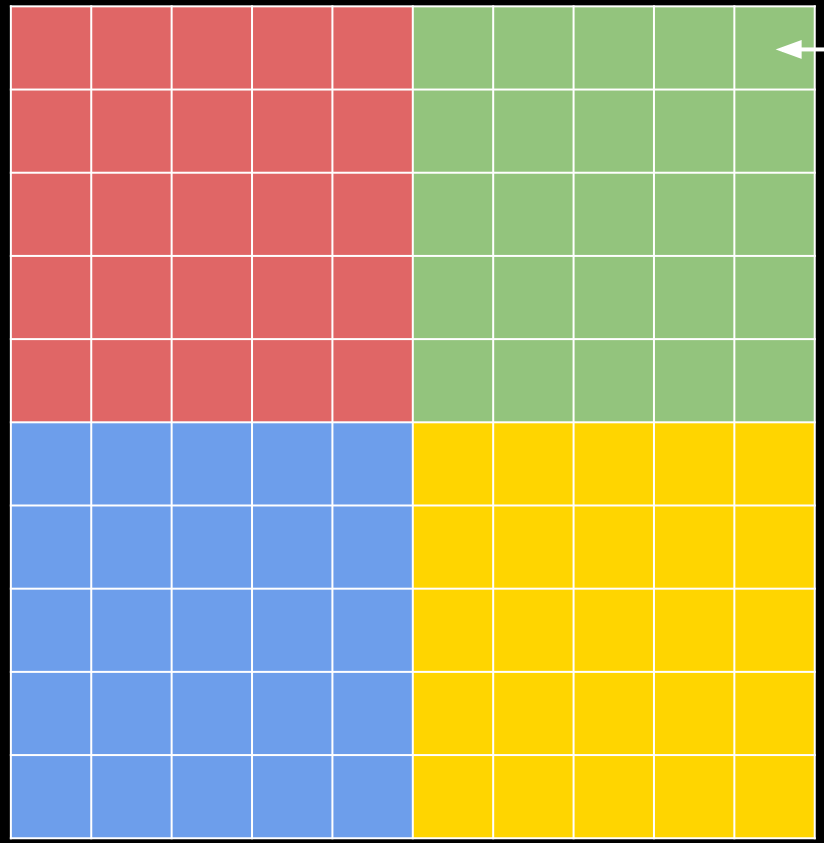
light passed through filter

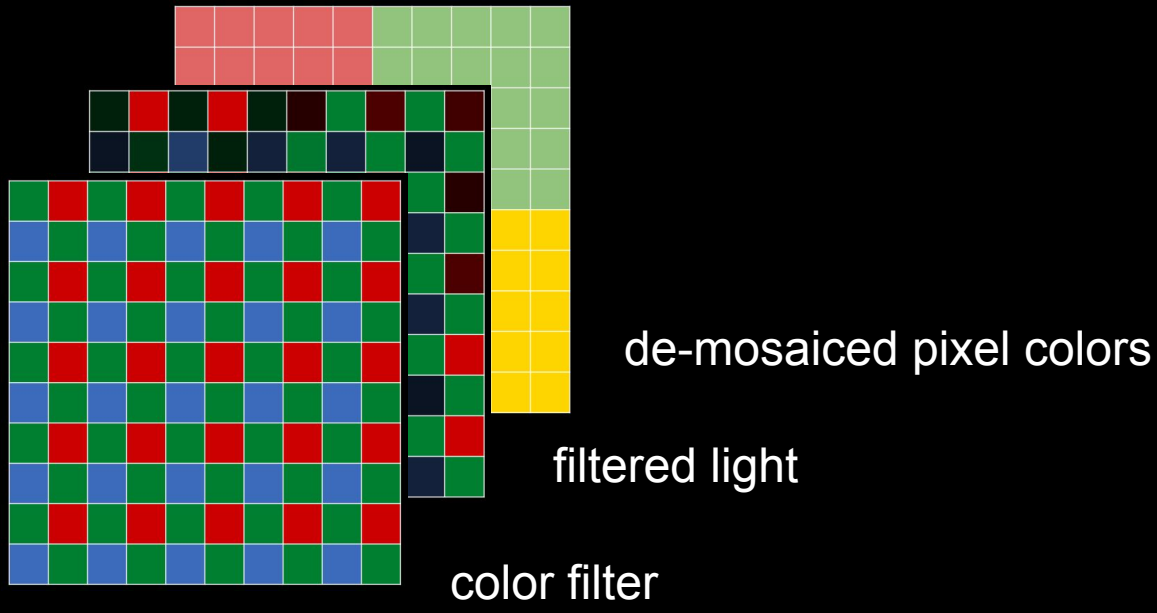
# image sensor

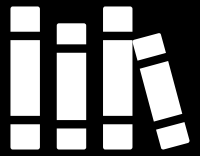


de-mosaiced
pixel colors

# image sensor




de-mosaiced pixel colors
filtered light
color filter



typing text

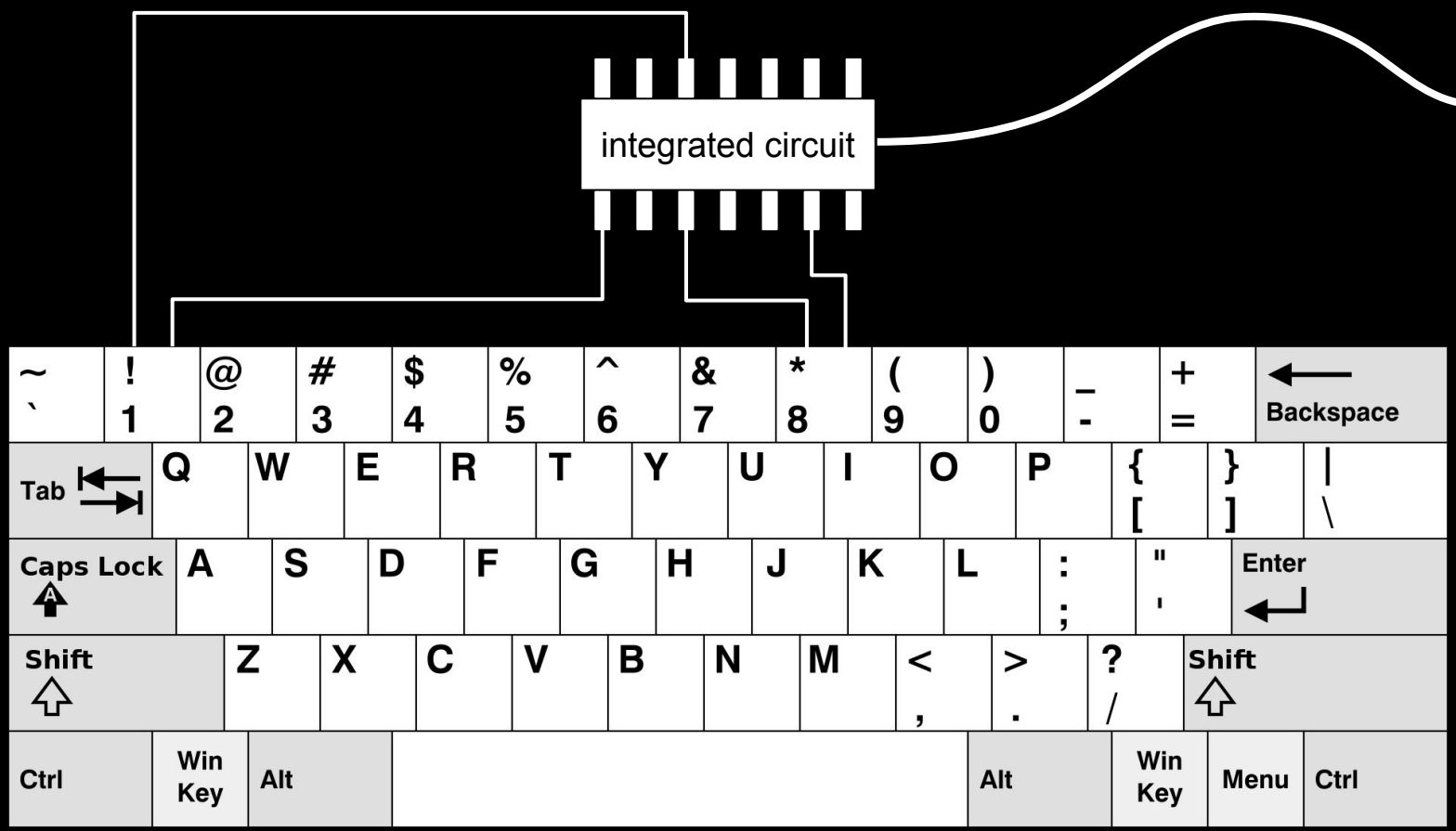



Image source: Wikipedia

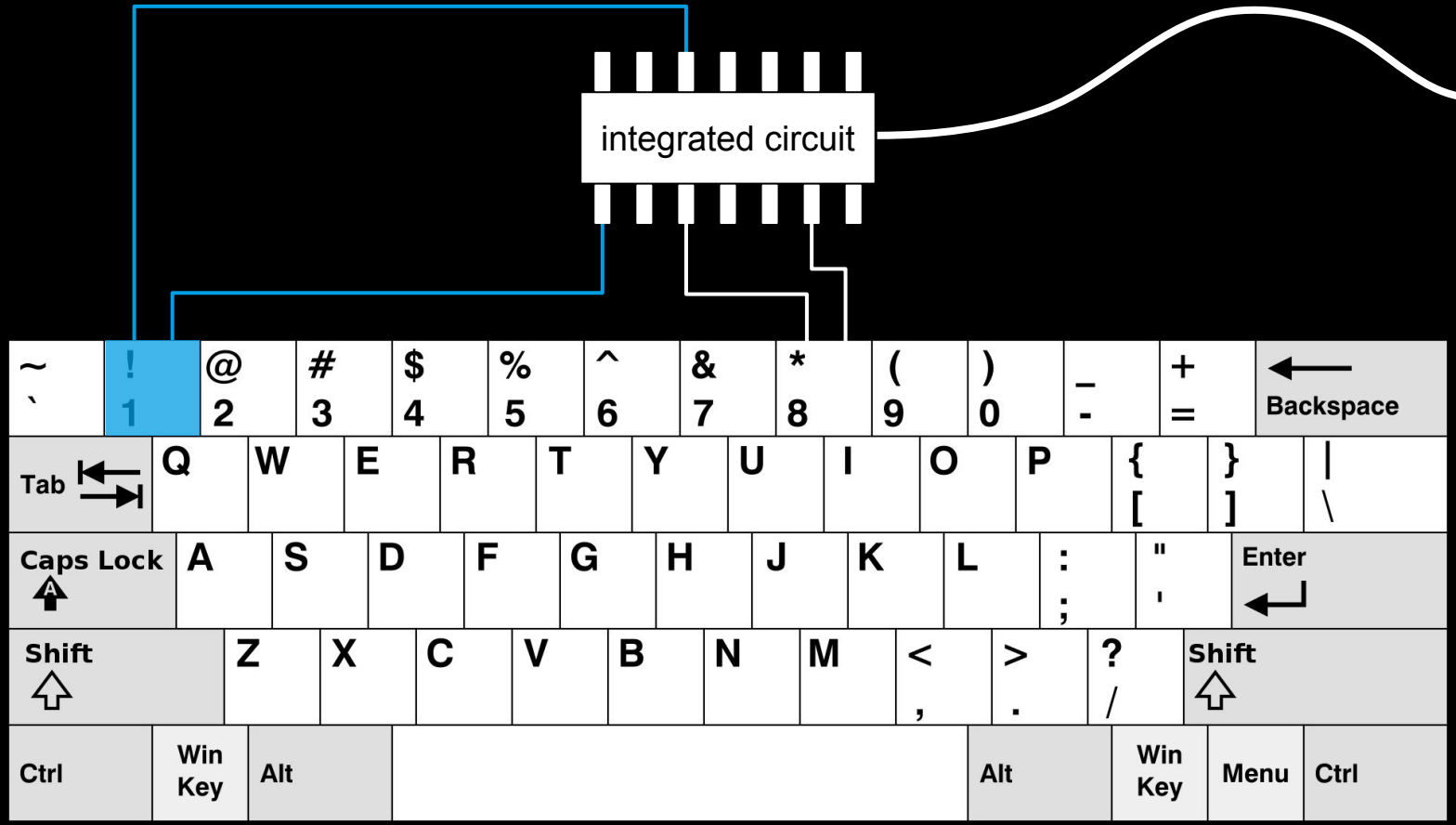



Image source: Wikipedia

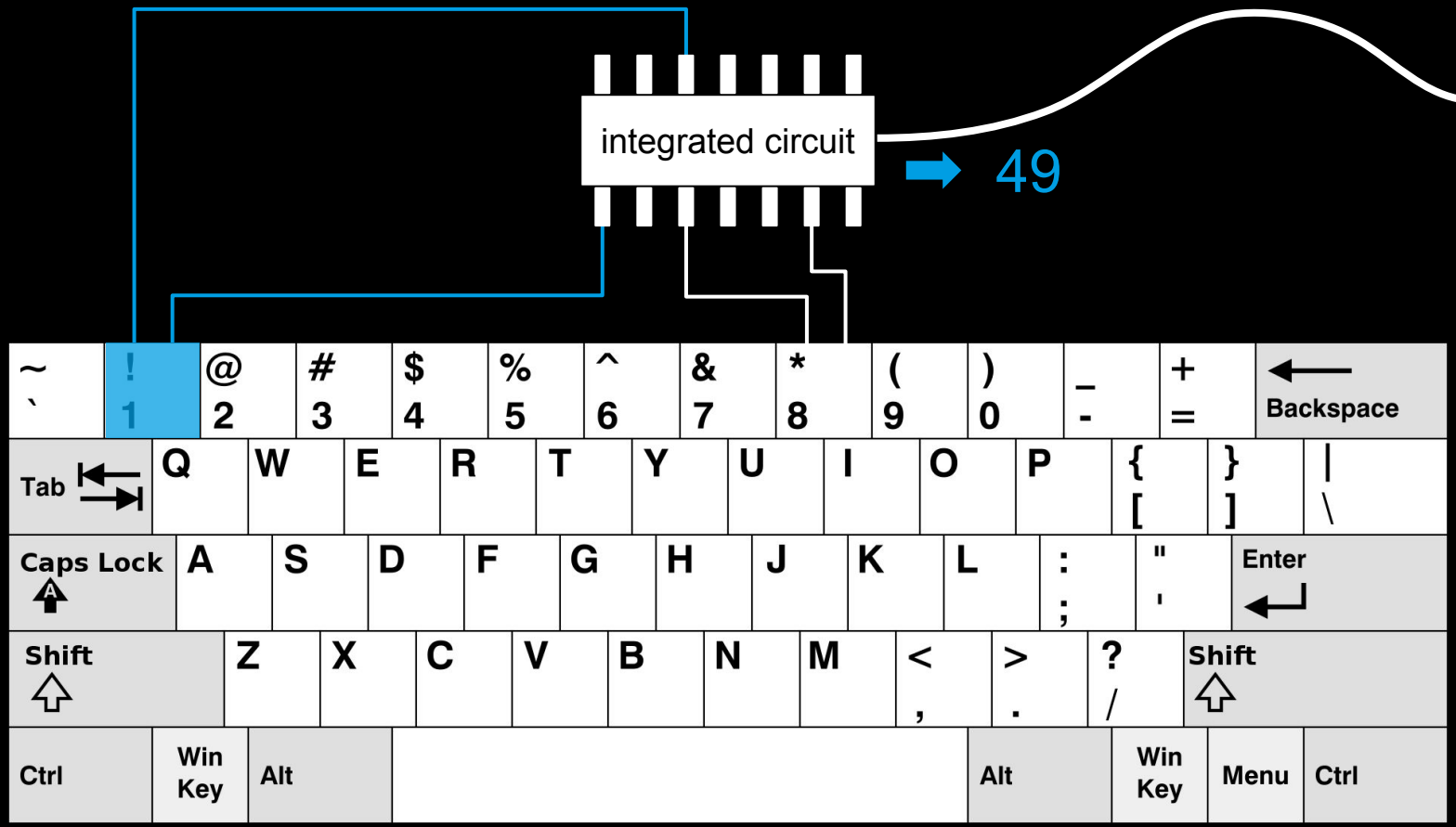



Image source: Wikipedia

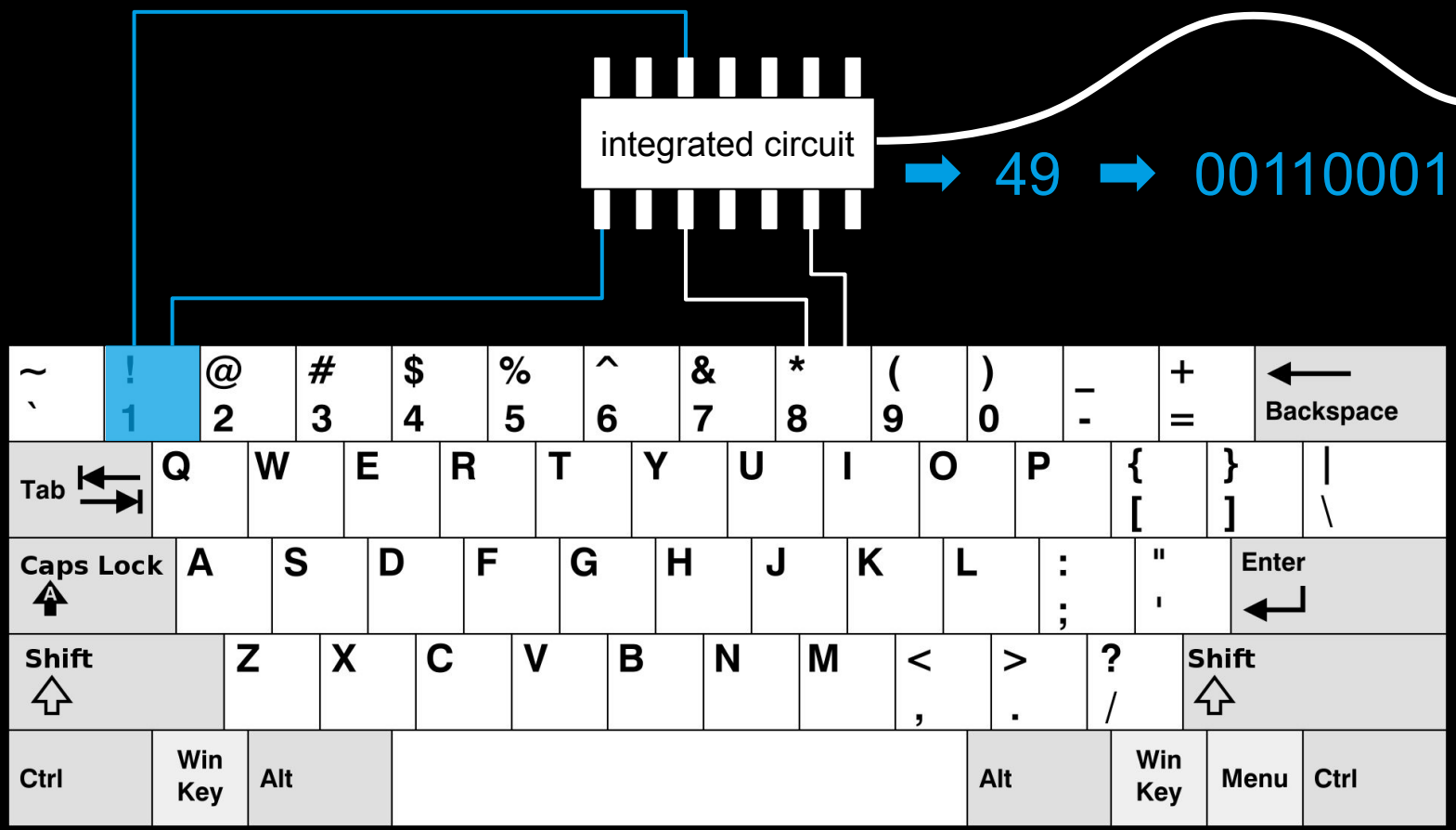



Image source: Wikipedia

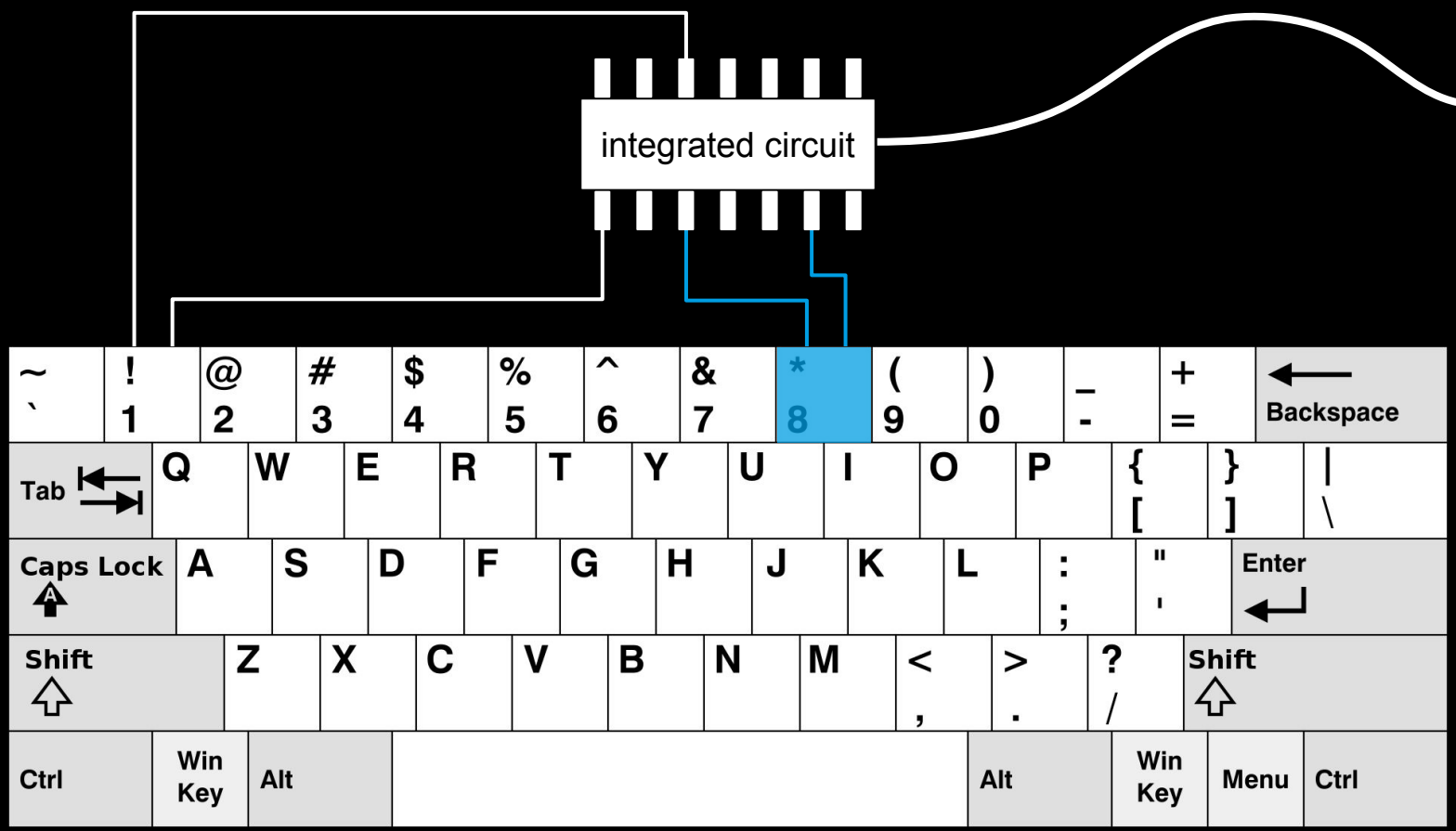
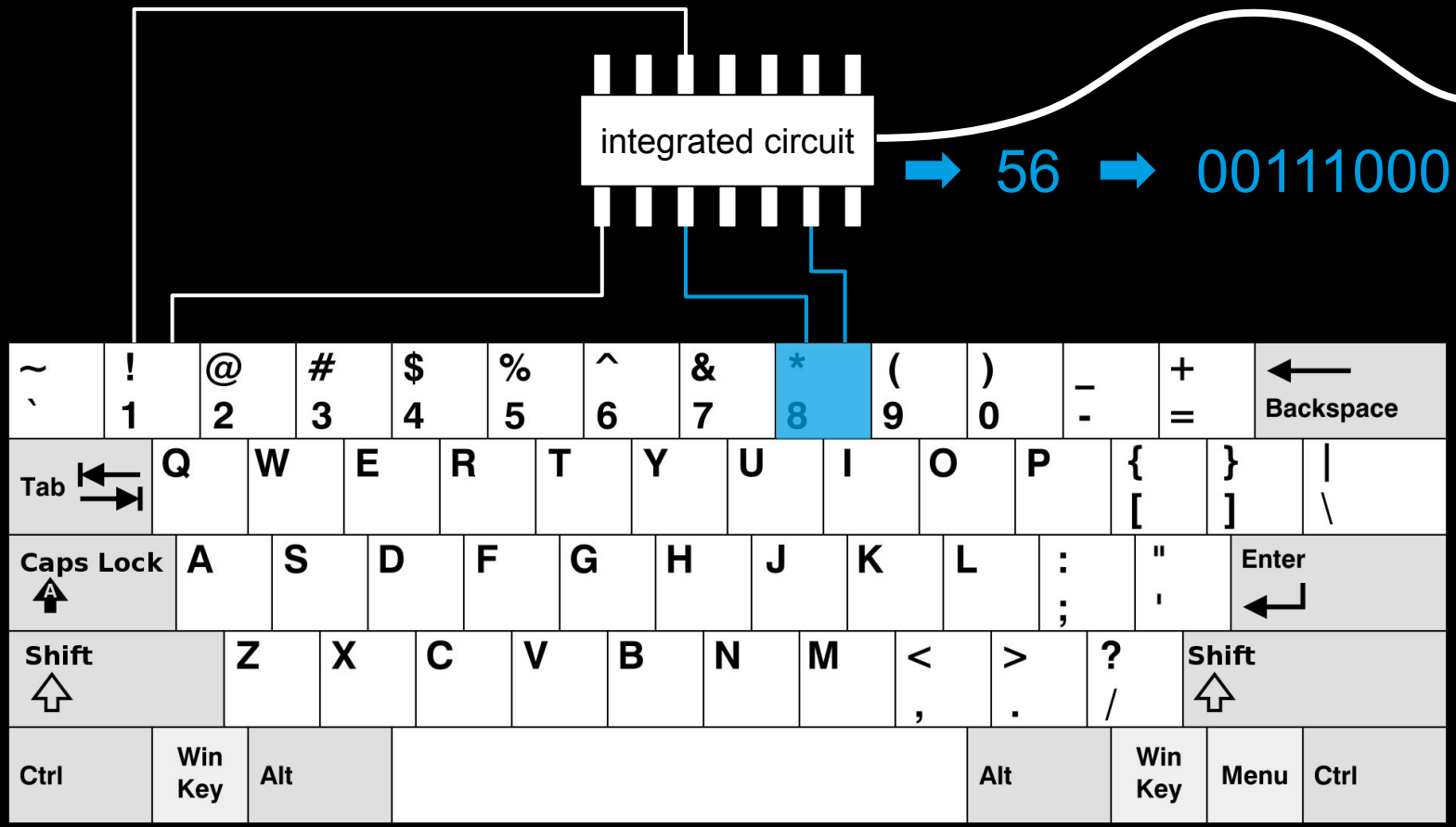



Image source: Wikipedia

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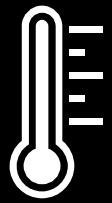
scanning text

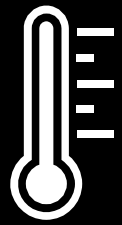
+

optical character recognition (OCR)



temperature sensor

A thermometer measures the temperature using a proxy, such as electrical resistance. The result is a change in voltage, which can be converted into a temperature.



```
1100 0101 1101 1110
1001 0110 1111 0100
0000 0111 1111 0001
```

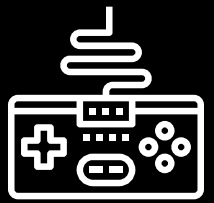


Image source: Wikipedia

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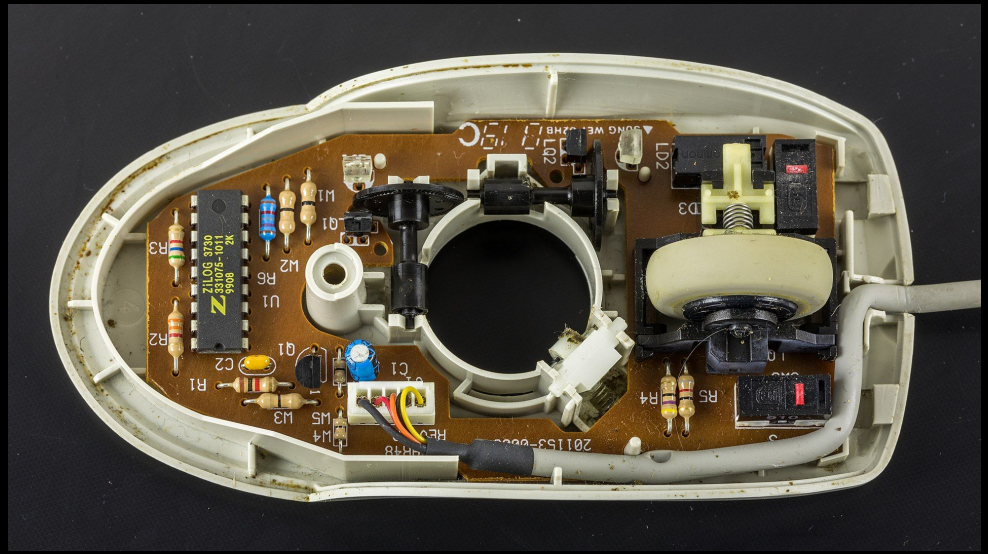

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