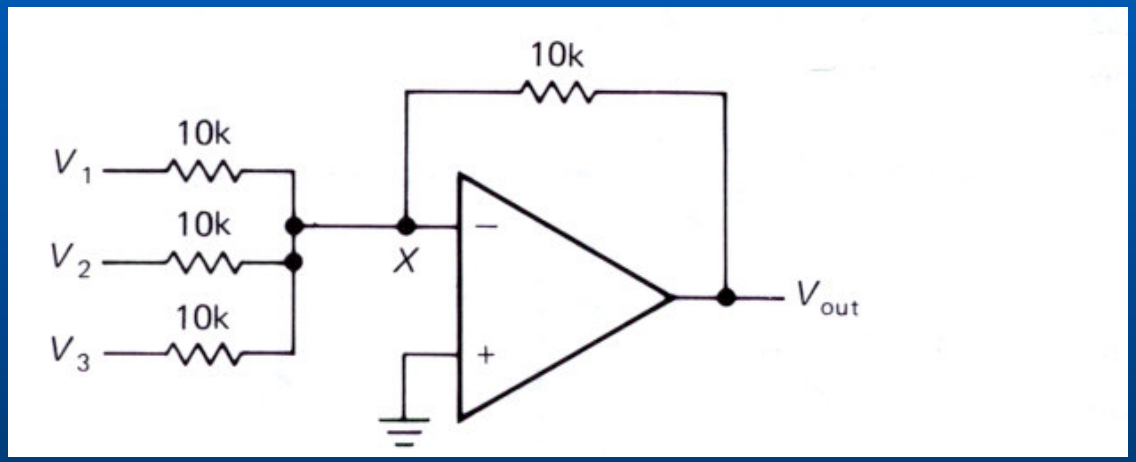
Digital to Analog Converters

Costas Foudas, Imperial College,
Rm: 508, x47590

Recall: The 741 Op.Amp IV

Summing Amplifier :

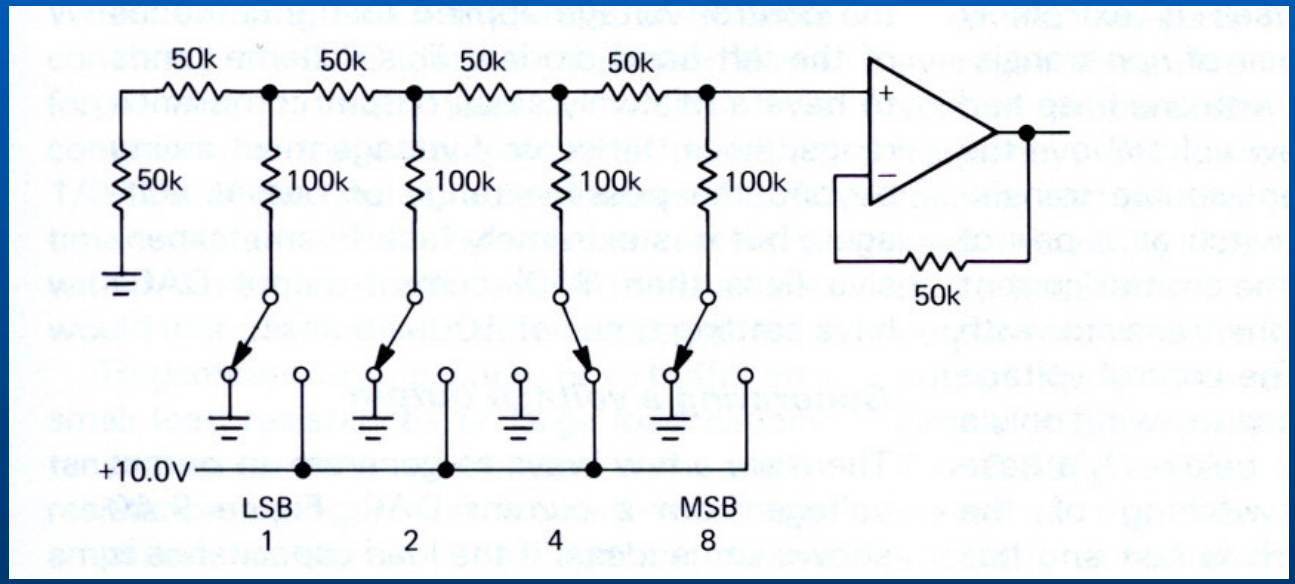


Exercise : Show that V_{out} = - (V1+V2+V3)

Costas Foudas, Imperial College,
Rm: 508, x47590

The 741 Op.Amp IV

R-2R Network to convert digital to analog

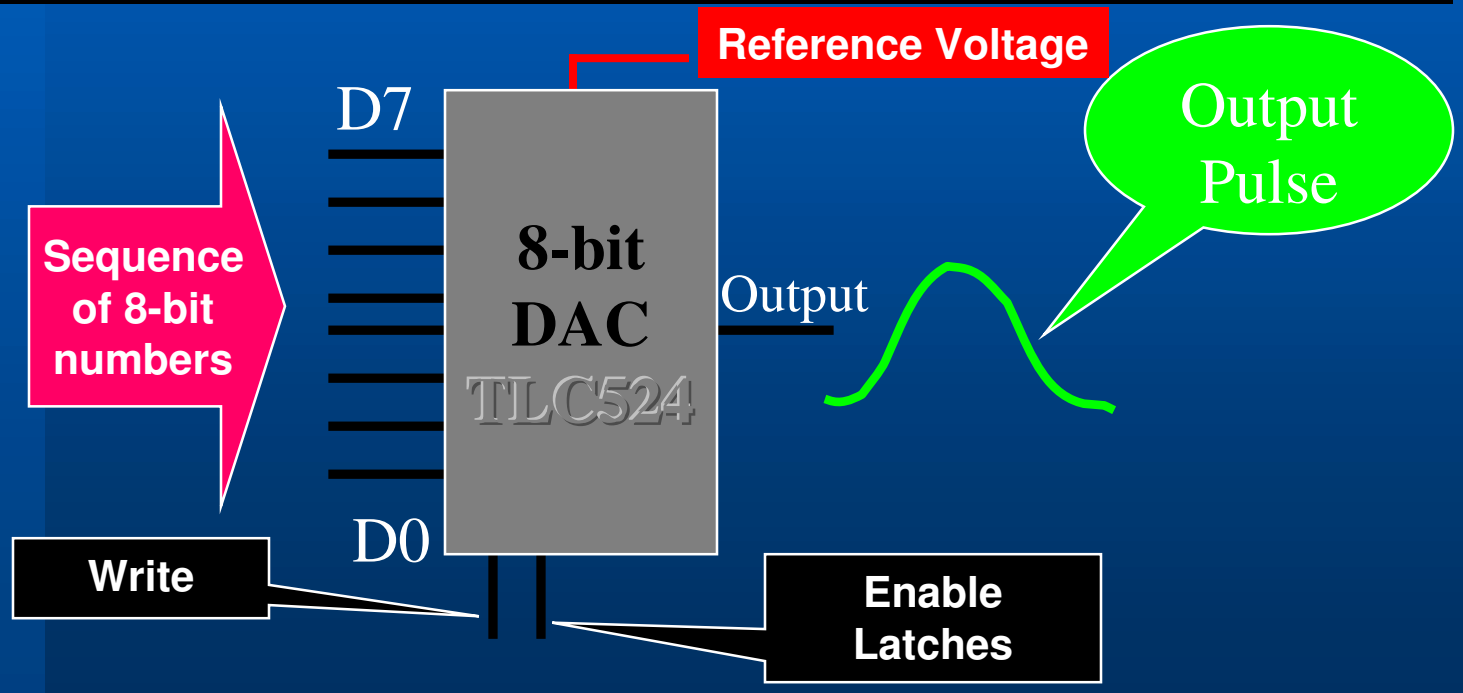


By now you should know how does It work…

Rm: 508, x47590

Operation I

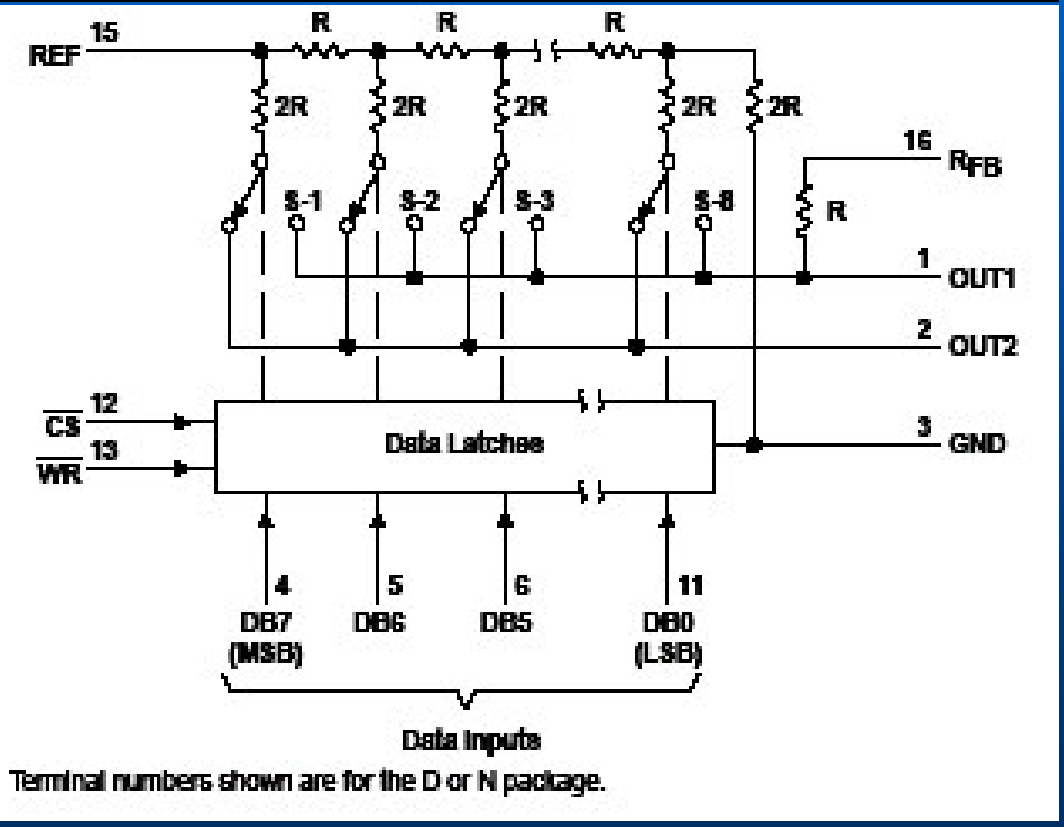
The DIGITAL to ANALOG CONVERTERS (DAC) are devices that convert digital to analog signals:



Costas Foudas, Imperial College,
Rm: 508, x47590

Operation II

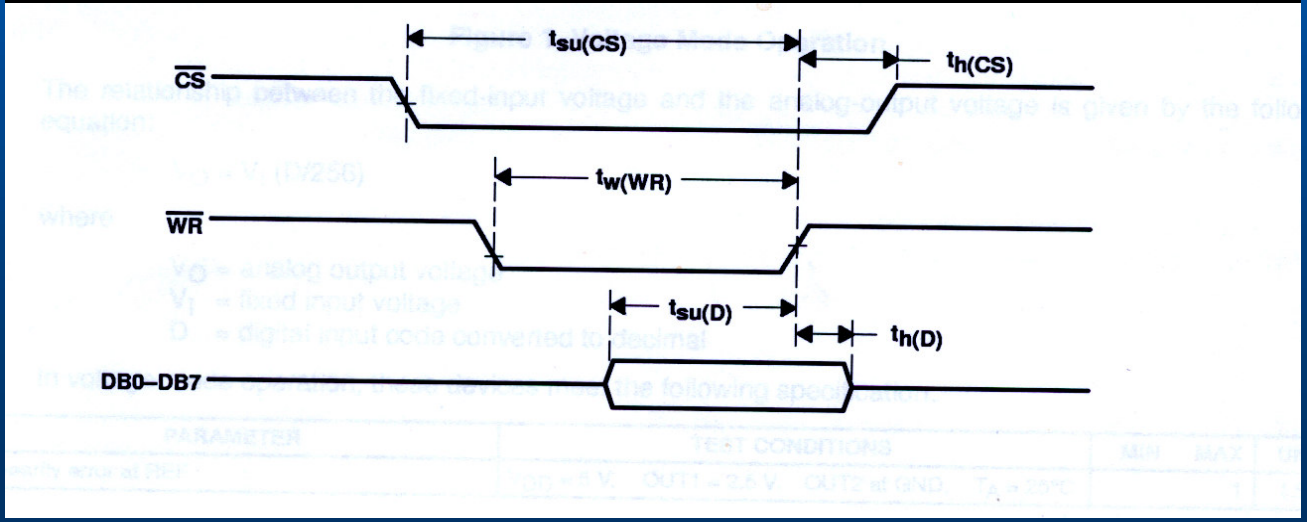
The basic operational idea of the DAC we will be using is:



Costas Foudas, Imperial College,
Rm: 508, x47590

Write Cycles of the TLC7524

The DAC has internal registers to store the data (1 Byte) and signals which control the write operation (CS*, WR*):



Costas Foudas, Imperial College,
Rm: 508, x47590

The TLC7524 DAC

For your analog signal generator you will be using an 8-bit DAC to convert the 8-bit Signals, from the ATmega103 ports, to analog Signals of given frequency, amplitude and offset.

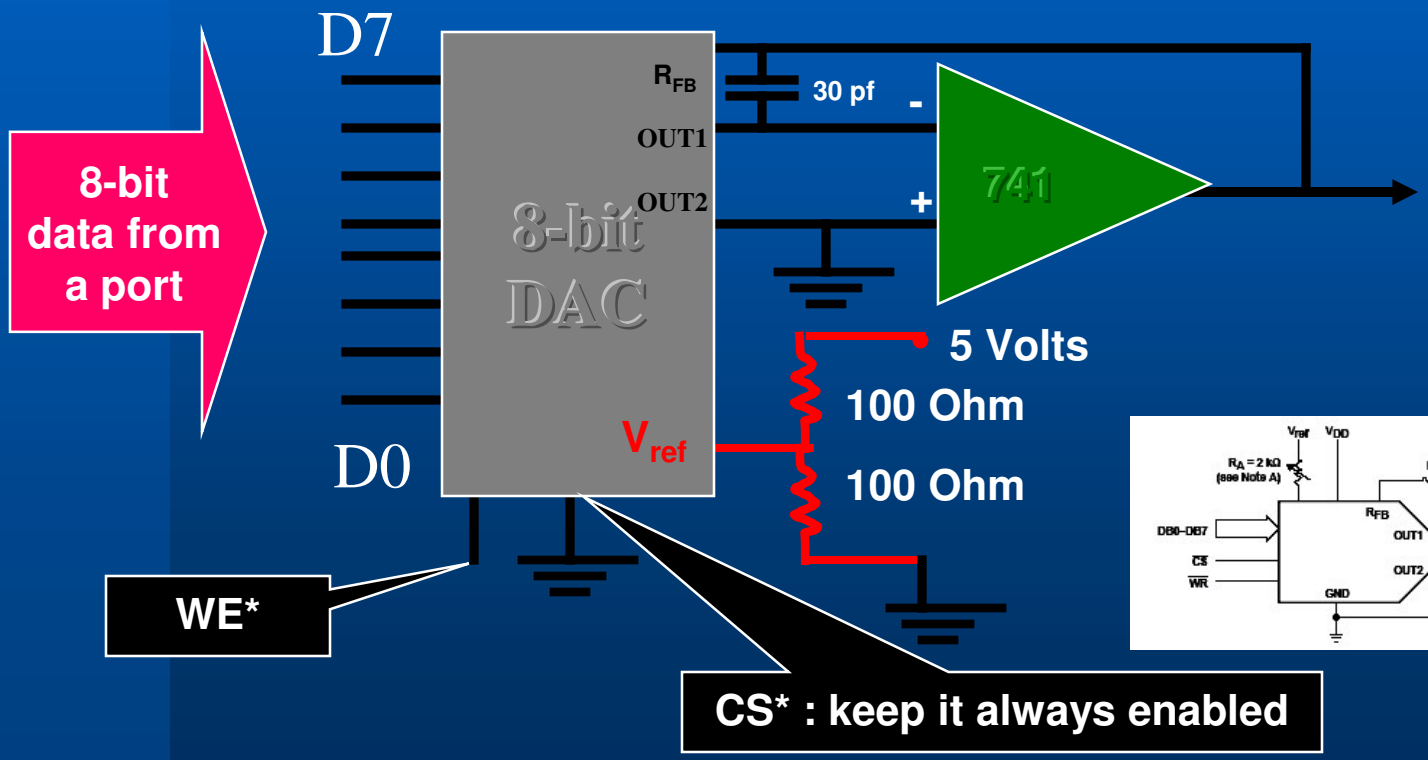
The TLC7524 Data Sheet

Recommended operating conditions :

		V_{DD} = 5 V			V_{DD} = 15 V			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{DD}		4.75	5	5.25	14.5	15	15.5	V
Reference voltage, V_{ref}			±10			±10		V
High-level input voltage, V_{IH}		2.4			13.5			V
Low-level input voltage, V_{IL}				0.8			1.5	V
CS setup time, $t_{su(CS)}$		40			40			ns
CS hold time, $t_{h(CS)}$		0			0			ns
Data bus input setup time, $t_{su(D)}$		25			25			ns
Data bus input hold time, $t_{h(D)}$		10			10			ns
Pulse duration, $\overline{WR}$ low, $t_{w(WR)}$		40			40			ns
Operating free-air temperature, T_A	TLC7524C	0		70	0		70	°C
	TLC7524I	−25		85	−25		85	
	TLC7524E	−40		85	−40		85	

Producing a Voltage Level

You can write numbers to the DAC in a similar way as with the 3-byte memory module using the ATmega103 Ports



Task Plan

Design and construct a Signal Generator:

- The ATmega103 should be used to design a signal generator. The Amplitude, Frequency and Voltage offset should be subject to change under program control.
- The signals should be produced using a DAC and an Operational Amplifier driven by one of the ATmega103 ports.
- The generator should have a user interface.
- The LCD should be used to display a menu and the given frequency amplitude and offset settings.
- The Keyboard should be used for user input.