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MIDI to Voltage Converter Part 1

MAX 525 12BIT DAC with an Arduino Board

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What you need:

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What you need :

- Arduino Board (Arduino Mega 2560)

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What you need :

- Arduino Board (Arduino Mega 2560)
- Digital Analog Converter with SPI (MAX525)

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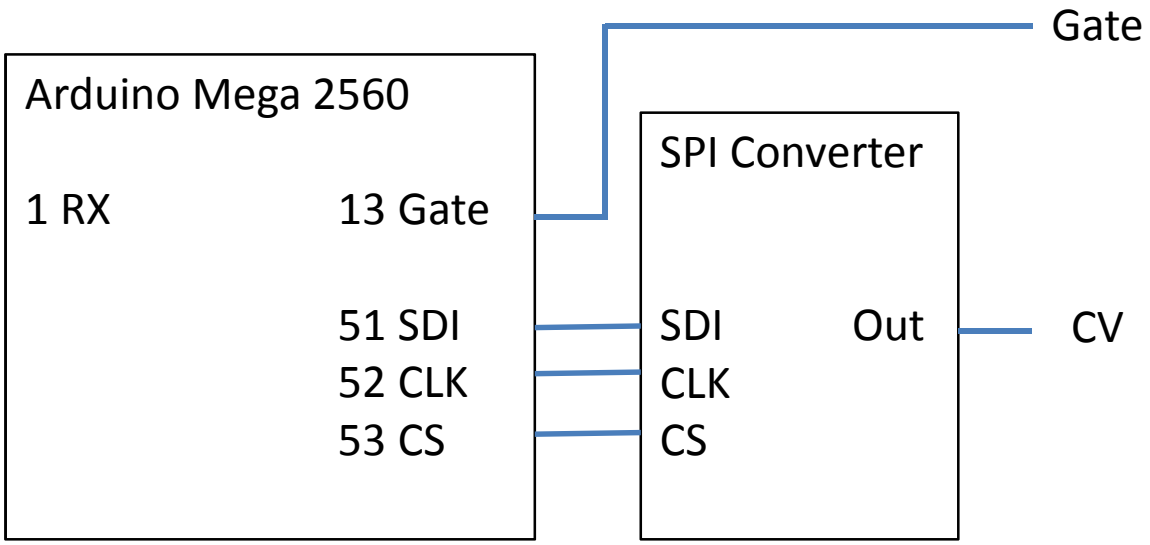
What you need :

- Arduino Board (Arduino Mega 2560)
- Digital Analog Converter with SPI (MAX525)
- MIDI Plug + Opto coupler

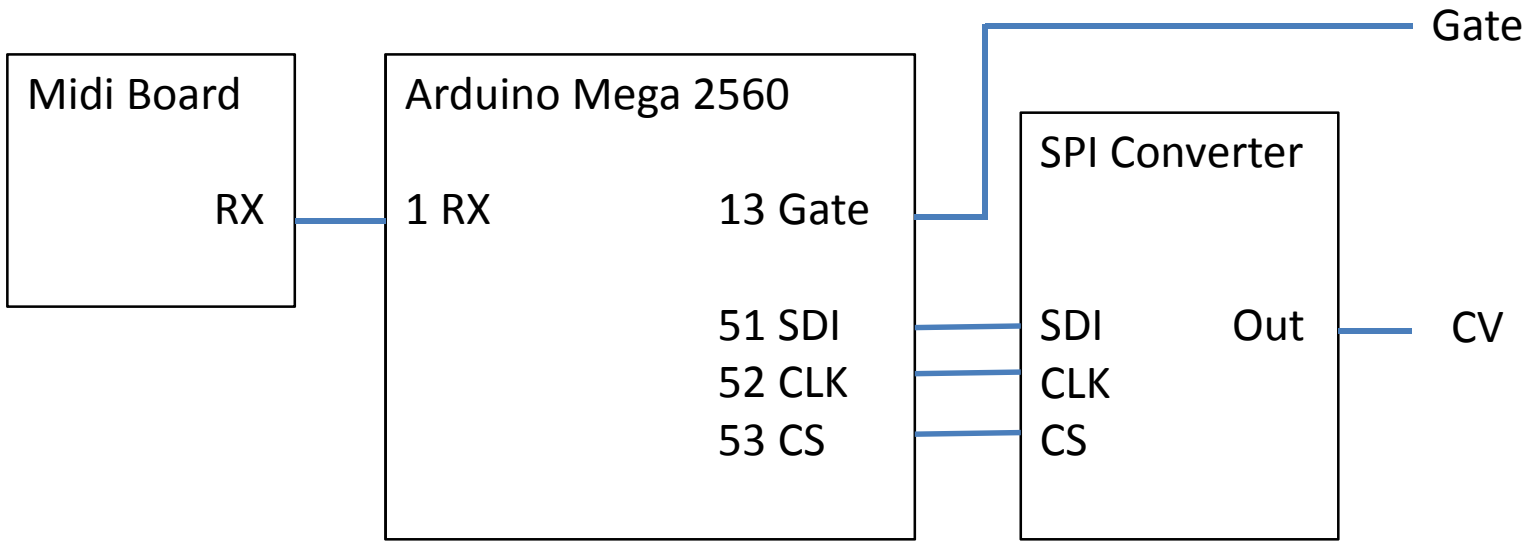
Arduino Board

Arduino Mega 2560	
1 RX	13 Gate
	51 SDI
	52 CLK
	53 CS

Arduino Board + SPI Converter



Arduino Board + SPI Converter + Midi Board



DAC Converter Board

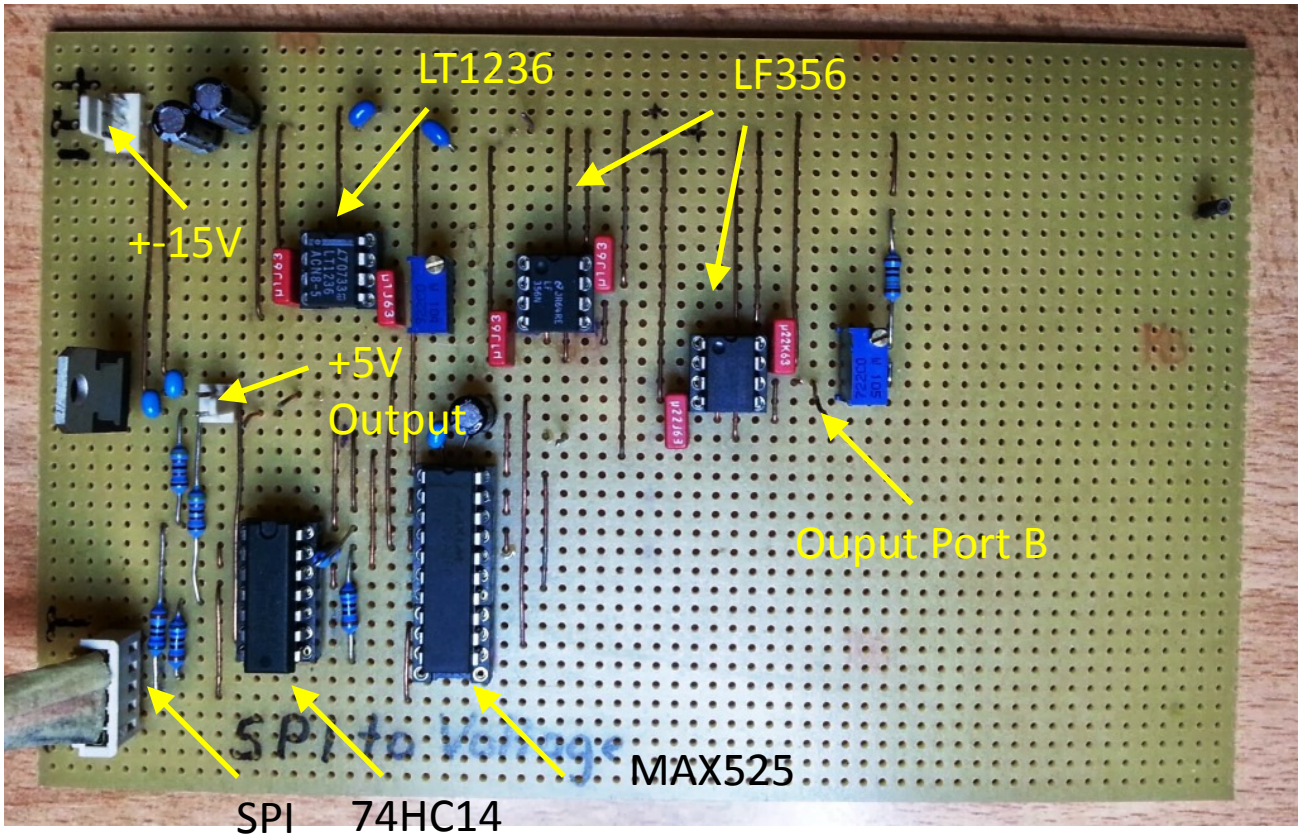
On the board there is MAX525 with 4 12bit DACs inside.

Beside the converter and the buffer OpAmps there is a LT1236 5V voltage reference and a 74HC14.

I use LF356 as Buffer OpAmps.

The output voltage range is 0 to 2V

DAC Converter Board



Reference voltage is trimmed to 2V

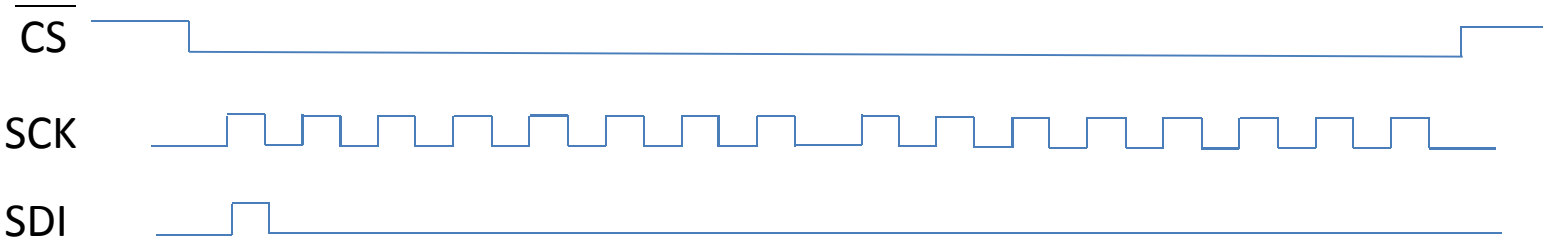
Vref = Vdd -1,4V!!
See Datasheet page 8.

SPI Connector

- SDO (Serial Data Out) / MISO (Master in, Slave out)
- SDI (Serial Data In) / MOSI (Master out, Slave in)
- SCK (Serial Clock) / SCLK
- CS (Chip Select)

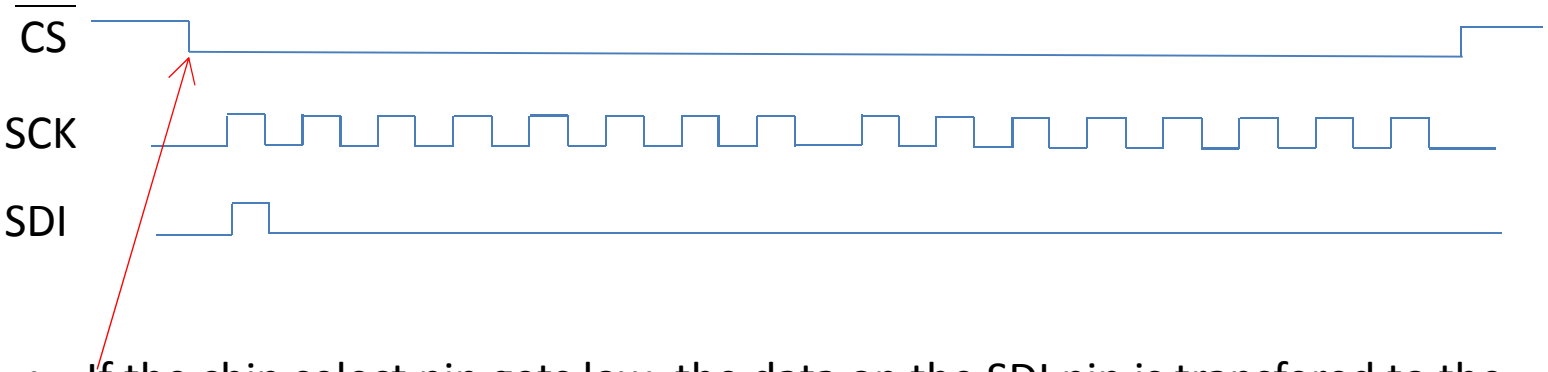
SPI Communication

Timing



SPI Communication

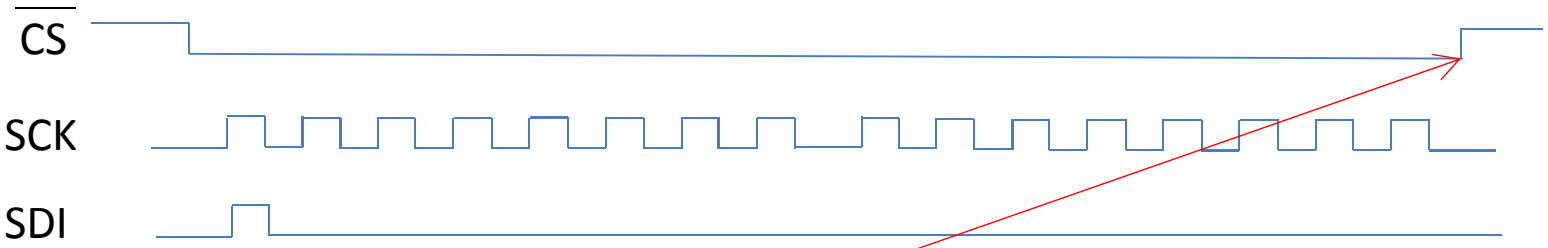
Timing



- If the chip select pin gets low the data on the SDI pin is transfered to the internal register on every falling edge of the clock signal.

SPI Communication

Timing



- If the chip select pin gets low the data on the SDI pin is transfered to the internal register on every falling edge of the clock signal.
- With the rising edge of the chip select the data is transfered to the DAC output.

The serial Datastructure

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The serial Datastructure

MSB	LSB
16 Bit seriel data	

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The serial Datastructure

MSB					LSB
16 Bit seriel data					
Address Bits		**Control Bits**		**Data** MSB	LSB
A1	A0	C1	C0	D11…….D0	

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The serial Datastructure

MSB				LSB
16 Bit seriel data				
Address Bits		**Control Bits**		**Data** MSB LSB
A1	A0	C1	C0	D11……..D0
4 Address/ Control Bits				**12 data bits**

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MSB and LSB

4 Address/ Control Bits				12 data bits											
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1

MSB LSB

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MSB and LSB

MSB

128	64	32	16	8	4	2	1

LSB

128	64	32	16	8	4	2	1

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MSB and LSB

MSB

128	64	32	16	8	4	2	1
1	0	0	0				

LSB

128	64	32	16	8	4	2	1

This command is loading all DAC registers with the value of the input register.

All outputs have the same value.

See datasheet page 10 table 1.

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MSB and LSB

MSB

128	64	32	16	8 2048	4 1024	2 512	1 256
1	0	0	0	0	0	0	0

LSB

128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	0

128 + 0

0

MSB and LSB

MSB

128	64	32	16	8 2048	4 1024	2 512	1 256
1	0	0	0	0	0	0	0

LSB

128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	0

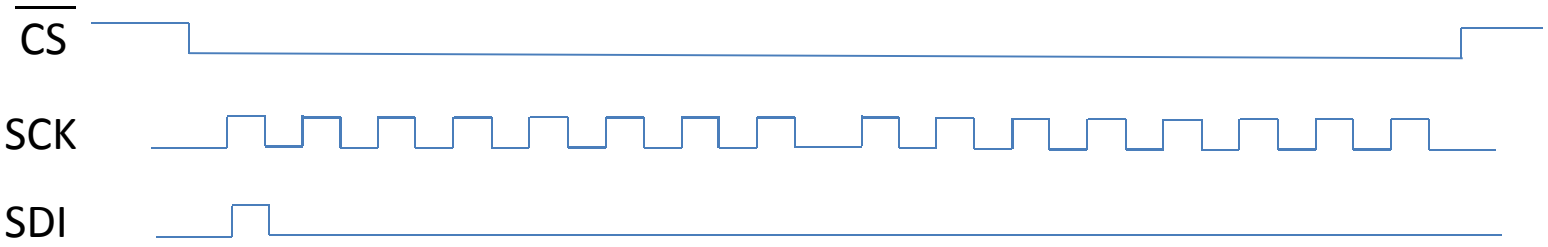
128 + 0

0

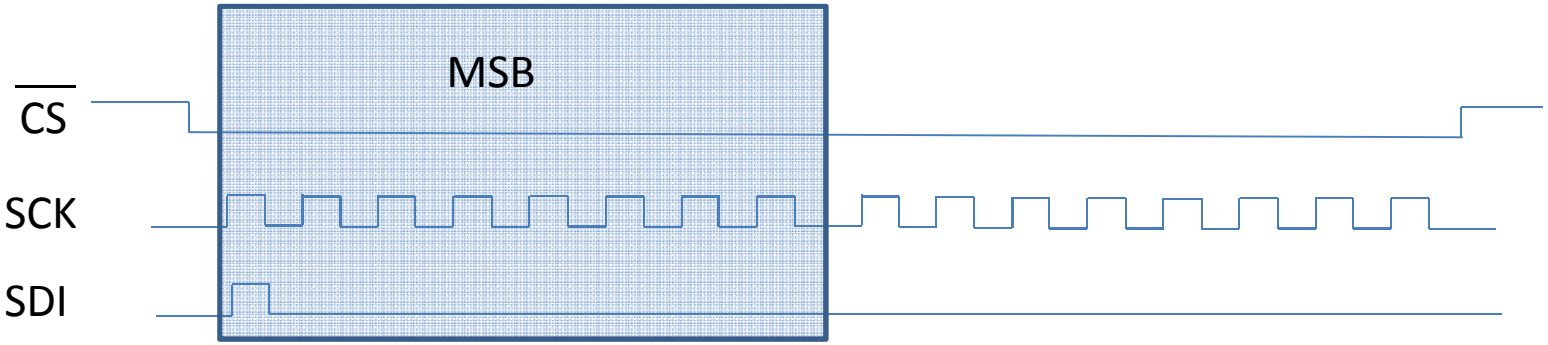
128

0 Volt output voltage

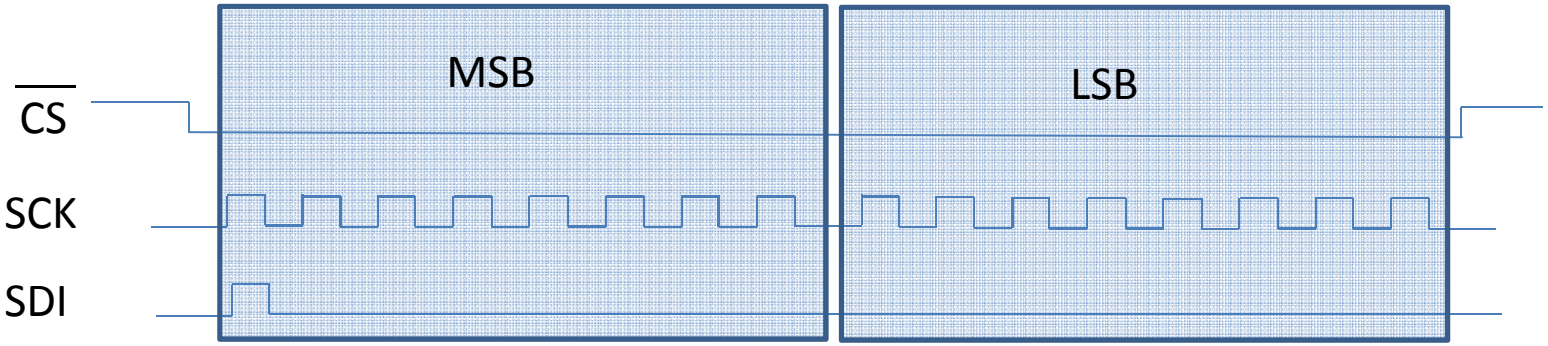
Timing chart
Output value 0



Timing chart
Output value 0



Timing chart
Output value 0



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MSB and LSB

MSB

128	64	32	16	8 2048	4 1024	2 512	1 256
1	0	0	0	1	1	1	1

LSB

128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1

128 + 15

255

143

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MSB and LSB

MSB

128	64	32	16	8 2048	4 1024	2 512	1 256
1	0	0	0	1	1	1	1

LSB

128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1

128 + 15

255

143

Output voltage = VRef * (Value/4096)

MSB and LSB

MSB

128	64	32	16	8 2048	4 1024	2 512	1 256
1	0	0	0	1	1	1	1

LSB

128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1

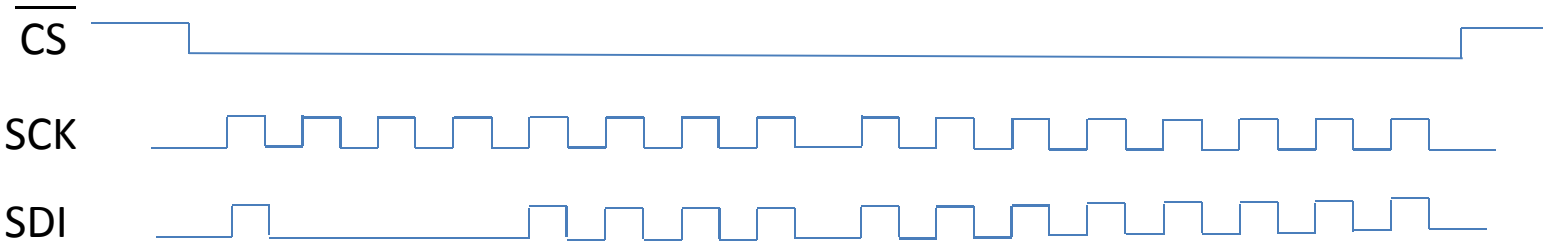
128 + 15

255

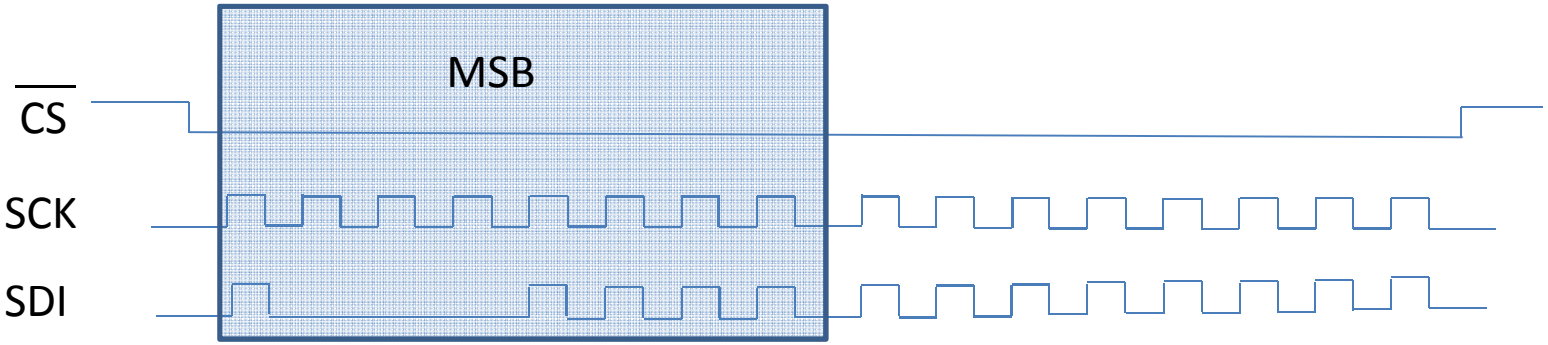
143

Output voltage = 2V * (4095/4096)
= 1,99V

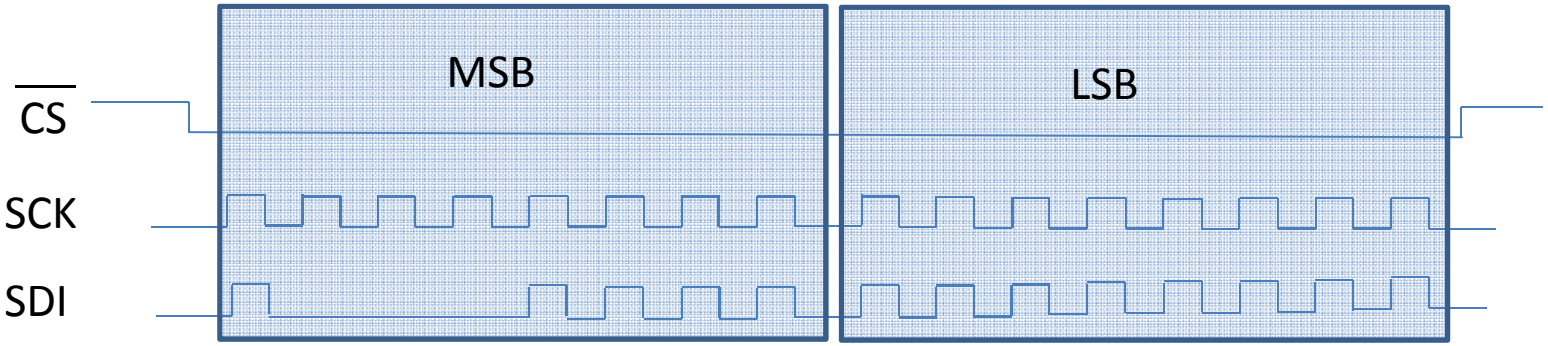
Timing chart
Output value 4095



Timing chart
Output value 4095



Timing chart
Output value 4095



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Program sequence

Program sequence

- Define the CS pin, settting to output, set value = high

Program sequence

- Define the CS pin, settting to output, set value = high
- Activate SPI interface

Program sequence

- Define the CS pin, settting to output, set value = high
- Activate SPI interface
- Setting the SPI parameter

Program sequence

- Define the CS pin, settting to output, set value = high
- Activate SPI interface
- Setting the SPI parameter
- Set CS = low -> shifts the following data to the input register

Program sequence

- Define the CS pin, settting to output, set value = high
- Activate SPI interface
- Setting the SPI parameter
- Set CS = low -> shifts the following data to the input register
- Transmit MSB thru SPI

Program sequence

- Define the CS pin, settting to output, set value = high
- Activate SPI interface
- Setting the SPI parameter
- Set CS = low -> shifts the following data to the input register
- Transmit MSB thru SPI
- Transmit LSB thru SPI

Program sequence

- Define the CS pin, settting to output, set value = high
- Activate SPI interface
- Setting the SPI parameter
- Set CS = low -> shifts the following data to the input register
- Transmit MSB thru SPI
- Transmit LSB thru SPI
- Set CS = high -> shifts the value to the output register of the DAC

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End Part 1

- MAX 525: http://www.maximintegrated.com/datasheet/index.mvp/id/1445
- LT1236: http://www.linear.com/product/LT1236
- LF356: http://www.ti.com/product/lf356
- 6N139: http://www.ti.com/product/6n139
- 74HC14: http://www.ti.com/product/cd74hc14
- Arduino: http://www.arduino.cc/