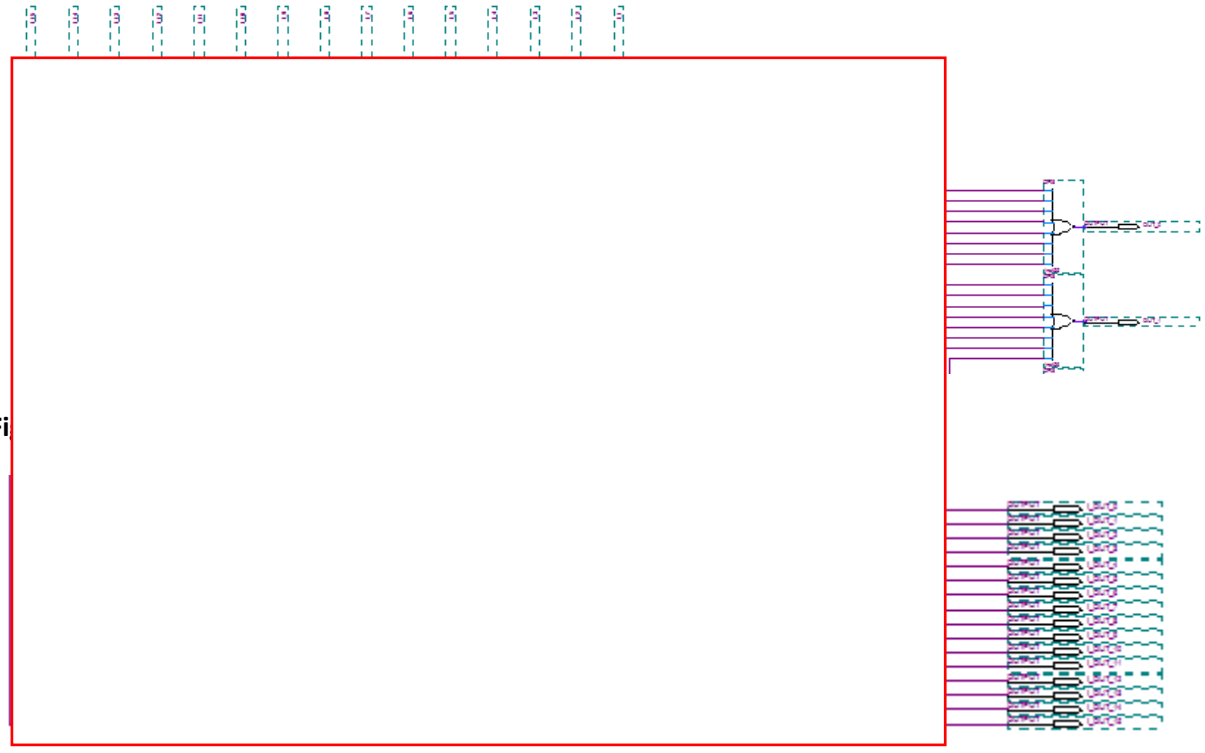
Project 5: D/A and A/D Converters

The purpose of
resistors, op-am

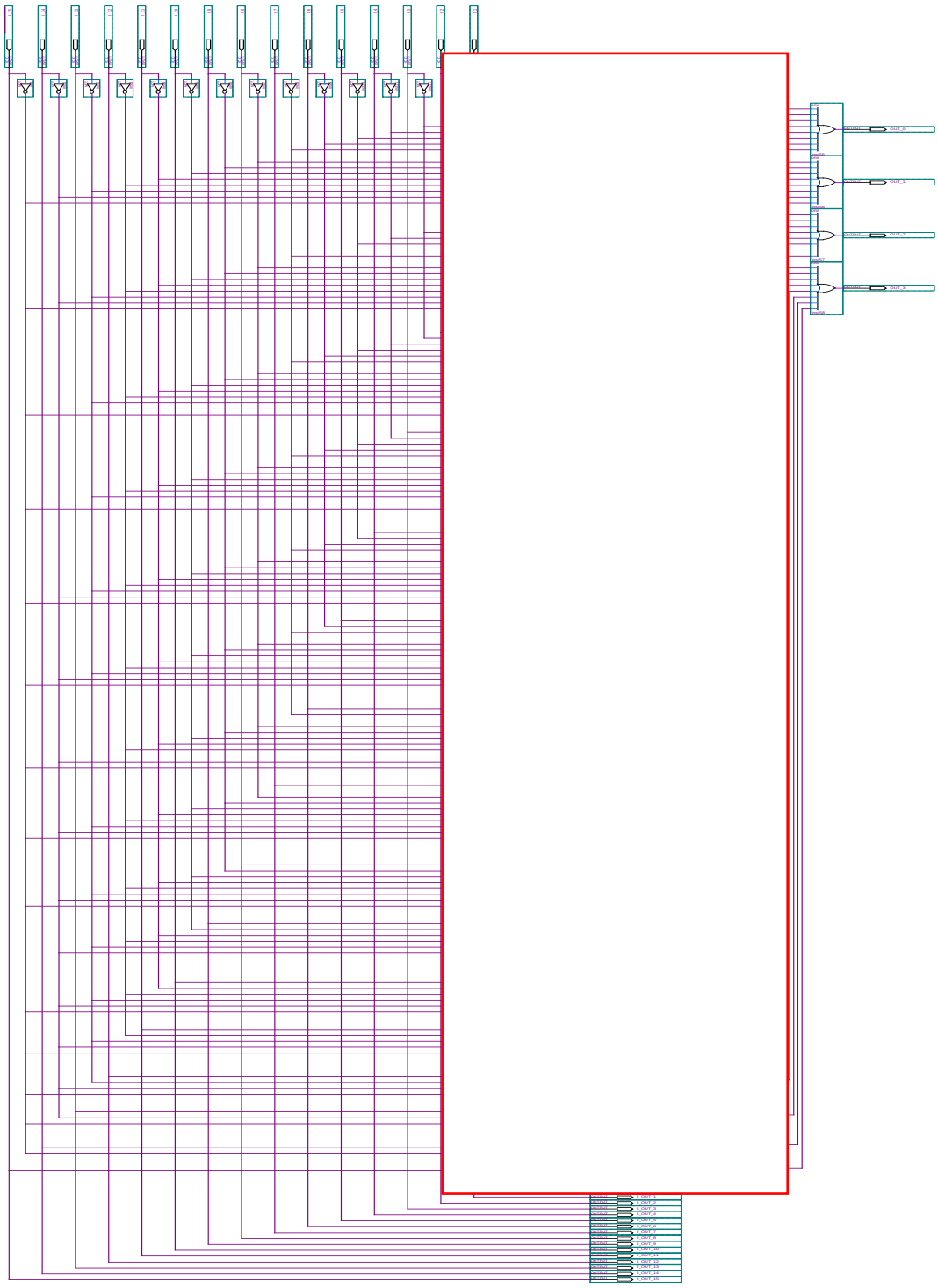
First, the numb
Calculations). Th
calculated(Calcu
actuality, 3R/2 v
were used. The
voltage levels in

ee
istors
the



Fi

Figure 3: voltage outputs



After building the circuit, the voltage of each level was measured in order to compare to the calculated levels (table 2 and figures 5-6). Then, the priority encoder was downloaded to the Altera board, and the

outputs of the circuit were connected to the expansion header on the Altera board. The pin assignments were made, and as the voltage increased, the 4 logic levels increased in order.

Logic level	Trial 1 (V)	Trial 2 (V)
0 0 0 0	0	0
0 0 0 1	0.17758	0.1718
0 0 10	0.49732	0.48038
0 0 11	0.78455	0.82613
0 100	1.13348	1.16044
0 101	1.4524	1.4051
0 110	1.7228	1.7277
0 111	2.0955	2.1036
1000	2.3584	2.4575
1001	2.7118	2.6591
1010	2.9829	2.9771
1011	3.3469	3.282
1100	3.6028	3.6346
1101	3.9735	3.9271
1110	4.2247	4.268
1111	4.5616	4.6434

Table 2: minimum voltage required for each logic level

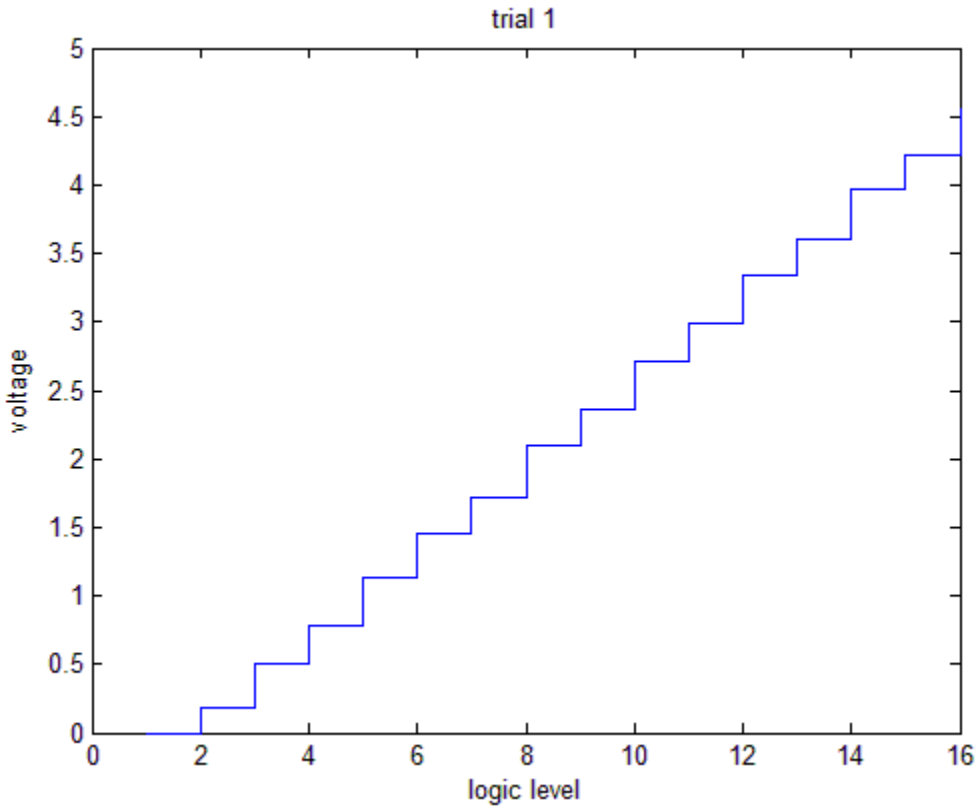


Figure 5: plot of voltage increase

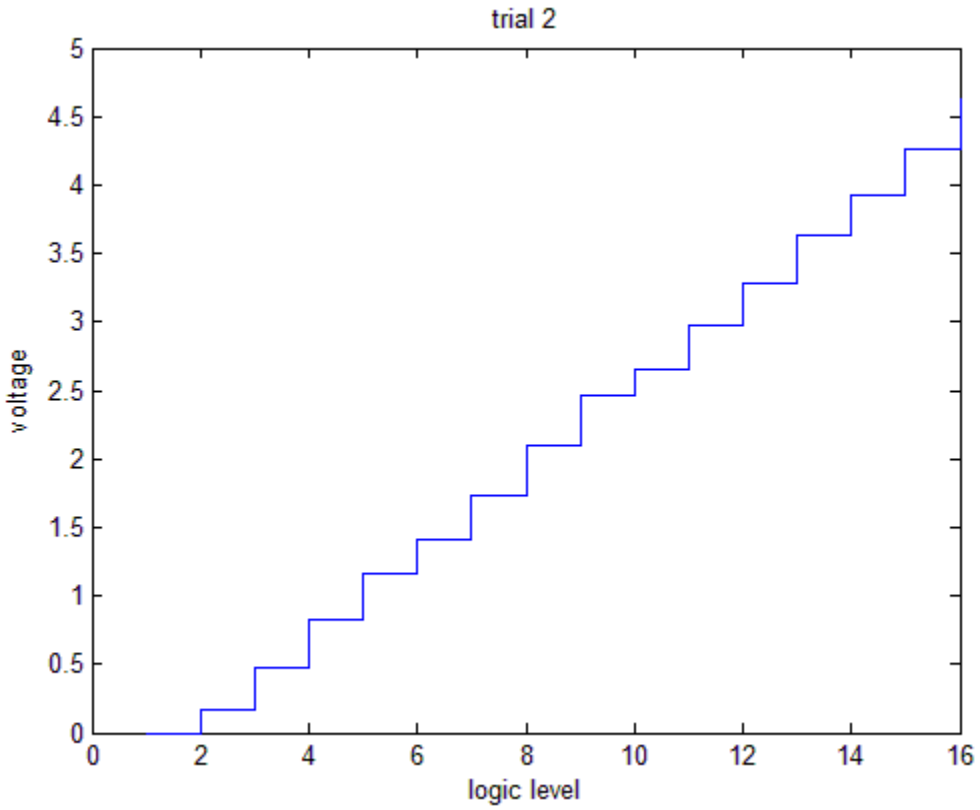


Figure 6: plot of voltage increase trial 2

Conclusion

This experiment re
reference voltage
analog voltage is s
the comparator wi
smallest voltage le
voltage levels are
resistors are deter
the circuit, it work

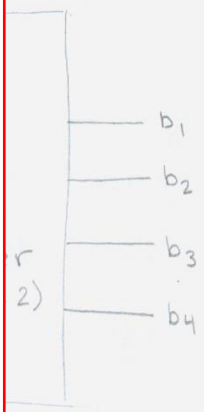
that
s the
The
nber of
uilding

Calculations

onverter

1.5kΩ = 1k + 500Ω

500Ω



r
2)

$V_{15} = \frac{29V_{ref}}{16} = 4.53125V$

$V_{14} = \frac{27V_{ref}}{16} = 4.21875V$

$V_{13} = \frac{25V_{ref}}{16} = 3.90625V$

$V_{12} = \frac{23V_{ref}}{16} = 3.59375V$

$V_{11} = \frac{21V_{ref}}{16} = 3.28125V$

$V_{10} = \frac{19V_{ref}}{16} = 2.96875V$

$V_9 = \frac{17V_{ref}}{16} = 2.65625V$

$V_8 = \frac{15V_{ref}}{16} = 2.34375V$

$V_7 = \frac{13V_{ref}}{16} = 2.03125V$

$V_6 = \frac{11V_{ref}}{16} = 1.71875V$

$V_5 = \frac{9V_{ref}}{16} = 1.40625V$

$V_4 = \frac{V_{ref}}{16R}(3R + R/2) = \frac{7V_{ref}}{16} = 1.09375V$

$V_3 = \frac{V_{ref}}{16R}(2R + R/2) = \frac{5V_{ref}}{32} = 0.78125V$

$V_2 = \frac{V_{ref}}{16R}(R + R/2) = \frac{3V_{ref}}{32} = 0.46875V$

$V_1 = \frac{V_{ref}}{16R}\left(\frac{R}{2}\right) = \frac{V_{ref}}{32} = 0.15625V$

$\rightarrow V_{ref} = 5V$