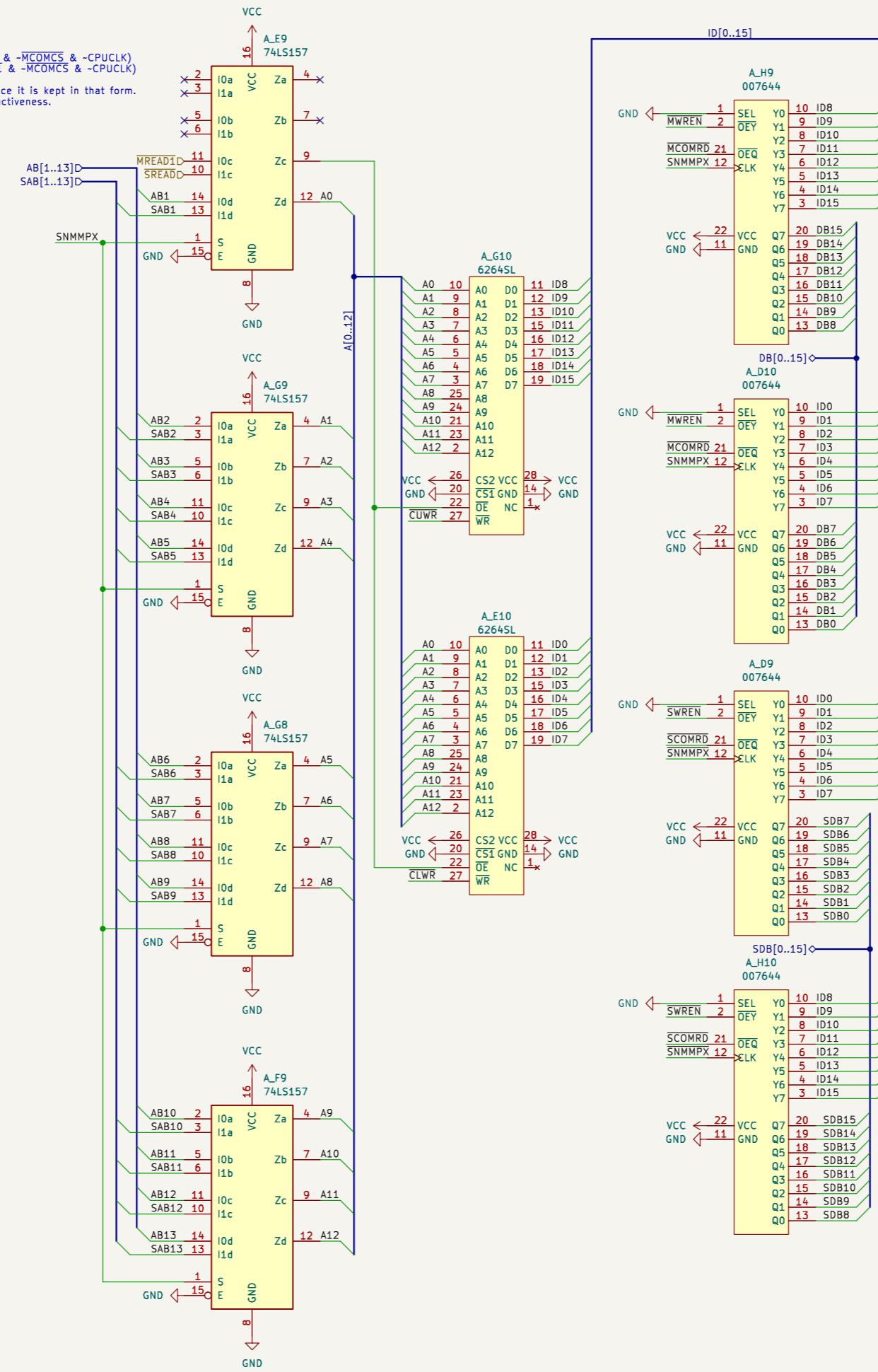
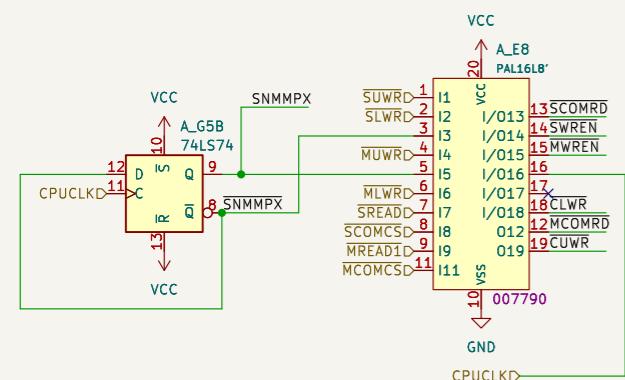


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$MCOMRD = \neg(MREAD1 \& \neg MCOMCS) = MREAD1 \mid MCOMCS$   
 $SCOMRD = \neg(SREAD \& \neg SCOMCS)$   
 $SWREN = \neg(SNMMPX \& SREAD \& \neg SCOMCS)$   
 $MWREN = \neg(SNMMPX \& MREAD1 \& \neg MCOMCS)$   
 $CLWR = \neg(CLWR \& \neg SNMMPX \& SREAD \& \neg SCOMCS \& \neg CPUCLK \mid \neg SNMMPX \& MREAD1 \& \neg MCOMCS \& \neg CPUCLK)$   
 $CUWR = \neg(CUWR \& \neg SNMMPX \& SREAD \& \neg SCOMCS \& \neg CPUCLK \mid \neg MUWR \& \neg SNMMPX \& MREAD1 \& \neg MCOMCS \& \neg CPUCLK)$

A All AND logic can be converted to OR form. But since AND logic and inverters are used in the PAL16L8 device it is kept in that form. The equations follow verilog syntax. The active low signals are not inverted, the bar is there only to show activeness.



This is from jammarcade.net

Pin 1 = SEL – changes whether the Q outputs require a rising edge clock or not.  
Pin 2 = OEQ – Output enable for the Y outputs else they are inputs. Active LOW  
Pin 21 = OEQ – Output enable for the Q (clocked) outputs else they are inputs. Active LOW  
Pin 12 = CLK – Clock input  
Pins 3–10 = Y outputs – normal outputs. If OEQ is LOW these pins become outputs  
mirroring the state of the Q input pins. SEL and CLK pins are not used in this mode.  
Pins 13–20 = Q outputs – clocked outputs. If OEQ is LOW these pins become outputs.  
If SEL is HIGH and CLK is HIGH these outputs will mirror the state of the Y inputs.  
If SEL is LOW then the outputs will only change state on a rising edge CLK.

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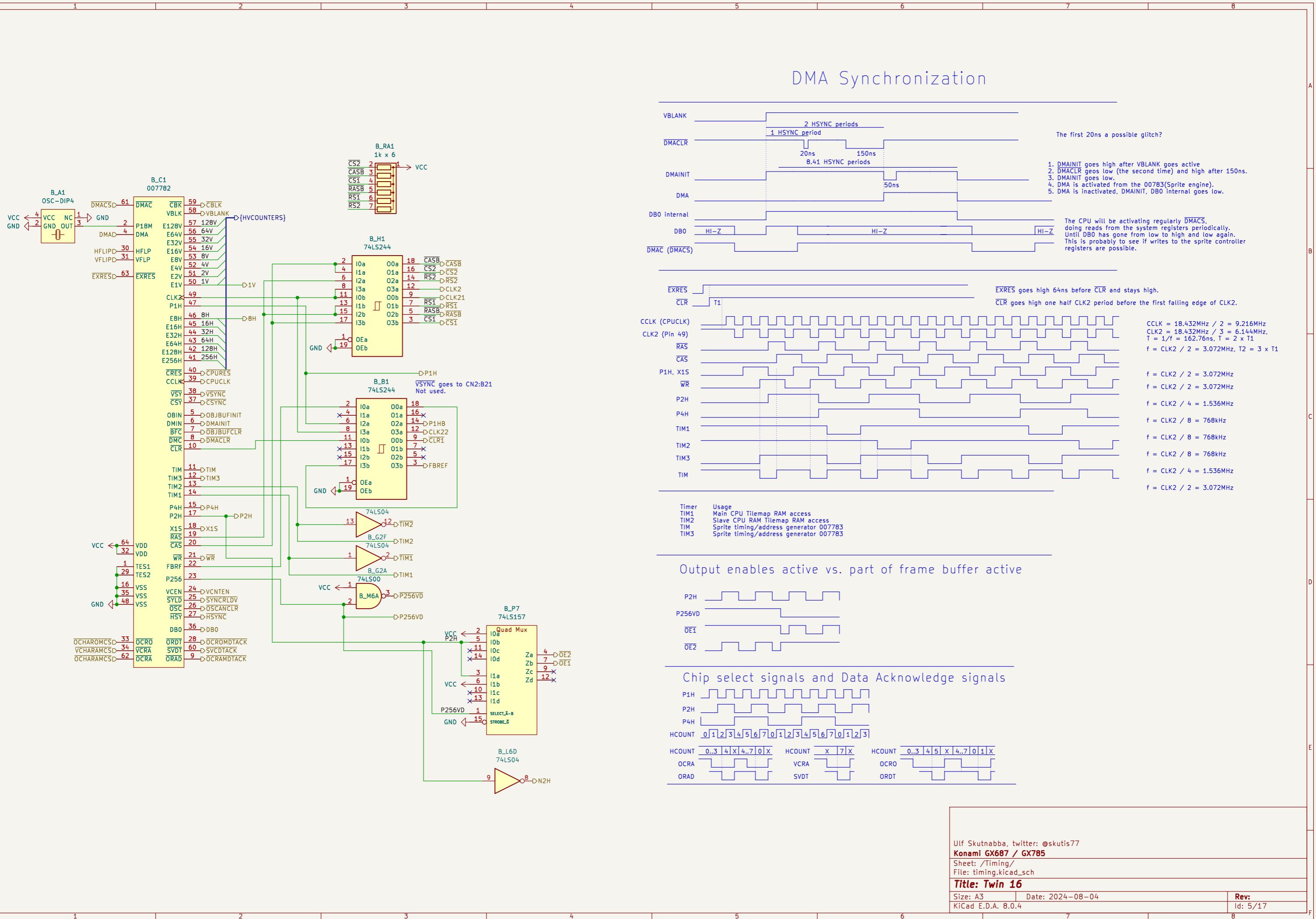
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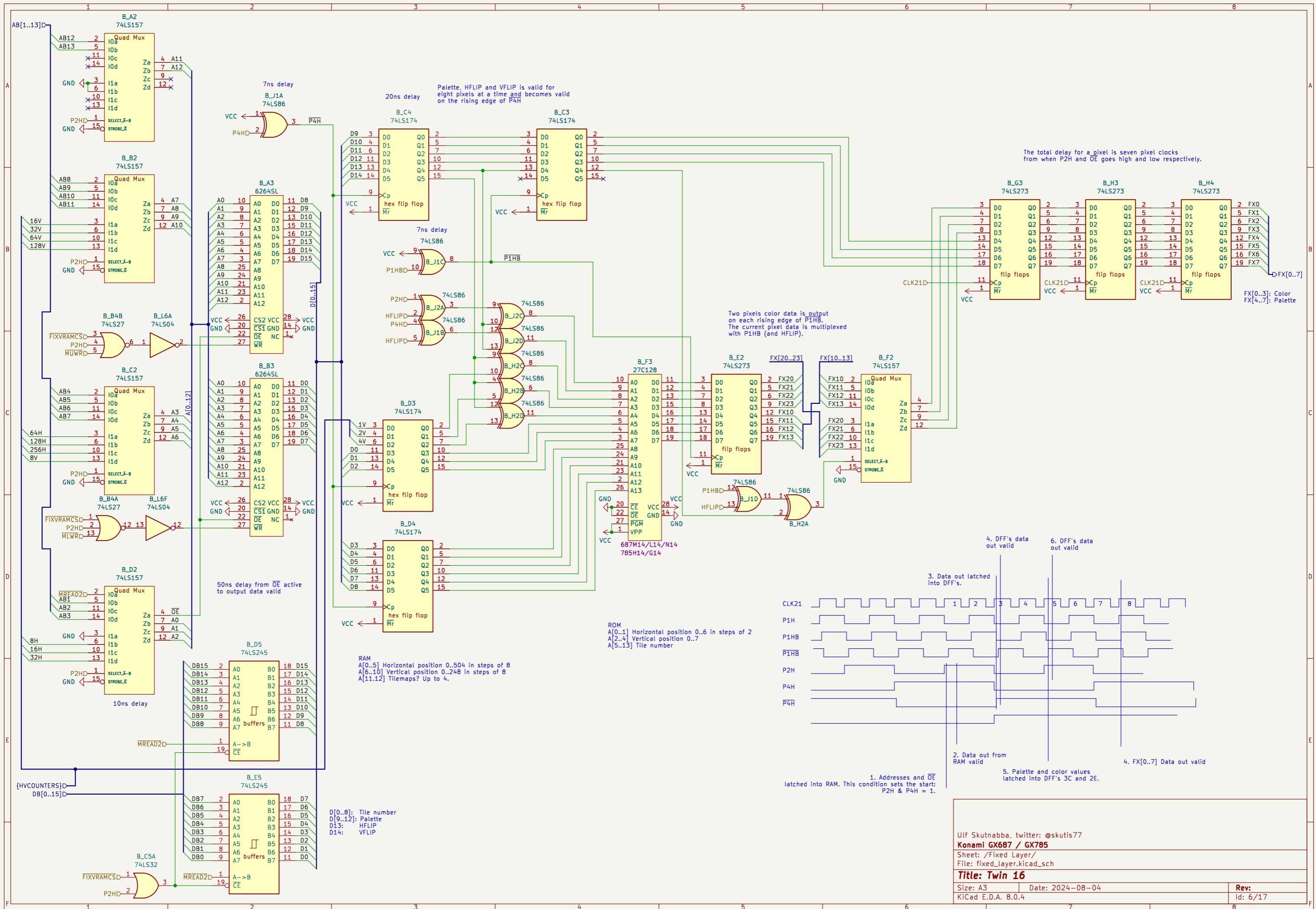
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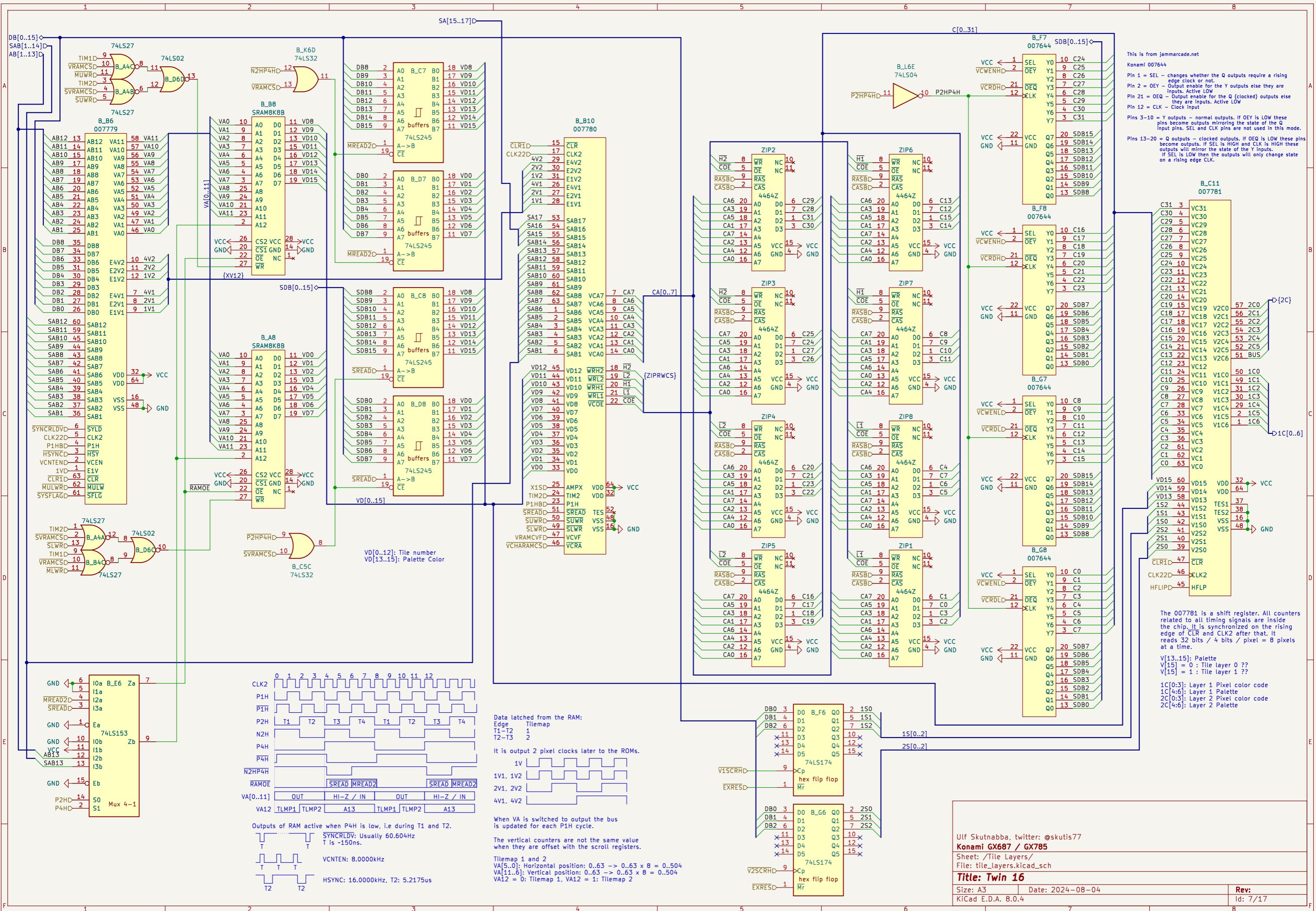
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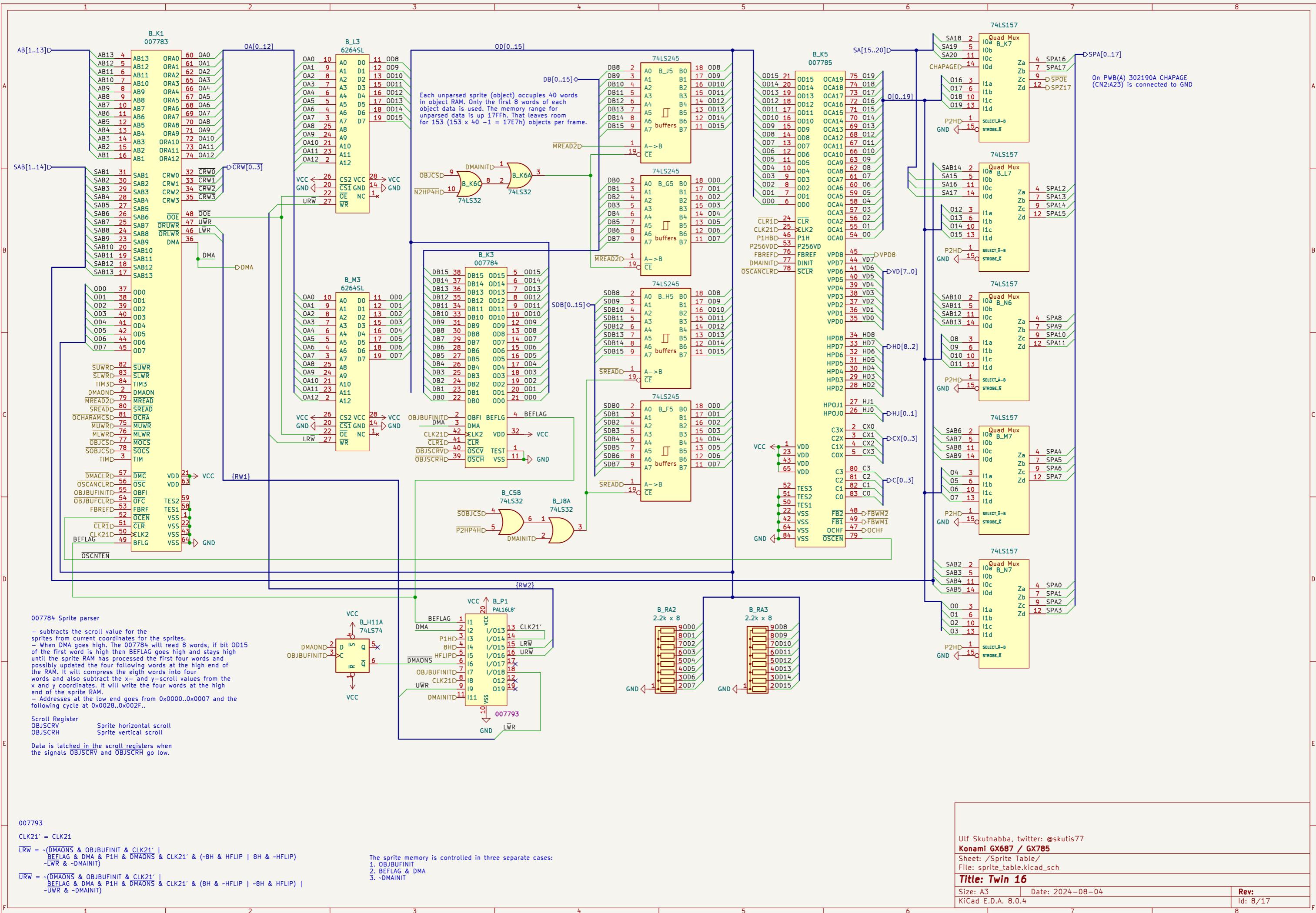
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KiCad E.D.A. 8.0.4

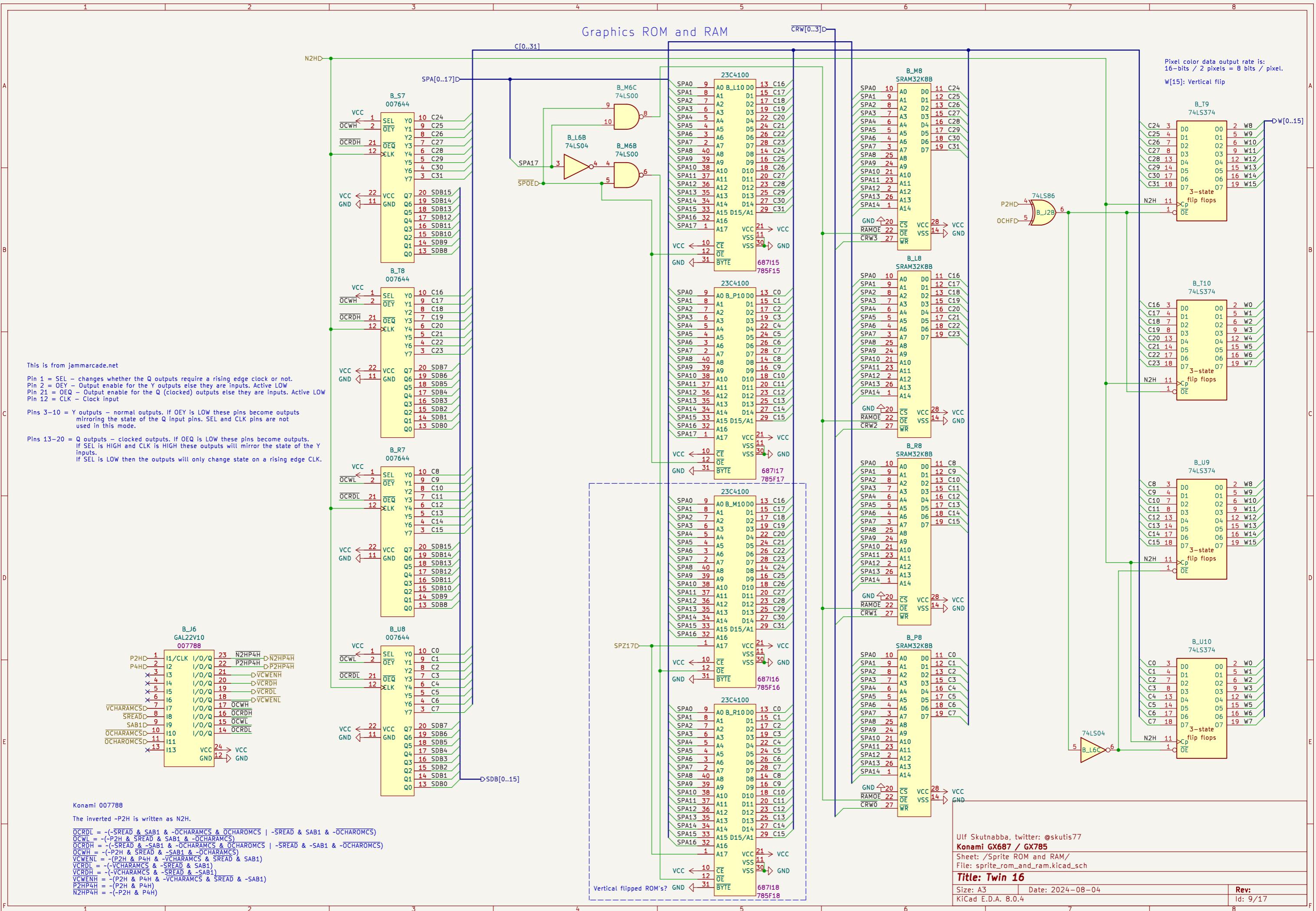
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Id: 4/17

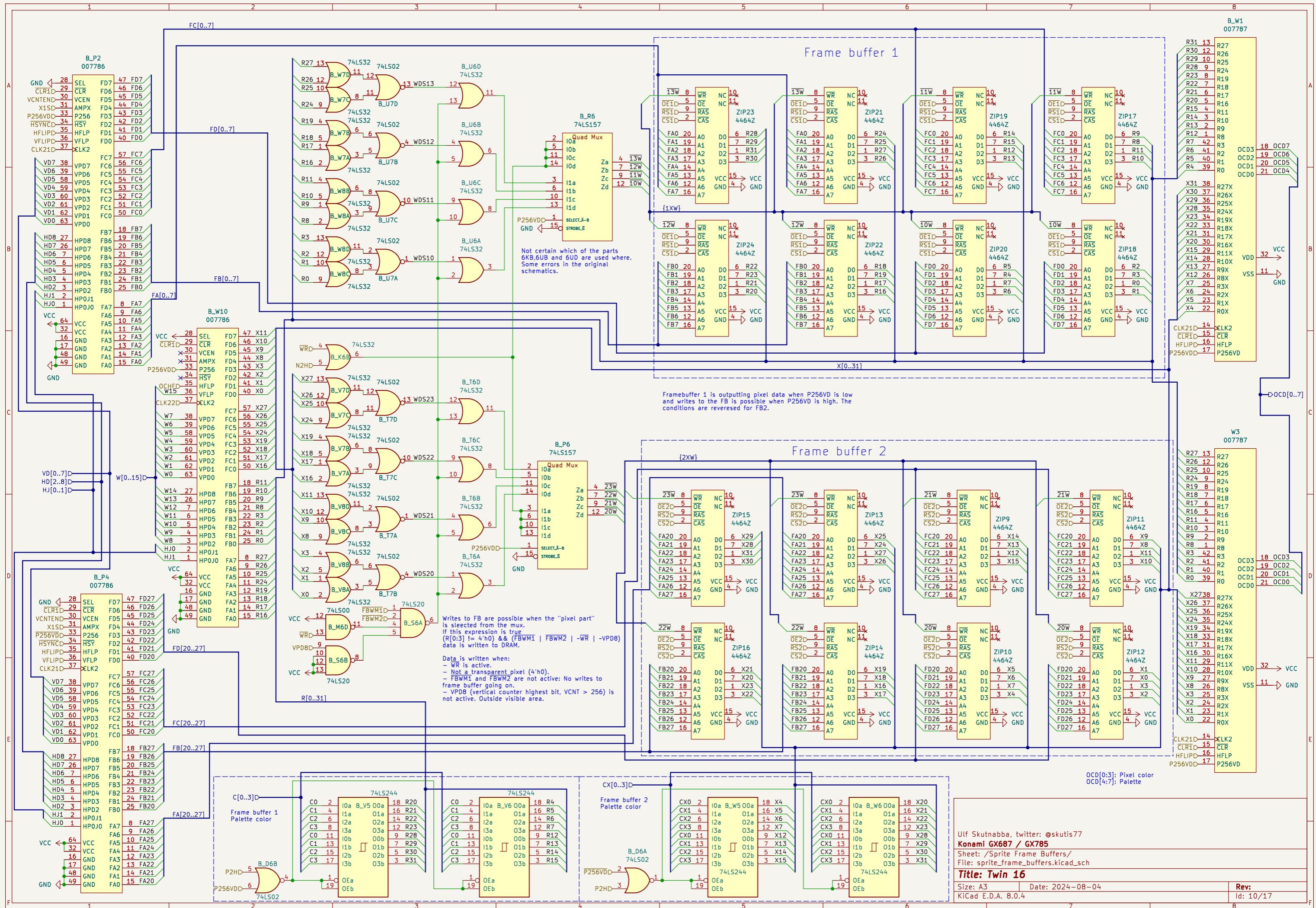


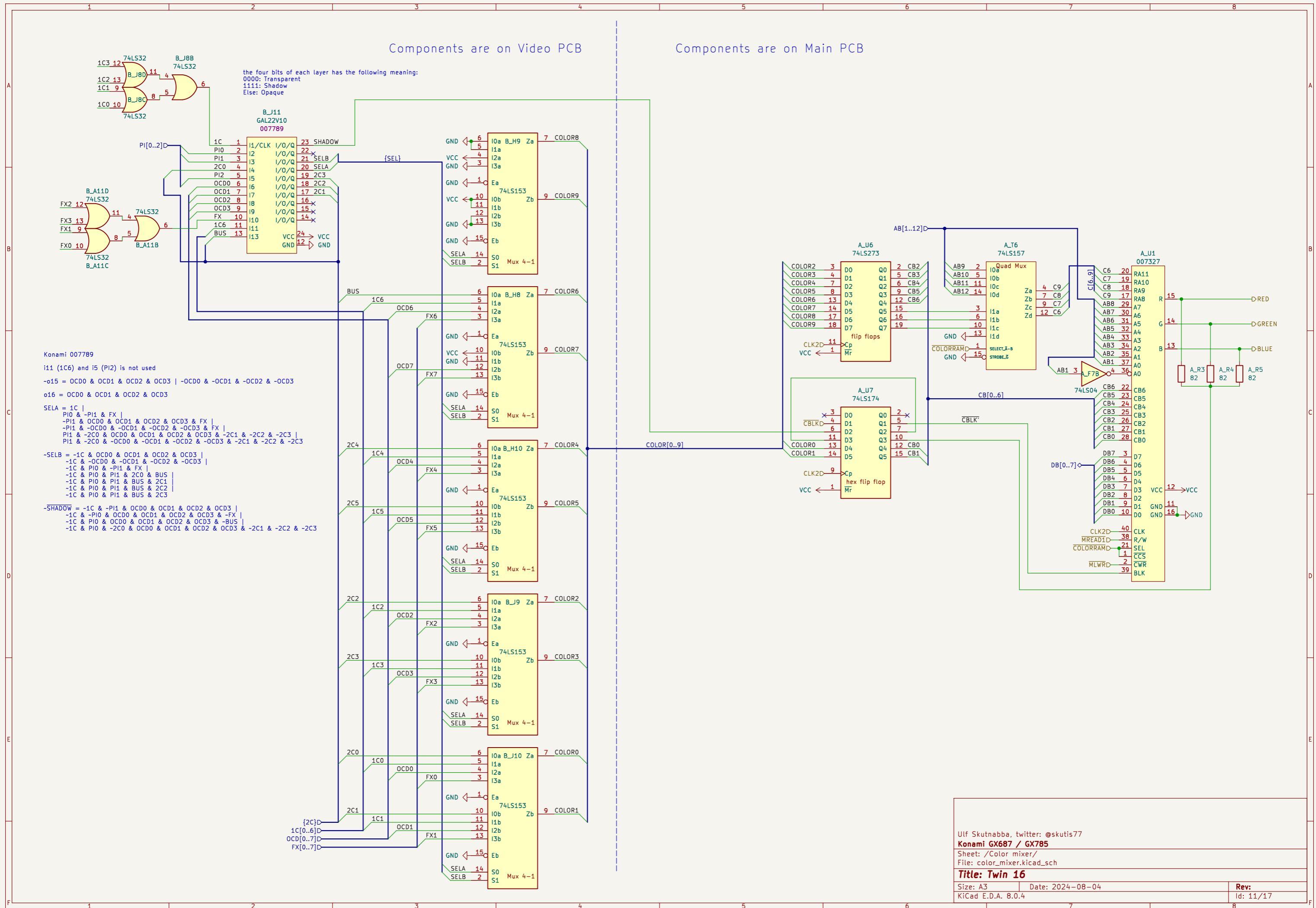


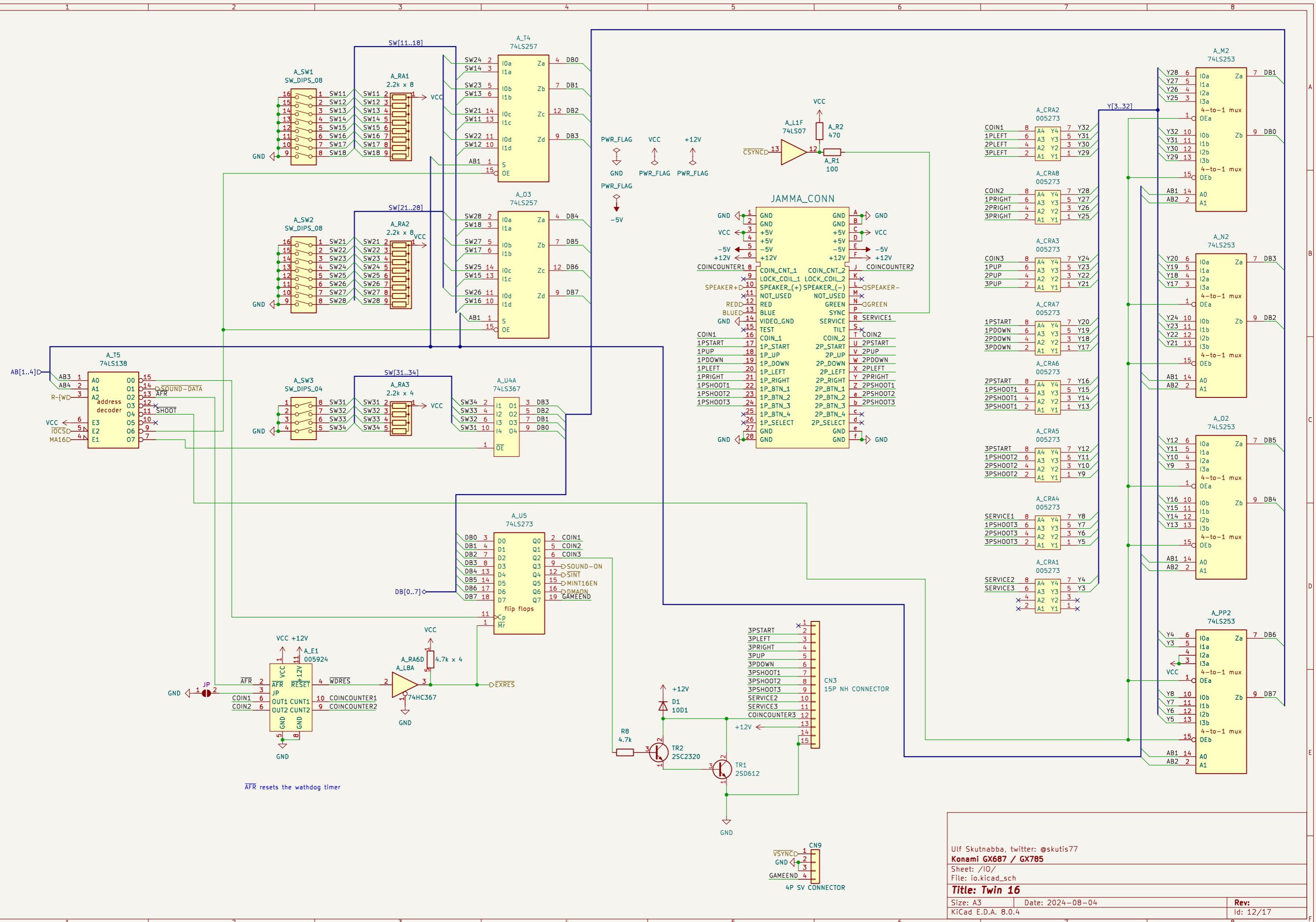


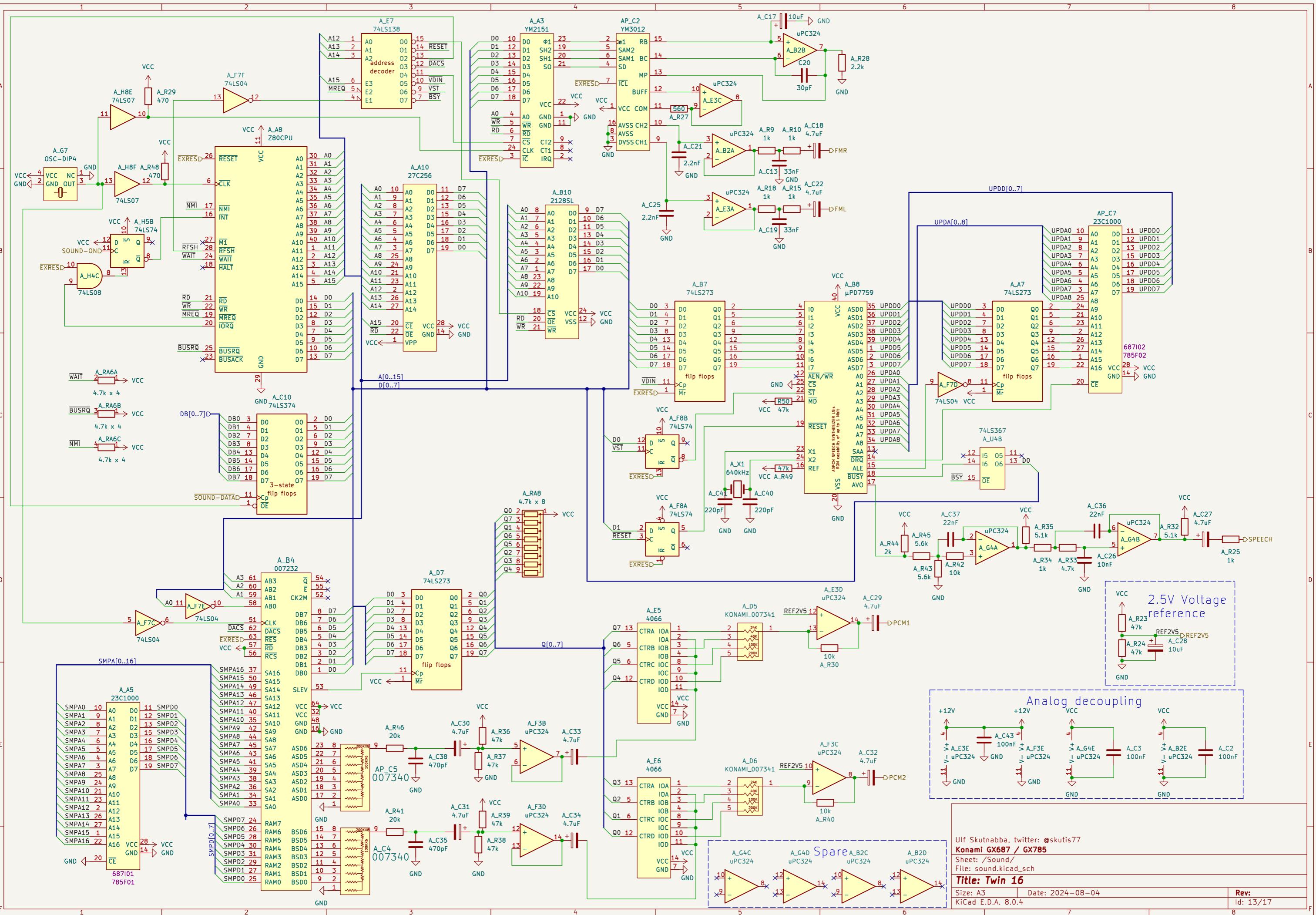




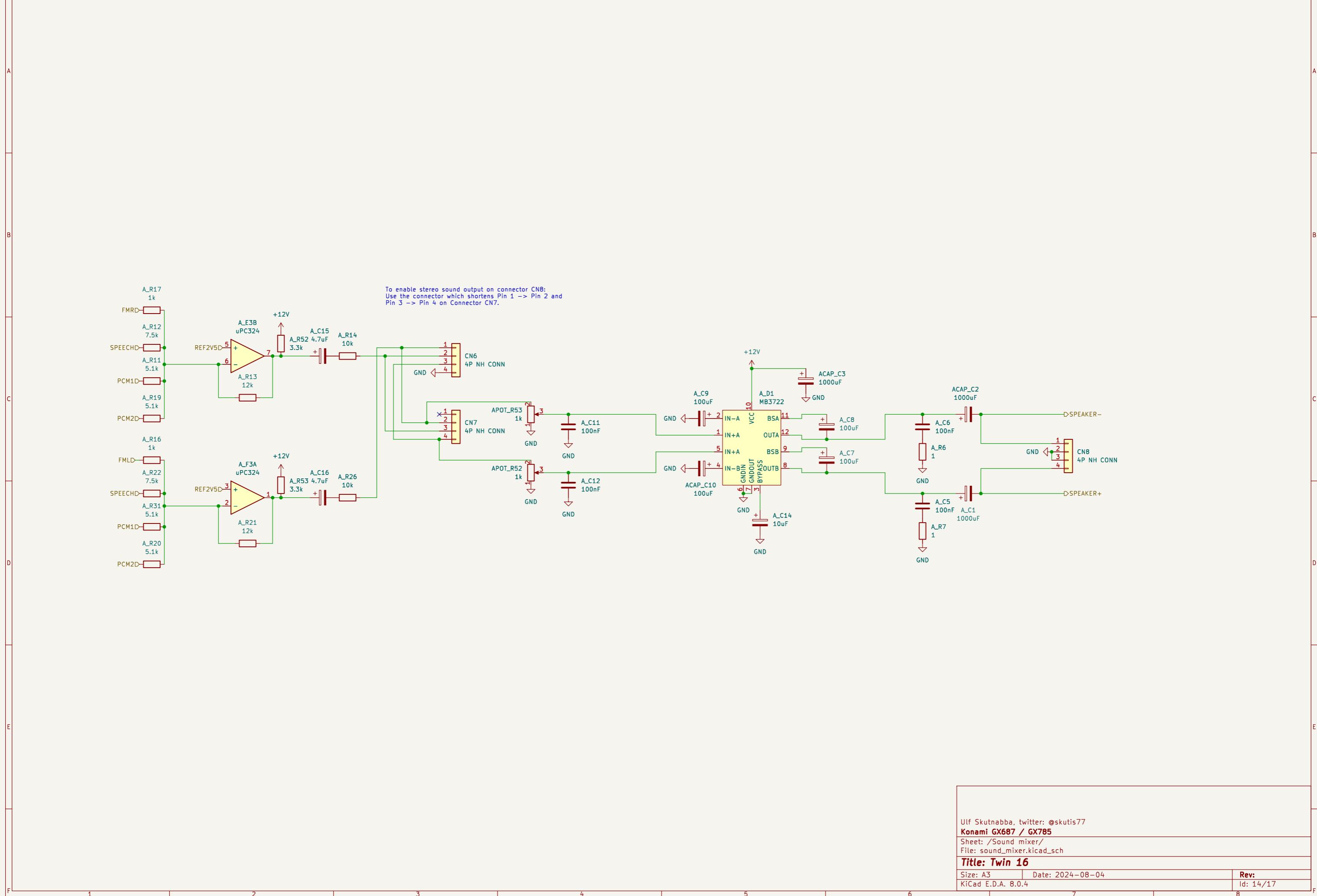




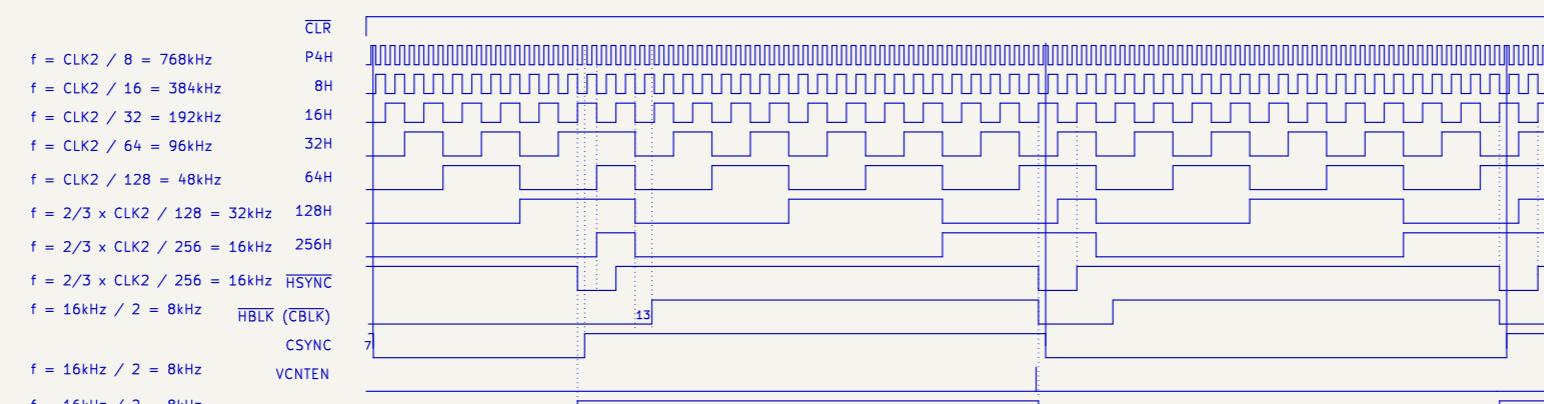




1 2 3 4 5 6 7 8



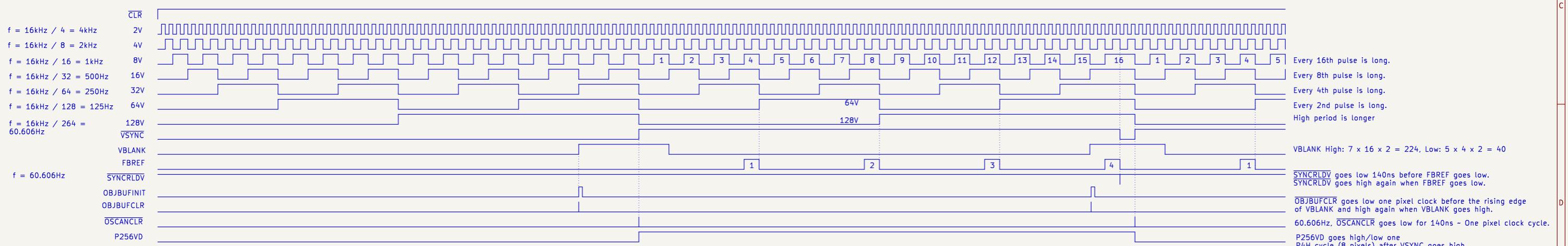
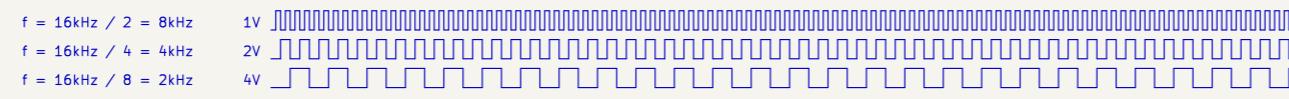
## Horizontal signals



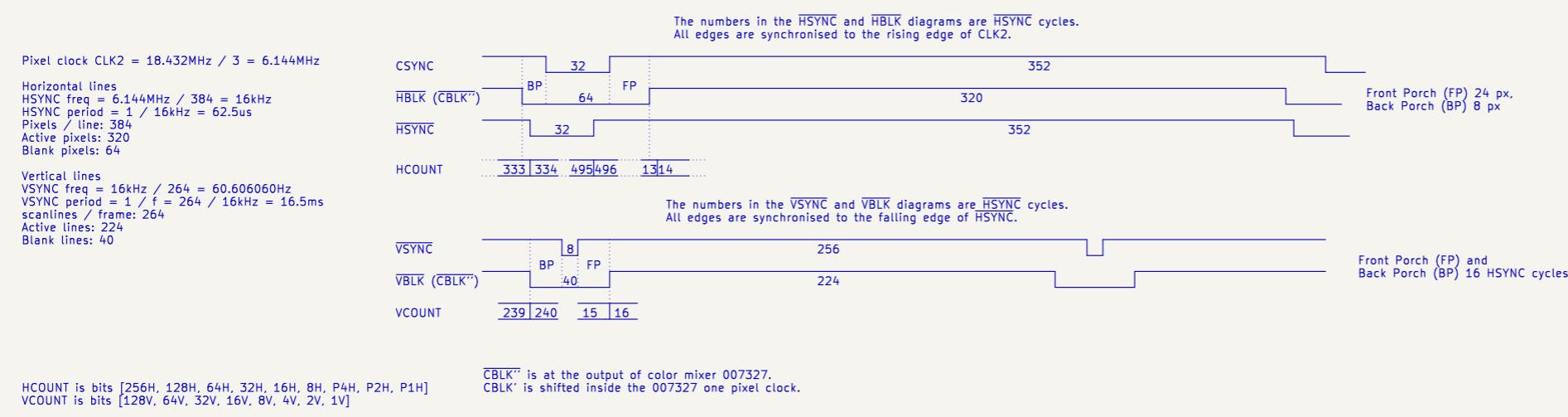
– The first VCNTEN is skipped after reset.  
It goes low 140ns before HSYNC goes low,  
and high again when HSYNC goes low.  
VCNTEN is active right before every second falling edge of  
HSYNC.

– CPURES goes high, and stays high, on the seventh falling edge  
of HSYNC.

## Vertical signals



## Horizontal and vertical synch timing diagrams



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Sheet: /Timing diagrams/

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Title: Twin 16

Size: A3 Date: 2024-08-04

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Rev:

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A

B

C

D

E

F

A

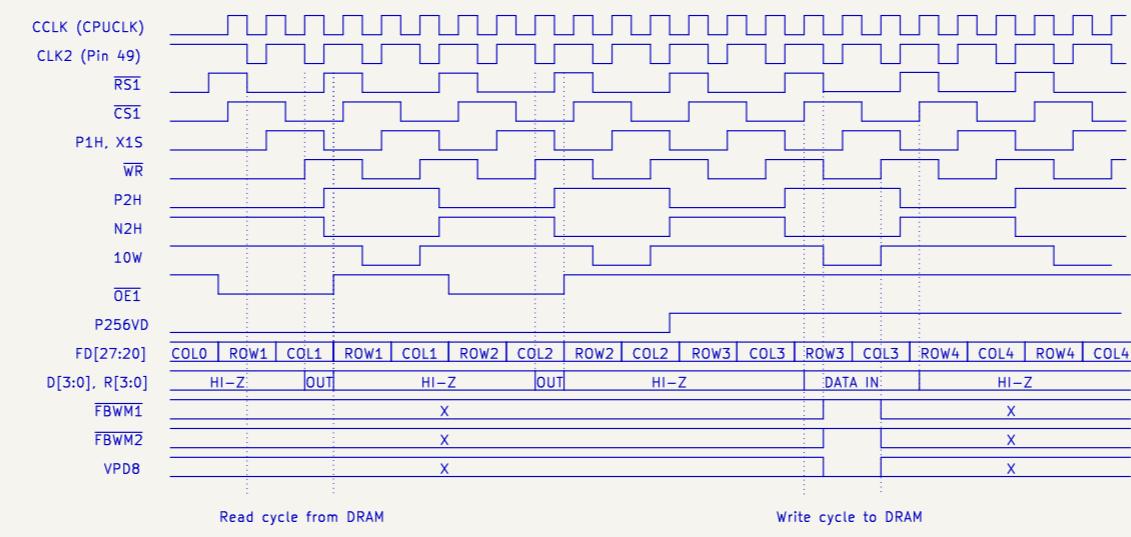
B

C

D

E

F



The same row and column addresses are repeated twice.  
One for read cycle and the other for write cycles.

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Sheet: /Sprite timing diagrams/  
File: sprite\_timing\_diagrams.kicad\_sch

**Title: Twin 16**

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