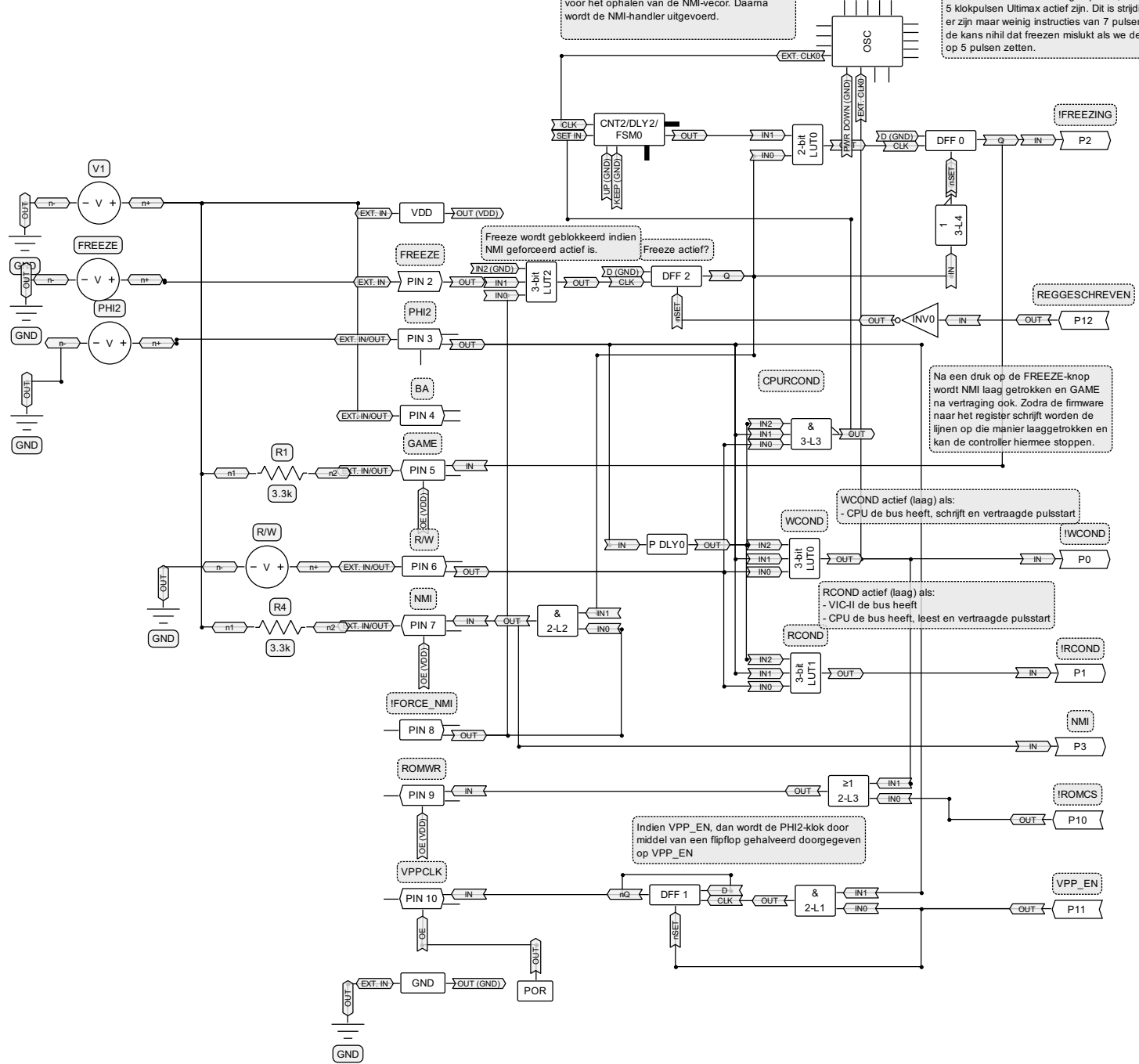


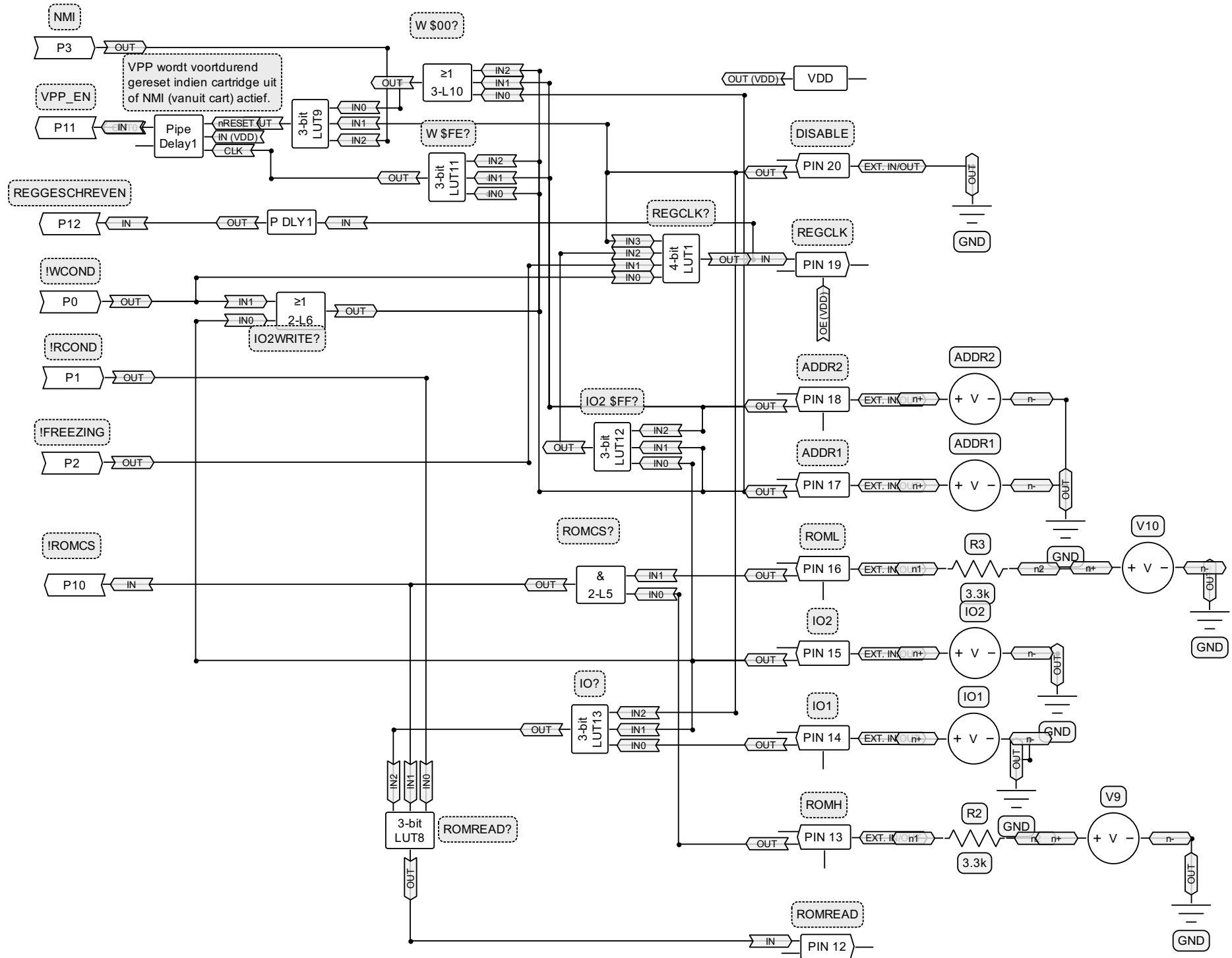
# Matrix 0

Bij NMI-interrupt maakt de C64 eerst zijn huidige instructie af. Daarna is de 6510 2 klokpulsen met interne aangelegeneden bezig. Daarna worden in 3 klokpulsen de program-counter en vlaggen naar de stack geschreven, Daarna 2 klokpulsen voor het ophalen van de NMI-vecor. Daarna wordt de NMI-handler uitgevoerd.

Een instructie kan 7 klokpulsen duren, deze afmaken kan dus nog 6 klokpulsen duren. Ultimax mag dus niet eerder dan 6 klokpulsen na NMI gestart worden, maar zodra de instructie afgelopen is, moet binnen 5 klokpulsen Ultimax actief zijn. Dit is strijdig, maar er zijn maar weinig instructies van 7 pulsen, dus is de kans nihil dat freezezen mislukt als we de teller op 5 pulsen zetten.



# Matrix 1



## Matrix 0

<b>VDD (PIN 1)</b>	
<i>Property</i>	<i>Value</i>
Min. value (V)	4.75
Typ. value (V)	5.00
Max. value (V)	5.25

<b>PIN 2 Label: "FREEZE"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in with Schmitt trigger
Out mode	None
Resistor	Pull Up
Resistor value	10K
Reset mode	Disable

<b>PIN 3 Label: "PHI2"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 4 Label: "BA"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 5 Label: "GAME"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital output
In mode	None
Out mode	1x open drain NMOS
Resistor	Floating

<b>PIN 6 Label: "R/W"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 7 Label: "NMI"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital output
In mode	None
Out mode	1x open drain NMOS
Resistor	Floating

<b>PIN 8 Label: "!FORCE_NMI"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 9 Label: "ROMWR"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital output
In mode	None
Out mode	1x push pull

<b>PIN 10 Label: "VPPCLK"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input/output
In mode	Digital in without Schmitt trigger
Out mode	1x push pull
Resistor	Pull Down
Resistor value	10K

<b>2-bit LUT0</b>		
<i>IN1</i>	<i>IN0</i>	<i>OUT</i>
0	0	0
0	1	0
1	0	1
1	1	0

<i>Property</i>	<i>Value</i>
Standard gates	Defined by user

<b>2-bit LUT1</b>		
<i>IN1</i>	<i>IN0</i>	<i>OUT</i>
0	0	0
0	1	0
1	0	0
1	1	1

<i>Property</i>	<i>Value</i>
Standard gates	AND

**2-bit LUT2**

IN1	IN0	OUT
0	0	0
0	1	0
1	0	0
1	1	1

Property	Value
Standard gates	AND

**2-bit LUT3**

IN1	IN0	OUT
0	0	0
0	1	1
1	0	1
1	1	1

Property	Value
Standard gates	OR

**3-bit LUT0  
Label: "WCOND"**

IN2	IN1	IN0	OUT
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Property	Value
Standard gates	Defined by user

**3-bit LUT1  
Label: "RCOND"**

IN2	IN1	IN0	OUT
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Property	Value
Standard gates	Defined by user

**3-bit LUT2**

IN2	IN1	IN0	OUT
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Property	Value
Standard gates	Defined by user

**3-bit LUT3  
Label: "CPURCOND"**

IN2	IN1	IN0	OUT
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Property	Value
Standard gates	NAND

**3-bit LUT4**

IN	OUT
0	1
1	0

Property	Value
Standard gates	Inverter

**DFF/LATCH0**

Property	Value
Mode	DFF
nSET/nRESET option	nSET
Initial polarity	High
Q output polarity	Non-inverted (Q)

**DFF/LATCH1**

Property	Value
Mode	DFF
nSET/nRESET option	nSET
Initial polarity	High
Q output polarity	Inverted (nQ)

<b>DFF/LATCH2</b> Label: "Freeze actief?"	
<i>Property</i>	<i>Value</i>
Mode	DFF
nSET/nRESET option	nSET
Initial polarity	High
Q output polarity	Non-inverted (Q)

<b>14-bit CNT2/DLY2/FSM0</b>	
<i>Property</i>	<i>Value</i>
Mode	Counter/FSM
Counter data	3
Output period (typical)	N/D
Edge select	Both
Counter value control	Set (counter value = FSM data)
FSM data sync with SPI clock	Disable
FSM data	Counter data
Clock	EXT. CLK0
Clock frequency	N/D

<b>P DLY0</b>	
<i>Property</i>	<i>Value</i>
Mode	Both edge delay
Delay	1 Cell
Output mode	Delayed

<b>POR</b>	
<i>Property</i>	<i>Value</i>
Chip power on delay	500 us

<b>OSC</b>	
<i>Property</i>	<i>Value</i>
LF power mode	Auto power on
LF frequency	1.73 kHz
Matrix power down	Disable
LF clock predivider	1
RC power mode	Auto power on
RC frequency	25 kHz
Matrix power down	Disable
RC clock predivider	1
'OUT0' divider	1
Clock selector	RC OSC
Ring power mode	Auto power on
Ring frequency	27 MHz
Matrix power down	Disable
Ring clock predivider	1
PWM & ADC clock source	RC OSC
'OUT1' divider	1

<b>P0 (out)</b> Label: "!WCOND"
------------------------------------

<b>P1 (out)</b> Label: "!RCOND"
------------------------------------

<b>P2 (out)</b> Label: "!FREEZING"
---------------------------------------

<b>P3 (out)</b> Label: "NMI"
---------------------------------

<b>P10 (in)</b> Label: "!ROMCS"
------------------------------------

<b>P11 (in)</b> Label: "VPP_EN"
------------------------------------

<b>P12 (in)</b> Label: "REGGESCHREVEN"
---

## Matrix 1

<b>VDD (PIN 1)</b>	
<i>Property</i>	<i>Value</i>
Min. value (V)	4.75
Typ. value (V)	5.00
Max. value (V)	5.25

<b>PIN 12 Label: "ROMREAD"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital output
In mode	None
Out mode	1x push pull

<b>PIN 13 Label: "ROMH"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 14 Label: "IO1"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 15 Label: "IO2"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 16 Label: "ROML"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>PIN 17 Label: "ADDR1"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Pull Up
Resistor value	10K

<b>PIN 18 Label: "ADDR2"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Pull Up
Resistor value	10K

<b>PIN 19 Label: "REGCLK"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital output
In mode	None
Out mode	1x push pull

<b>PIN 20 Label: "DISABLE"</b>	
<i>Property</i>	<i>Value</i>
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

<b>2-bit LUT5 Label: "ROMCS?"</b>		
<i>IN1</i>	<i>IN0</i>	<i>OUT</i>
0	0	0
0	1	0
1	0	0
1	1	1

<i>Property</i>	<i>Value</i>
Standard gates	AND

<b>2-bit LUT6 Label: "IO2WRITE?"</b>		
<i>IN1</i>	<i>IN0</i>	<i>OUT</i>
0	0	0
0	1	1
1	0	1
1	1	1

<i>Property</i>	<i>Value</i>
Standard gates	OR

**3-bit LUT8**  
 Label: "ROMREAD?"

IN2	IN1	IN0	OUT
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Property	Value
Standard gates	Defined by user

**3-bit LUT10**  
 Label: "W \$00?"

IN2	IN1	IN0	OUT
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Property	Value
Standard gates	OR

**3-bit LUT12**  
 Label: "IO2 \$FF?"

IN2	IN1	IN0	OUT
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Property	Value
Standard gates	Defined by user

**3-bit LUT9**

IN2	IN1	IN0	OUT
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Property	Value
Standard gates	Defined by user

**3-bit LUT11**  
 Label: "W \$FE?"

IN2	IN1	IN0	OUT
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Property	Value
Standard gates	Defined by user

**3-bit LUT13**  
 Label: "IO?"

IN2	IN1	IN0	OUT
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Property	Value
Standard gates	Defined by user

**4-bit LUT1**  
**Label: "REGCLK?"**

IN3	IN2	IN1	IN0	OUT
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Property	Value
Standard gates	Defined by user

**P DLY1**

Property	Value
Mode	Rising edge detector
Delay	2 Cells
Output mode	Delayed

**Pipe Delay1**

Property	Value
OUT0 PD num	4
OUT1 PD num	1
OUT1 output polarity	Non-inverted (OUT1)

**P0 (in)**  
**Label: "!WCOND"**
**P1 (in)**  
**Label: "!RCOND"**
**P2 (in)**  
**Label: "!FREEZING"**
**P3 (in)**  
**Label: "NMI"**
**P10 (out)**  
**Label: "!ROMCS"**
**P11 (out)**  
**Label: "VPP\_EN"**
**P12 (out)**  
**Label: "REGGESCHREVEN"**



## External Components

<b>R1</b>	
<i>Property</i>	<i>Value</i>
Element	Resistor
Resistance	3.3kOhm

<b>R2</b>	
<i>Property</i>	<i>Value</i>
Element	Resistor
Resistance	3.3kOhm

<b>R3</b>	
<i>Property</i>	<i>Value</i>
Element	Resistor
Resistance	3.3kOhm

<b>R4</b>	
<i>Property</i>	<i>Value</i>
Element	Resistor
Resistance	3.3kOhm

<b>V1</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Internal capacitance	100nF
Internal resistance	1Ohm
Type	DC
DC Voltage	5V

<b>PHI2</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Pre-start delay	0s
Repeat state	Cyclic
Pre-start state	Low
Type	Clock generator
Frequency	985kHz
Duty cycle	50%
Umax	5V
Umin	0V
Rise time	0.02μs
Fall time	0.01μs

<b>FREEZE</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Pre-start delay	0s
Repeat state	Cyclic
Pre-start state	Low
Type	Clock generator
Frequency	5kHz
Duty cycle	95%
Umax	3.3V
Umin	0V
Rise time	0.02μs
Fall time	0.01μs

<b>R/W</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Pre-start delay	0s
Repeat state	Cyclic
Pre-start state	Low
Type	Logic pattern
Mode	Normal
Umax	5V
Umin	0V
Levels adjustment	Standard
Rise time	0.015μs
Fall time	0.03μs

<b>R/W Pattern Points</b>	
<i>Duration</i>	<i>Voltage</i>
3.78μs	5V
0.815μs	0V
1.2μs	5V
0.815μs	0V
1.2μs	5V
0.815μs	0V
1.2μs	5V
0.815μs	0V
1.2μs	5V
0.815μs	0V
180.285μs	5V
0.532μs	0V
0.483μs	5V
0.532μs	0V
0.483μs	5V
0.523μs	0V
4.7μs	5V

<b>IO2</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Pre-start delay	0s
Repeat state	Cyclic
Pre-start state	Low
Type	Logic pattern
Mode	Normal
Umax	5V
Umin	0V
Levels adjustment	Standard
Rise time	0.03 $\mu$ s
Fall time	0.015 $\mu$ s

<b>IO2 Pattern Points</b>	
<i>Duration</i>	<i>Voltage</i>
1.05 $\mu$ s	5V
0.5 $\mu$ s	0V
2.55 $\mu$ s	5V
0.5 $\mu$ s	0V
1.5 $\mu$ s	5V
0.5 $\mu$ s	0V
1.5 $\mu$ s	5V
0.5 $\mu$ s	0V
1.5 $\mu$ s	5V
0.5 $\mu$ s	0V
1.5 $\mu$ s	5V
0.5 $\mu$ s	0V
87.4 $\mu$ s	5V

<b>IO1</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Type	DC
DC Voltage	5V

<b>ADDR1</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Type	DC
DC Voltage	5V

<b>ADDR2</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Pre-start delay	0s
Repeat state	Cyclic
Pre-start state	Low
Type	Logic pattern
Mode	Normal
Umax	5V
Umin	0V
Levels adjustment	Standard
Rise time	0.02 $\mu$ s
Fall time	0.01 $\mu$ s

<b>ADDR2 Pattern Points</b>	
<i>Duration</i>	<i>Voltage</i>
6 $\mu$ s	5V
7 $\mu$ s	0V
87 $\mu$ s	5V

<b>V9</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Type	DC
DC Voltage	5V

<b>V10</b>	
<i>Property</i>	<i>Value</i>
Element	Voltage Source
Type	DC
DC Voltage	3.3V

<b>Project Specs</b>			
	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>
VDD (V):	4.75	5.00	5.25
Temperature (°C):	0.00	25.00	80.00

<b>General Settings</b>	
Power Supply Control mode	Regulator always ON and Charge Pump always OFF (use for dynamic VDD > 2.7V)
GPIO quick charge	Disable
Pattern ID	1
Lock status	Unlocked