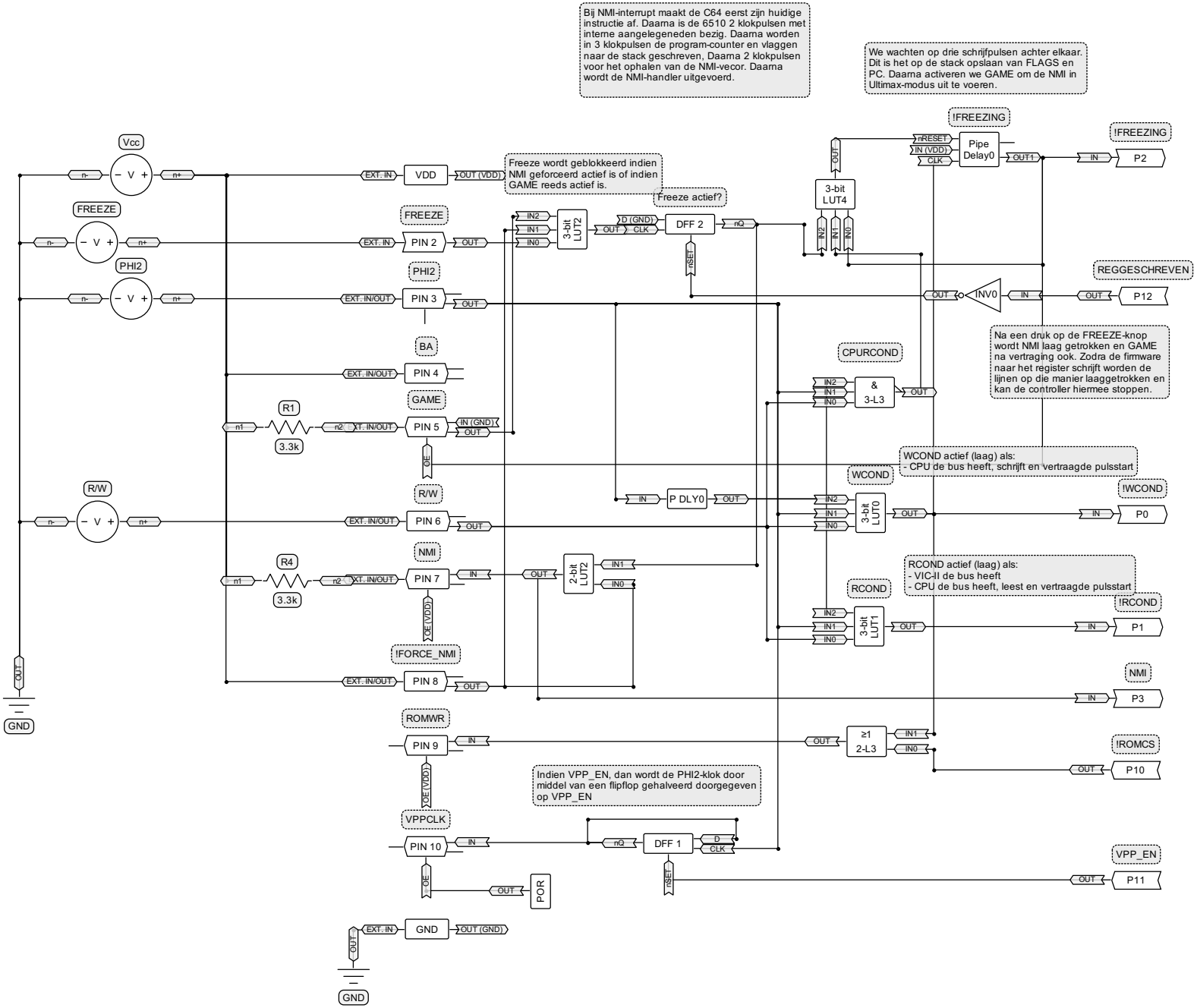
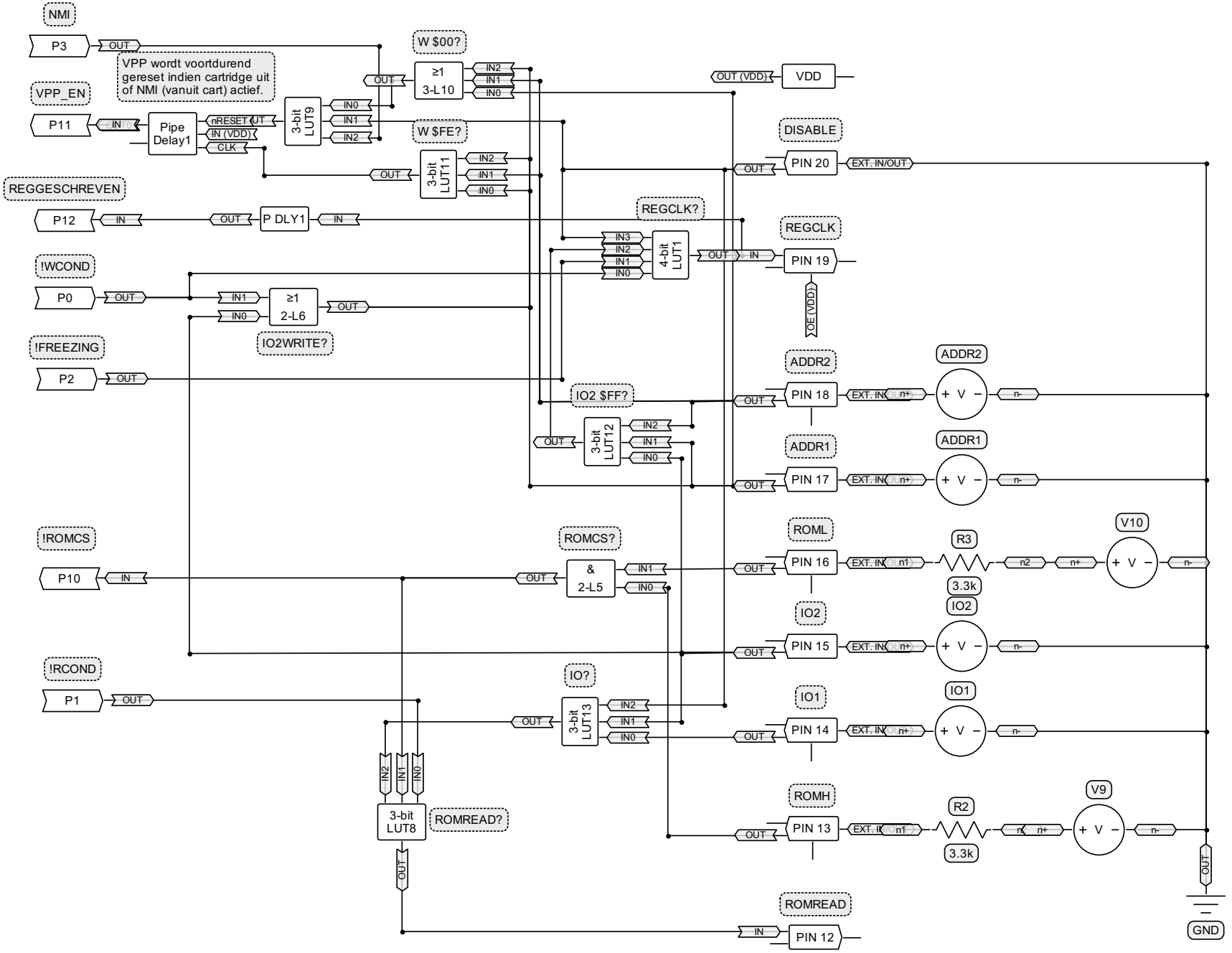
Matrix 0


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.
We wachten op drie schrijfpulsen achter elkaar. Dit is het op de stack opslaan van FLAGS en PC. Daarna activeren we GAME om de NMI in Ultimax-modus uit te voeren.
Vcc
FREEZE
PHI2
R/W
R1
3.3k
R4
3.3k
GND
VDD
PIN 2
PIN 3
PIN 4
PIN 5
PIN 6
PIN 7
PIN 8
PIN 9
PIN 10
GND
Freeze wordt geblokkeerd indien NMI geforceerd actief is of indien GAME reeds actief is.
Freeze actief?
3-bit LUT2
DFF 2
3-bit LUT4
Pipe Delay0
!FREEZING
P2
REGGESCHREVEN
INV0
P12
BA
GAME
CPURCOND
& 3-L3
Na een druk op de FREEZE-knop wordt NMI laag getrokken en GAME na vertraging ook. Zodra de firmware naar het register schrijft worden de lijnen op die manier laaggetrokken en kan de controller hiermee stoppen.
WCOND actief (laag) als:
- CPU de bus heeft, schrijft en vertraagde pulsstart
WCOND
!WCOND
P DLY0
3-bit LUT0
P0
RCOND actief (laag) als:
- VIC-II de bus heeft
- CPU de bus heeft, leest en vertraagde pulsstart
RCOND
!RCOND
3-bit LUT1
P1
NMI
2-bit LUT2
P3
!FORCE_NMI
ROMWR
≥1 2-L3
!ROMCS
P10
Indien VPP_EN, dan wordt de PHI2-klok door middel van een flipflop gehalveerd doorgegeven op VPP_EN
VPPCLK
DFF 1
VPP_EN
P11
POR

Matrix 1


NMI
P3
OUT
VPP wordt voortdurend gereset indien cartridge uit of NMI (vanuit cart) actief.
VPP_EN
P11
IN
Pipe Delay1
nRESET OUT
IN (VDD)
CLK
3-bit LUT9
IN0
IN1
IN2
W $00?
≥1 3-L10
W $FE?
3-bit LUT11
REGGESCHREVEN
P12
P DLY1
REGCLK?
4-bit LUT1
IN3
!WCOND
P0
≥1 2-L6
IO2WRITE?
!FREEZING
P2
IO2 $FF?
3-bit LUT12
OUT (VDD)
VDD
DISABLE
PIN 20
EXT. IN/OUT
REGCLK
PIN 19
OE (VDD)
ADDR2
PIN 18
EXT. IN
n+
n-
ADDR1
PIN 17
!ROMCS
P10
ROMCS?
& 2-L5
ROML
PIN 16
n1
R3
3.3k
n2
V10
IO2
PIN 15
!RCOND
P1
IO?
3-bit LUT13
IO1
PIN 14
3-bit LUT8
ROMREAD?
ROMH
PIN 13
R2
V9
GND
ROMREAD
PIN 12

Matrix 0

VDD (PIN 1)

Property	*Value*
Min. value (V)	4.75
Typ. value (V)	5.00
Max. value (V)	5.25

PIN 2
Label: "FREEZE"

Property	*Value*
I/O selection	Digital input
In mode	Digital in with Schmitt trigger
Out mode	None
Resistor	Pull Up
Resistor value	10K
Reset mode	Disable

PIN 3
Label: "PHI2"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 4
Label: "BA"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 5
Label: "GAME"

Property	*Value*
I/O selection	Digital input/output
In mode	Digital in without Schmitt trigger
Out mode	1x open drain NMOS
Resistor	Floating

PIN 6
Label: "R/W"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 7
Label: "NMI"

Property	*Value*
I/O selection	Digital output
In mode	None
Out mode	1x open drain NMOS
Resistor	Floating

PIN 8
Label: "!FORCE_NMI"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 9
Label: "ROMWR"

Property	*Value*
I/O selection	Digital output
In mode	None
Out mode	1x push pull

PIN 10
Label: "VPPCLK"

Property	*Value*
I/O selection	Digital input/output
In mode	Digital in without Schmitt trigger
Out mode	1x push pull
Resistor	Pull Down
Resistor value	10K

2-bit LUT2

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

Property	*Value*
Standard gates	Defined by user

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	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

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

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	1
1	1	1	1

Property	Value
Standard gates	Defined by user

DFF/LATCH1

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

DFF/LATCH2
Label: "Freeze actief?"

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

P DLY0

Property	*Value*
Mode	Both edge delay
Delay	1 Cell
Output mode	Delayed

POR

Property	*Value*
Chip power on delay	500 us

Pipe Delay0
Label: "!FREEZING"

Property	*Value*
OUT0 PD num	3
OUT1 PD num	3
OUT1 output polarity	Non-inverted (OUT1)

P0 (out)
Label: "!WCOND"

P1 (out)
Label: "!RCOND"

P2 (out)
Label: "!FREEZING"

P3 (out)
Label: "NMI"

P10 (in)
Label: "!ROMCS"

P11 (in)
Label: "VPP_EN"

P12 (in)
Label: "REGGESCHREVEN"

Matrix 1

VDD (PIN 1)

Property	*Value*
Min. value (V)	4.75
Typ. value (V)	5.00
Max. value (V)	5.25

PIN 12
Label: "ROMREAD"

Property	*Value*
I/O selection	Digital output
In mode	None
Out mode	1x push pull

PIN 13
Label: "ROMH"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 14
Label: "IO1"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 15
Label: "IO2"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 16
Label: "ROML"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

PIN 17
Label: "ADDR1"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Pull Up
Resistor value	10K

PIN 18
Label: "ADDR2"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Pull Up
Resistor value	10K

PIN 19
Label: "REGCLK"

Property	*Value*
I/O selection	Digital output
In mode	None
Out mode	1x push pull

PIN 20
Label: "DISABLE"

Property	*Value*
I/O selection	Digital input
In mode	Digital in without Schmitt trigger
Out mode	None
Resistor	Floating

2-bit LUT5
Label: "ROMCS?"

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

Property	*Value*
Standard gates	AND

2-bit LUT6
Label: "IO2WRITE?"

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

Property	Value
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 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 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 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 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 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	1
1	0	0	1	1
1	0	1	0	0
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

R1

Property	*Value*
Element	Resistor
Resistance	3.3kOhm

R2

Property	*Value*
Element	Resistor
Resistance	3.3kOhm

R3

Property	*Value*
Element	Resistor
Resistance	3.3kOhm

R4

Property	*Value*
Element	Resistor
Resistance	3.3kOhm

Vcc

Property	*Value*
Element	Voltage Source
Internal capacitance	100nF
Internal resistance	1Ohm
Type	DC
DC Voltage	5V

PHI2

Property	*Value*
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

FREEZE

Property	*Value*
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

R/W

Property	*Value*
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

R/W Pattern Points

Duration	*Voltage*
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

IO2	
Property	*Value*
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	0.03µs
Fall time	0.015µs

IO2 Pattern Points	
Duration	*Voltage*
1.05µs	5V
0.5µs	0V
2.55µs	5V
0.5µs	0V
1.5µs	5V
0.5µs	0V
1.5µs	5V
0.5µs	0V
1.5µs	5V
0.5µs	0V
1.5µs	5V
0.5µs	0V
87.4µs	5V

IO1	
Property	*Value*
Element	Voltage Source
Type	DC
DC Voltage	5V

ADDR1	
Property	*Value*
Element	Voltage Source
Type	DC
DC Voltage	5V

ADDR2	
Property	*Value*
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	0.02µs
Fall time	0.01µs

ADDR2 Pattern Points	
Duration	*Voltage*
6µs	5V
7µs	0V
87µs	5V

V9	
Property	*Value*
Element	Voltage Source
Type	DC
DC Voltage	5V

V10	
Property	*Value*
Element	Voltage Source
Type	DC
DC Voltage	3.3V

Project Specs			
	Min.	*Typ.*	*Max.*
VDD (V):	4.75	5.00	5.25
Temperature (°C):	0.00	25.00	80.00

General Settings	
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