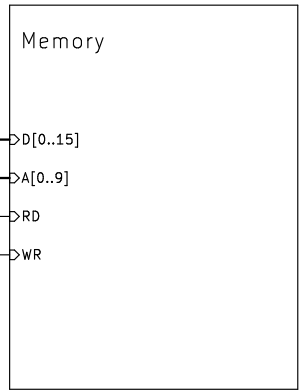
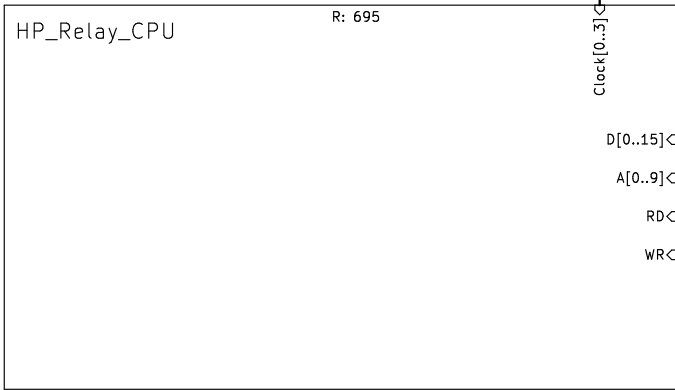
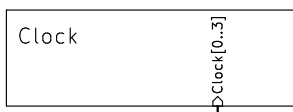
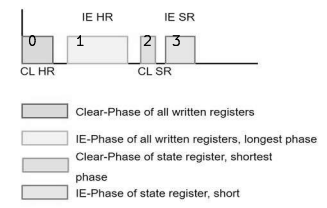


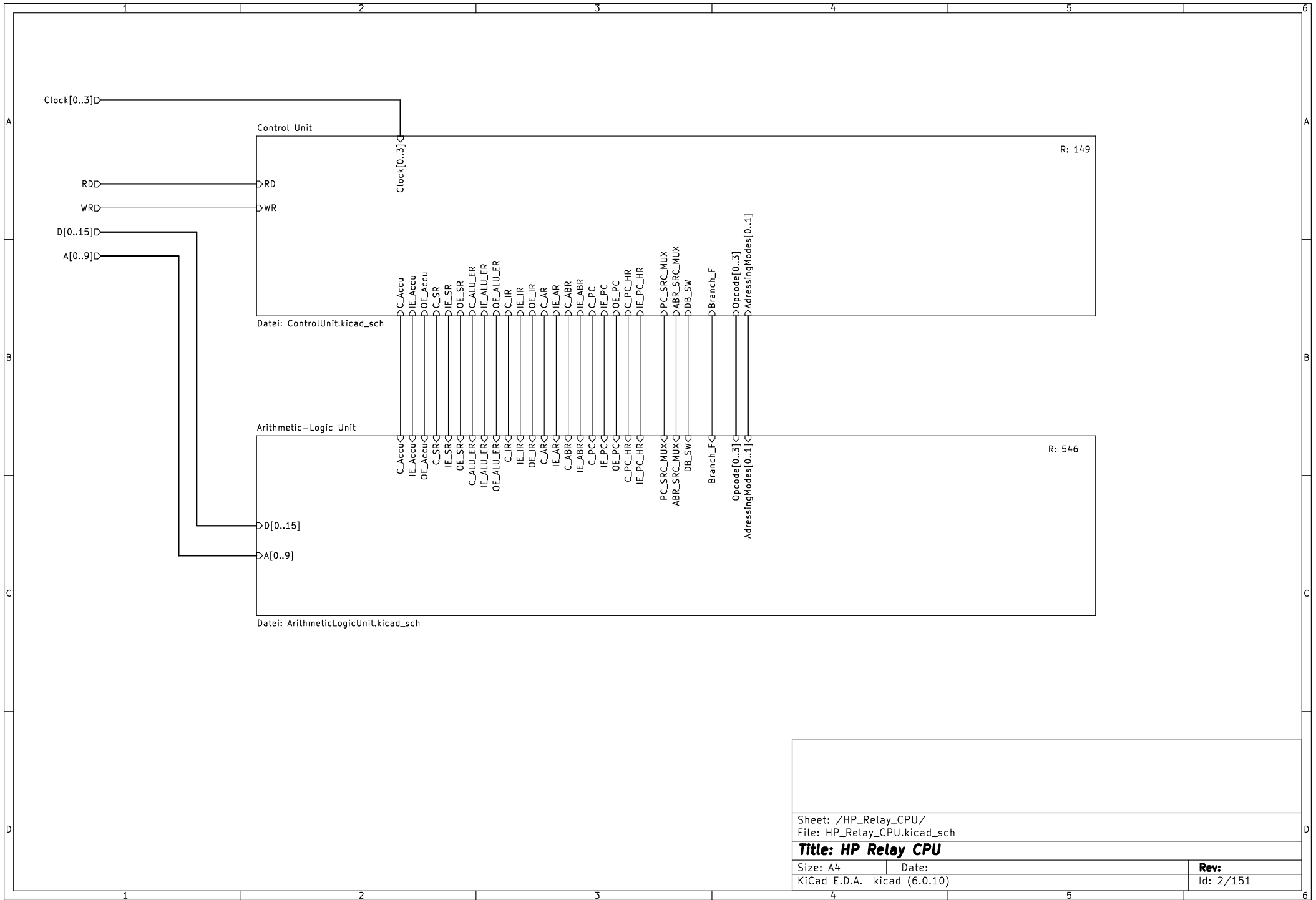
Command	
LDA X	x -> Accu
LDAM X	M(X) -> Accu
LDAI X	M(M(X)) -> Accu
STAM X	Accu -> M(X)
STAI X	Accu -> M(M(X))
ADD X	Accu+X -> Accu
ADDM X	Accu+M(X) -> Accu
ADDI X	Accu+M(M(X)) -> Accu
AND X	Accu&X -> Accu
ANDM X	Accu&M(X) -> Accu
ANDI X	Accu&M(M(X)) -> Accu
OR X	Accu X -> Accu
ORM X	Accu M(X) -> Accu
ORI X	Accu M(M(X)) -> Accu
NOT	not(Accu) -> Accu
SHL	shl(Accu) -> Accu
SHR	shr(Accu) -> Accu
BA X	X -> PC
BN X	NF? X -> PC
BC X	CF? X -> PC
BZ X	ZF? X -> PC
BE X	EF? X -> PC
CALL X	PC+1 -> SR, X -> PC
RET	SR+1 -> PC



Opcode				
Typ	LD	0001		
4	ST	0010		
	MOP	0011		
	B	0100		
	CALL	0101		
	RET	0110		
	NOP	1111		
Adr	---	00		
2	X	01		
	M(X)	10		
	M(M(X))	11		
MOP	ADD	0001		
4	AND	0010		
	OR	0011		
	NOT	0101		
	SHR	0110		
	SHL	0111		
B	A	000	Immer	
3	C	001	Carry	
	N	010	Negativ	
	Z	011	Zero	
	E	100	Gerade	
Typ	Adr	MOP	B	Res
4	2	4	3	000
D15				D0

All buses are counted: LSB == 0

Sheet: /	
File: Relco.kicad_sch	
Title: Relais-Computer Overview	
Size: A4	Date:
KiCad E.D.A. kicad (6.0.10)	Rev:
	Id: 1/151

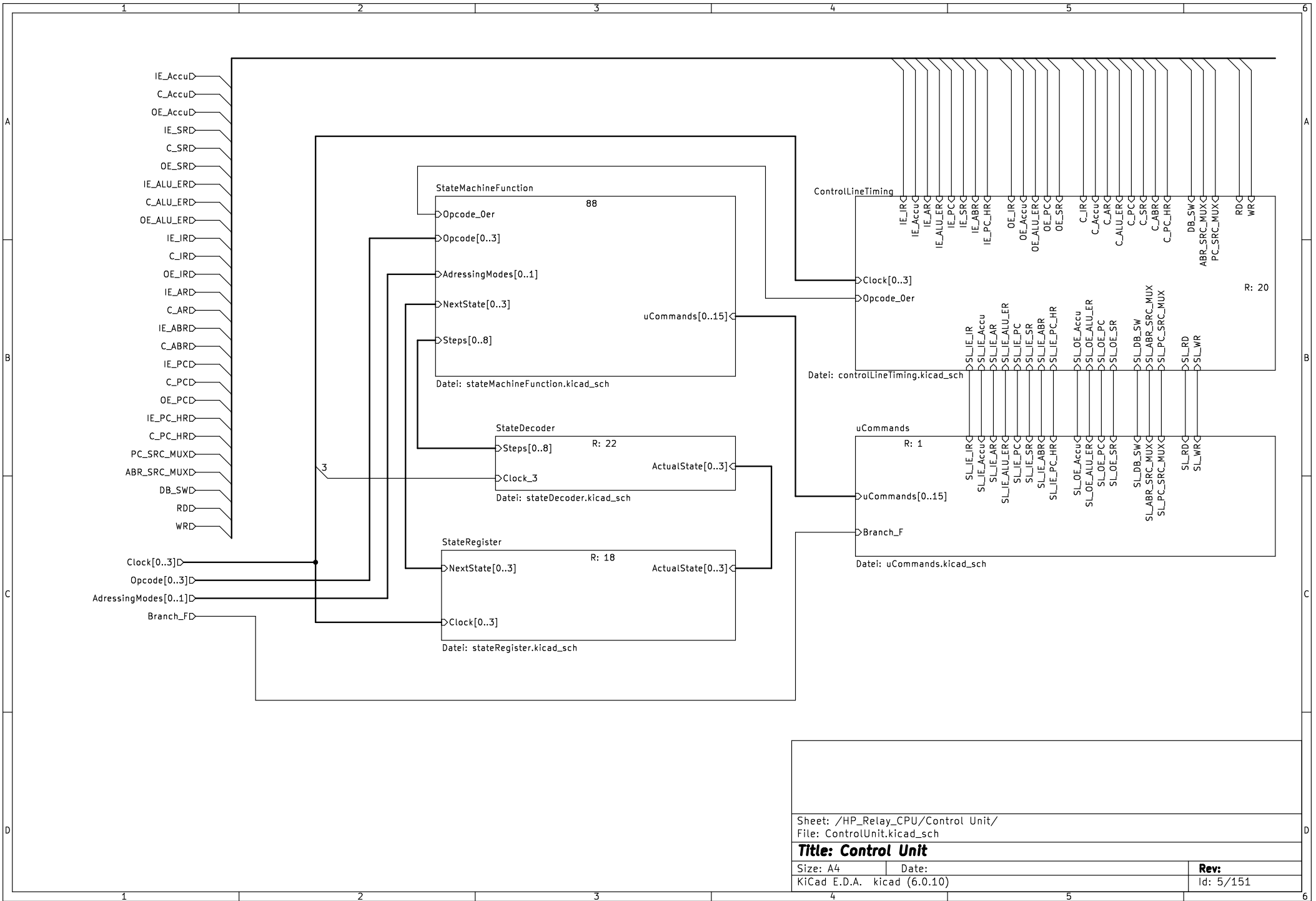


Sheet: /HP_Relay_CPU/
 File: HP_Relay_CPU.kicad_sch

Title: HP Relay CPU

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

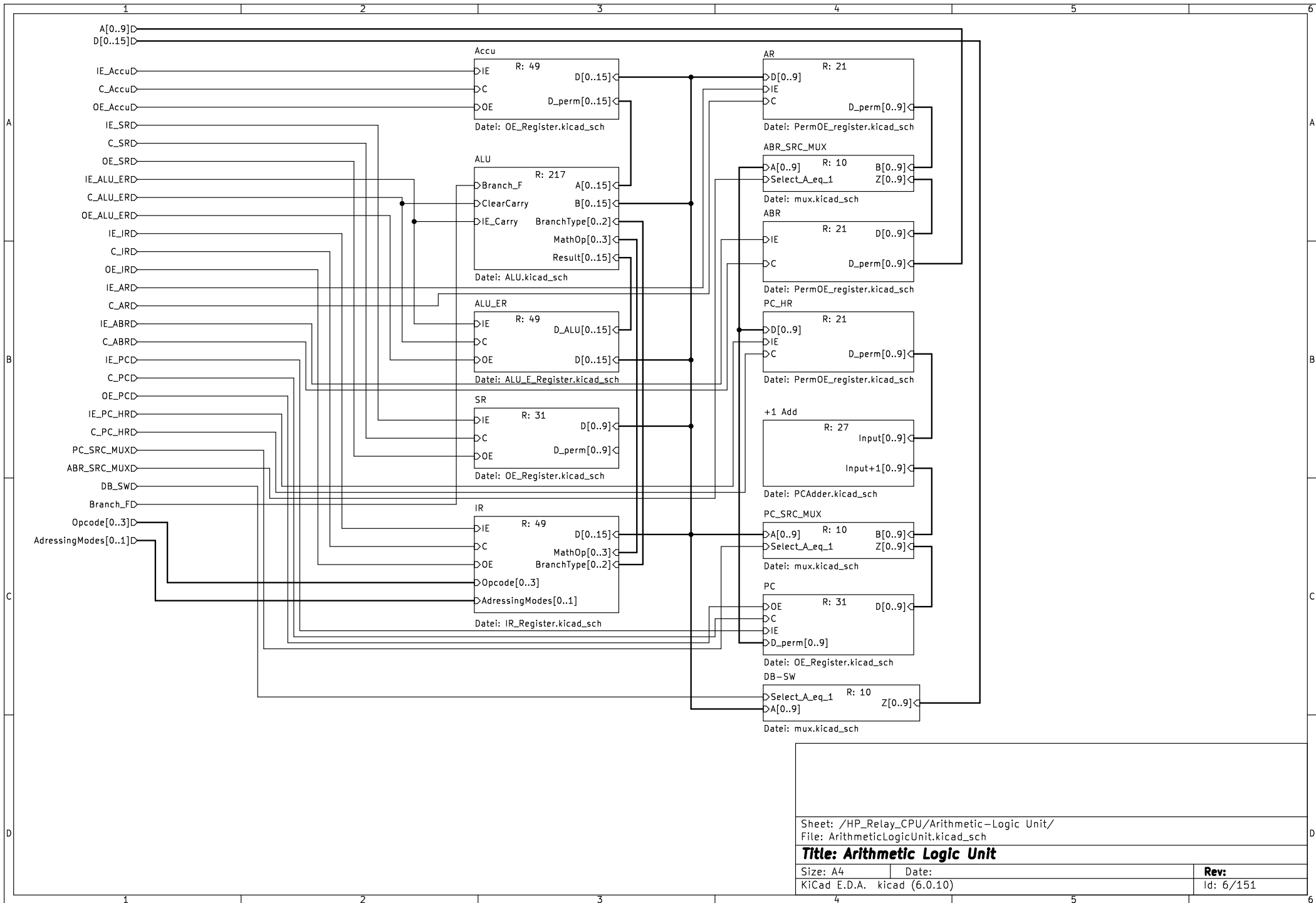
Rev:
 Id: 2/151



Sheet: /HP_Relay_CPU/Control Unit/
 File: ControlUnit.kicad_sch

Title: Control Unit

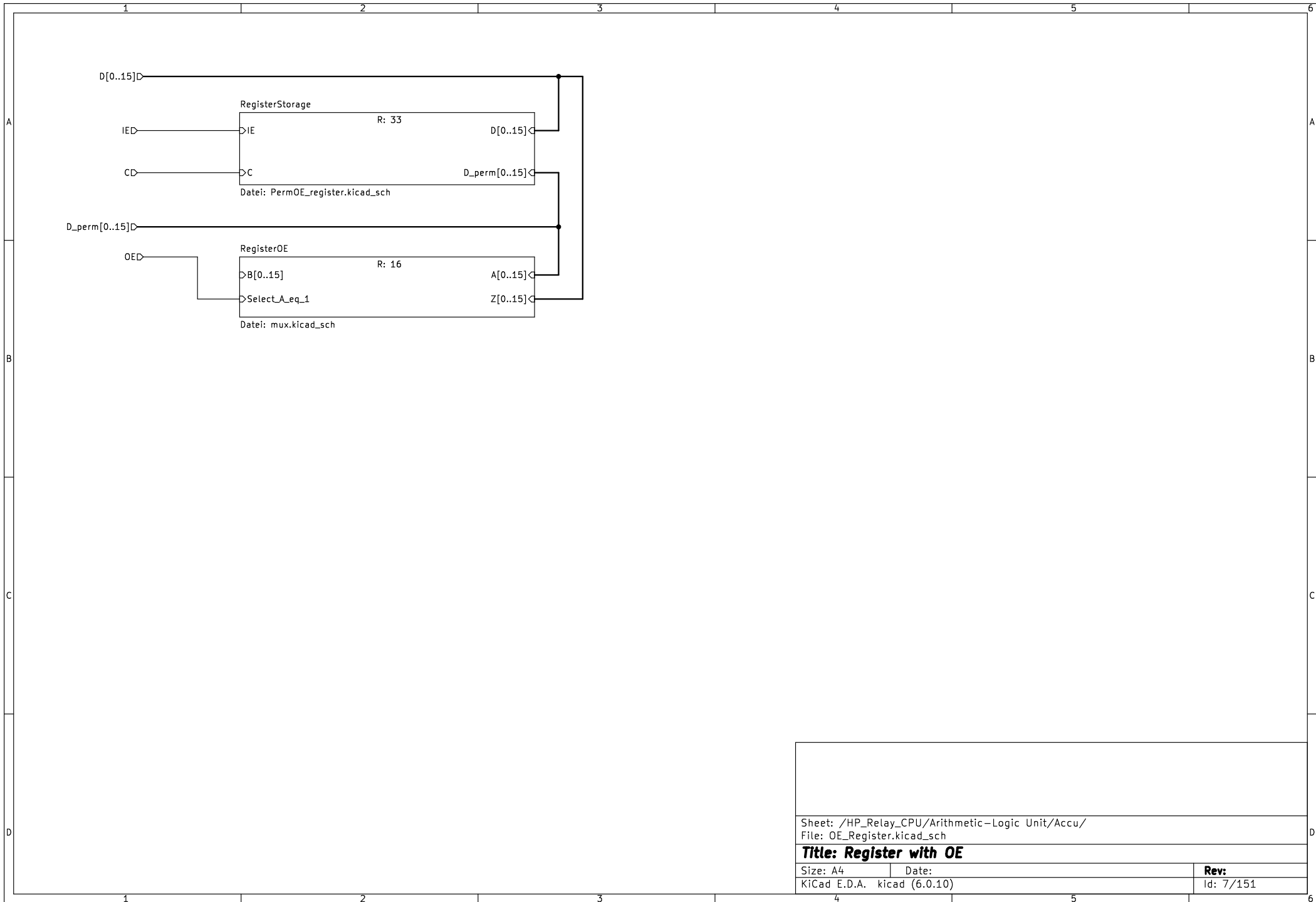
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 5/151



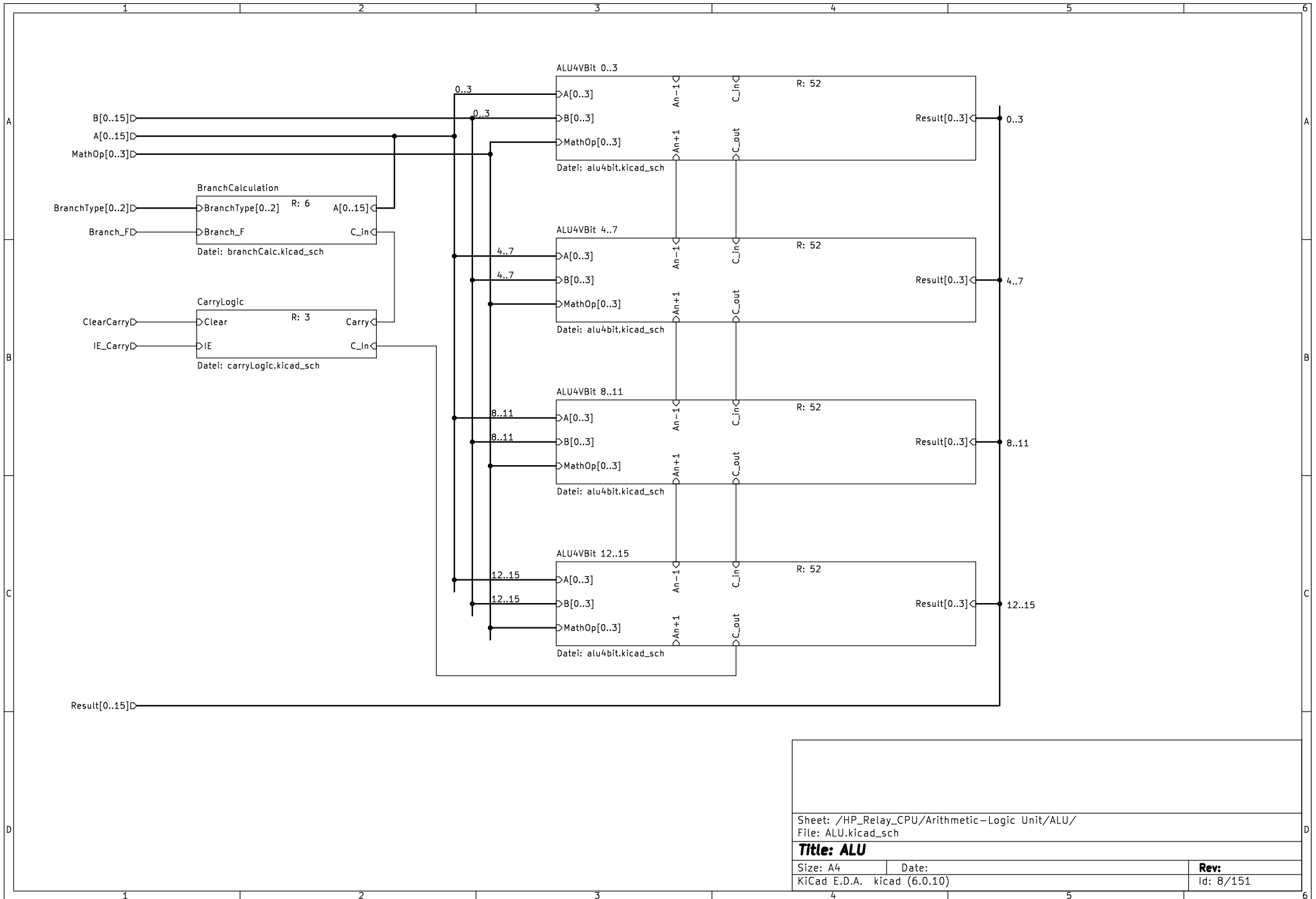
Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/
 File: ArithmeticLogicUnit.kicad_sch

Title: Arithmetic Logic Unit

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 6/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/Accu/	
File: OE_Register.kicad_sch	
Title: Register with OE	
Size: A4	Date:
KiCad E.D.A. kicad (6.0.10)	Rev: Id: 7/151



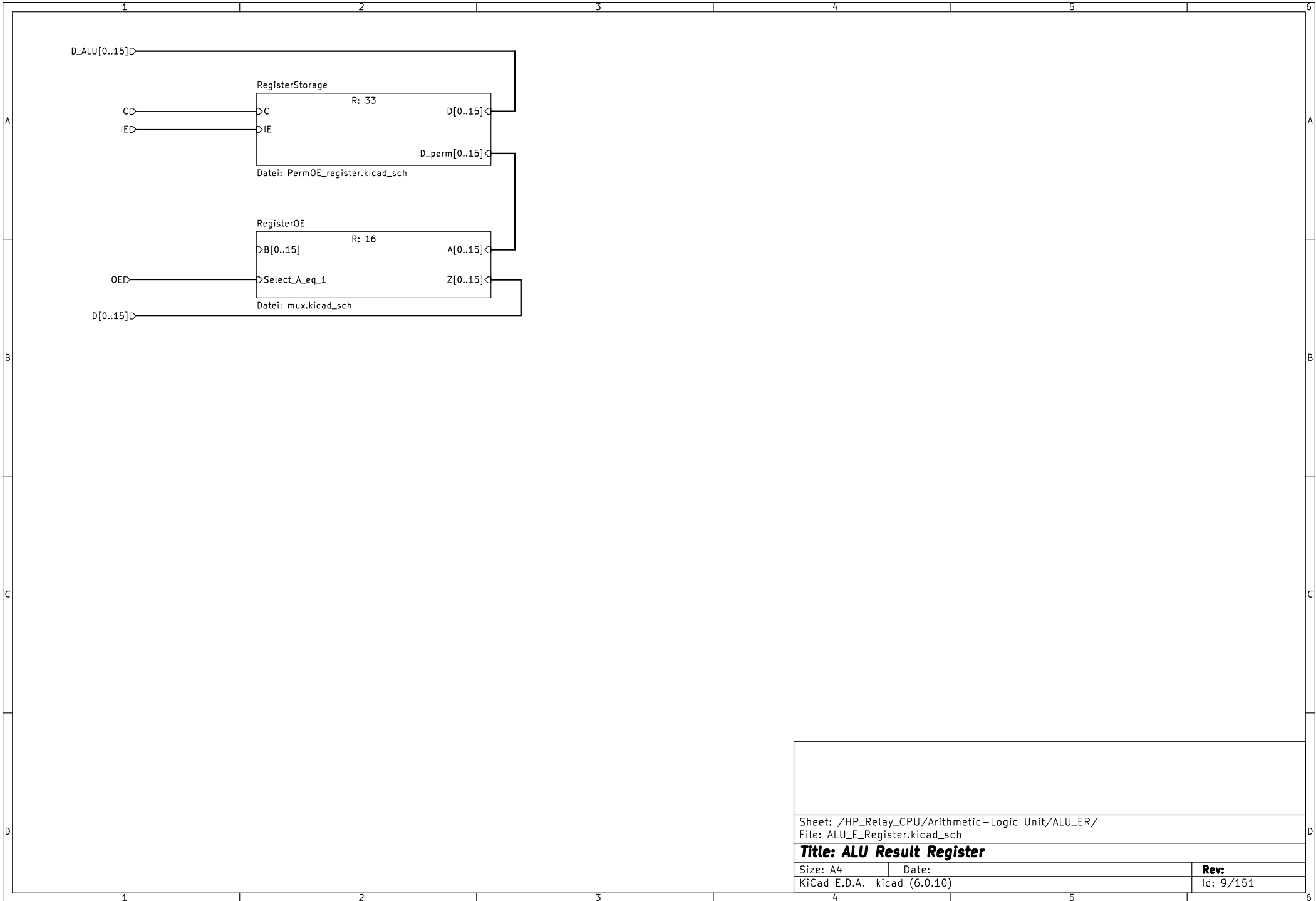
Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/ALU/
 File: ALU.kicad_sch

Title: ALU

Size: A4
 KiCad E.D.A. kicad (6.0.10)

Date:

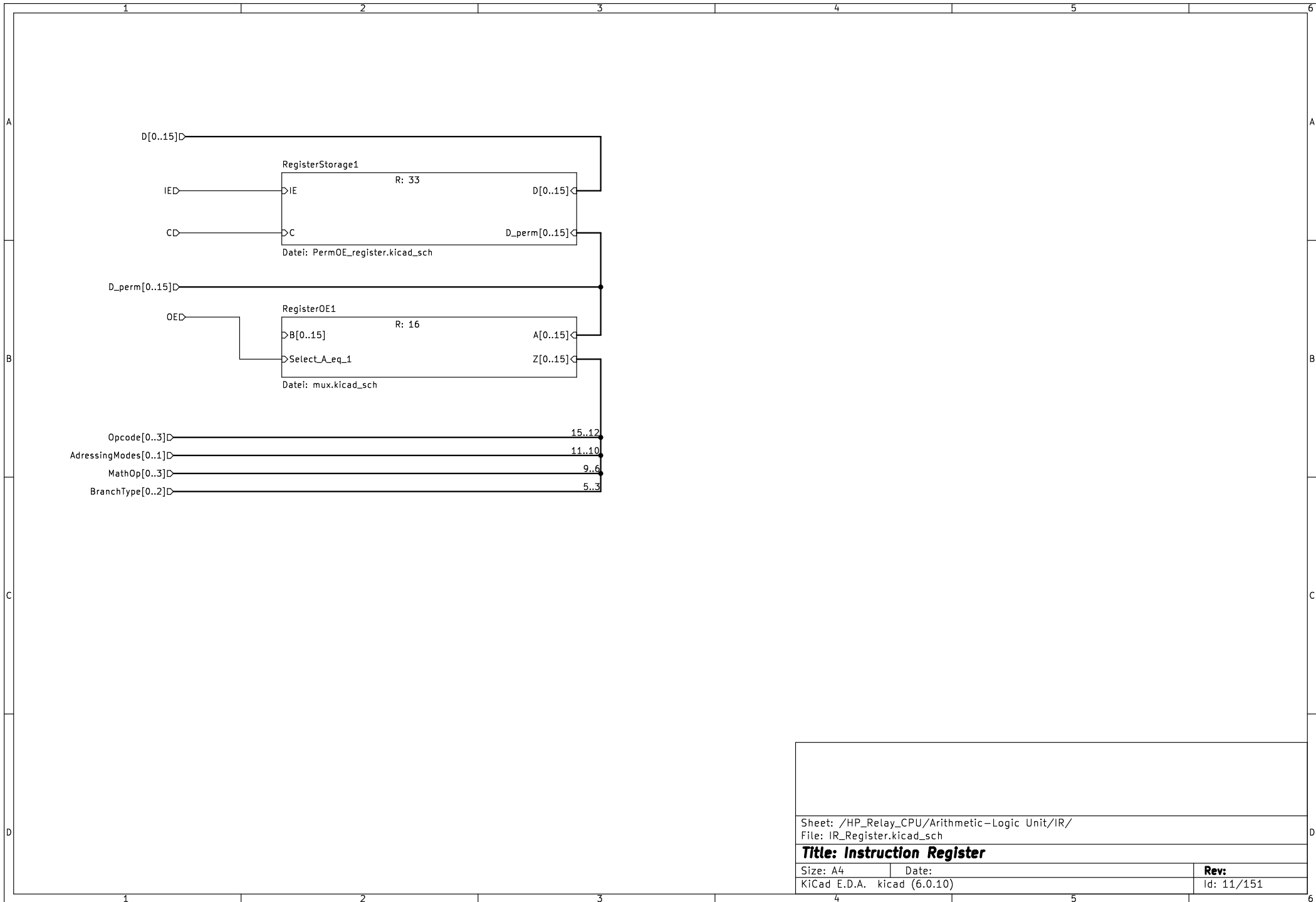
Rev:
 Id: 8/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/ALU_ER/
 File: ALU_E_Register.kicad_sch

Title: ALU Result Register

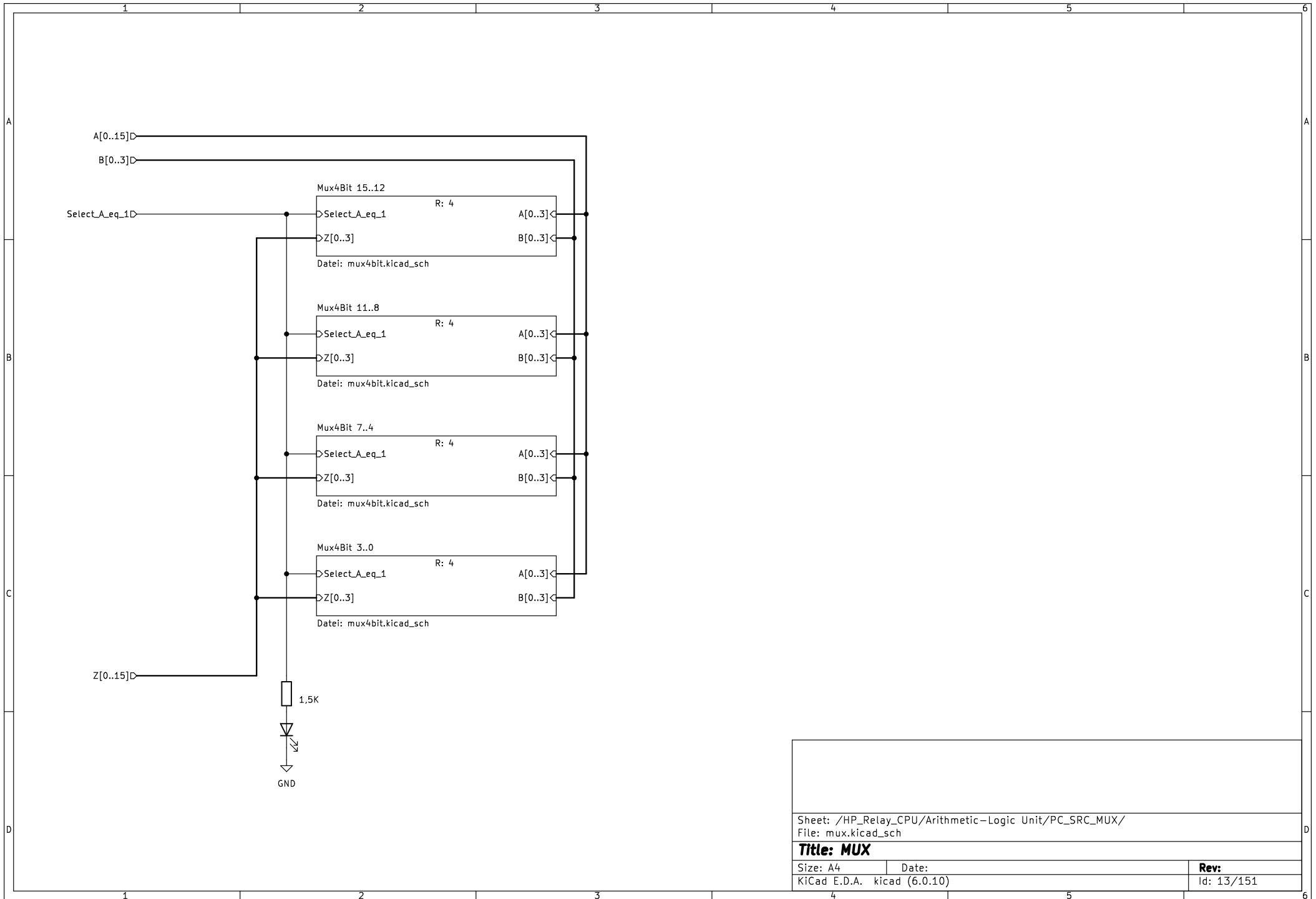
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 9/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/IR/
 File: IR_Register.kicad_sch

Title: Instruction Register

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 11/151



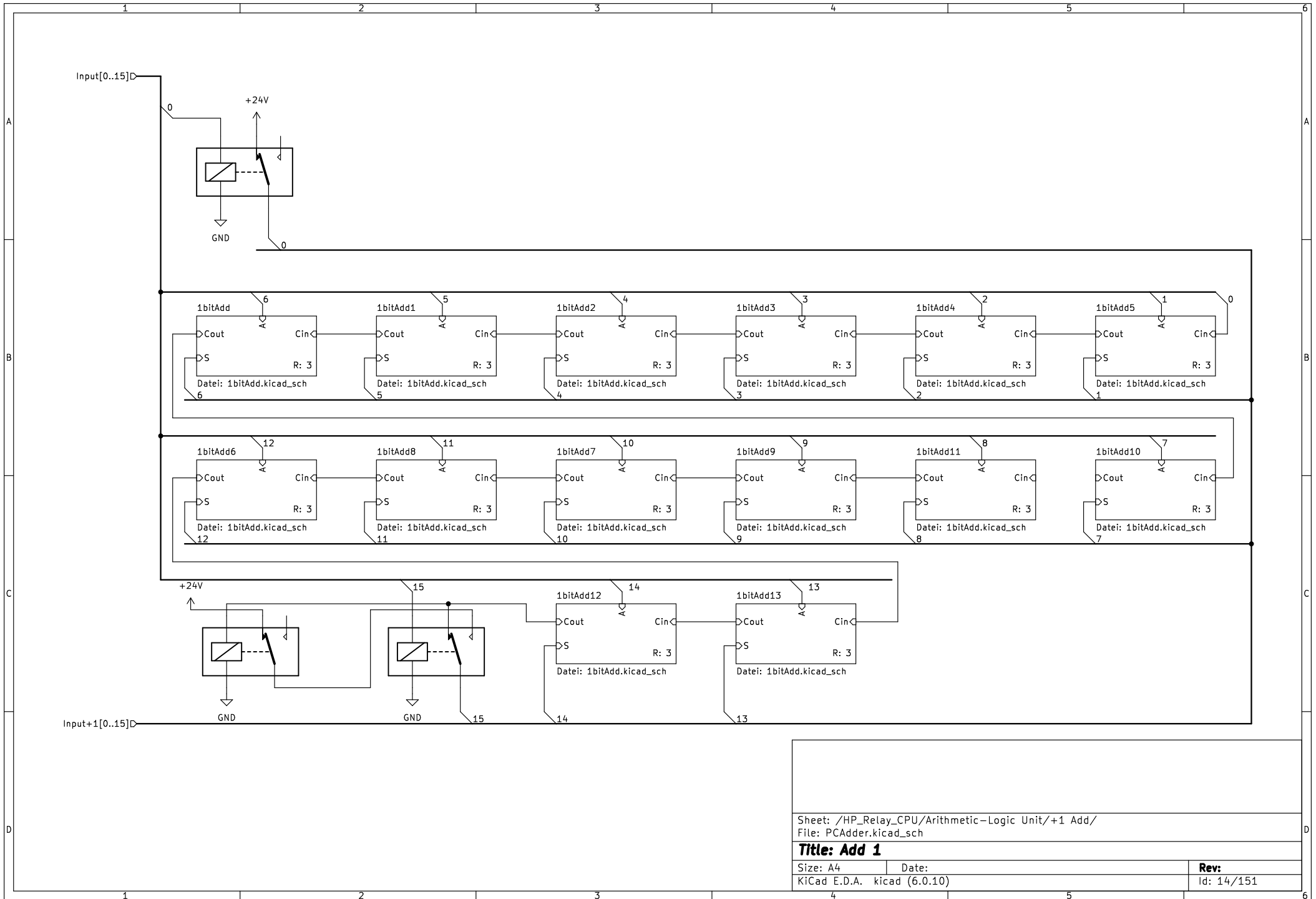
Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/PC_SRC_MUX/
 File: mux.kicad_sch

Title: MUX

Size: A4
 KiCad E.D.A. kicad (6.0.10)

Date:

Rev:
 Id: 13/151

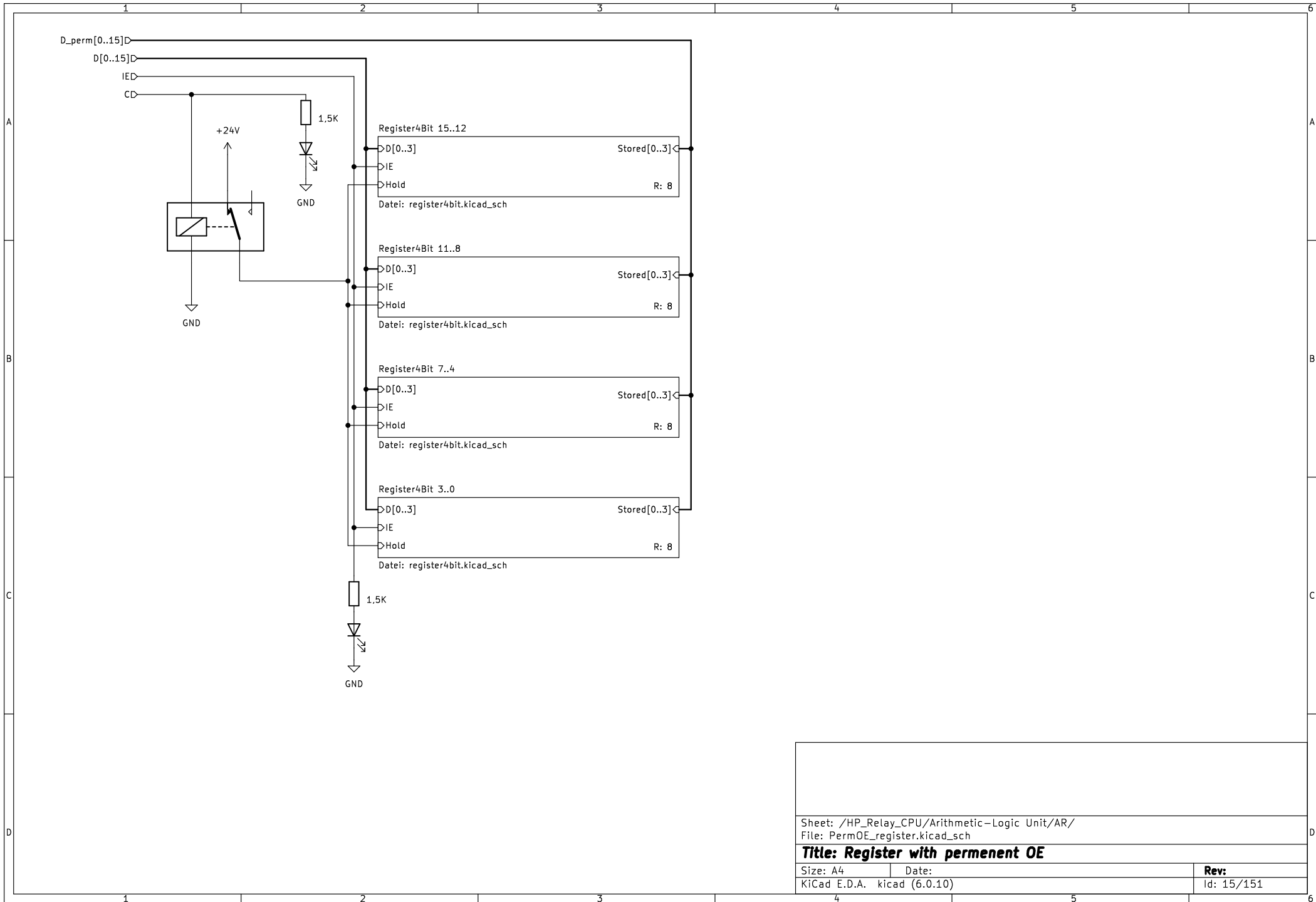


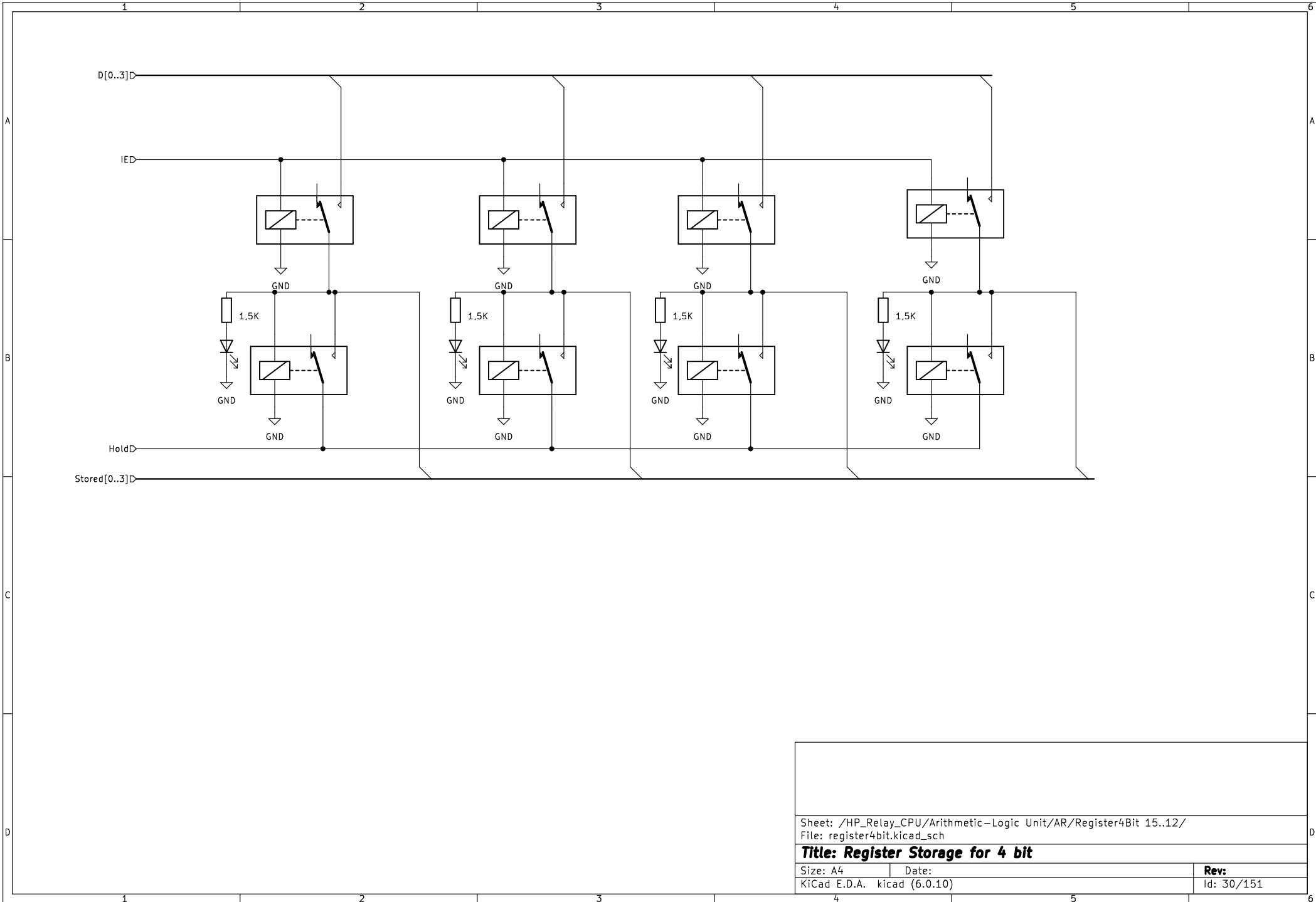
Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/+1 Add/
 File: PCAdder.kicad_sch

Title: Add 1

Size: A4
 KiCad E.D.A. kicad (6.0.10)

Date:
 Rev:
 Id: 14/151

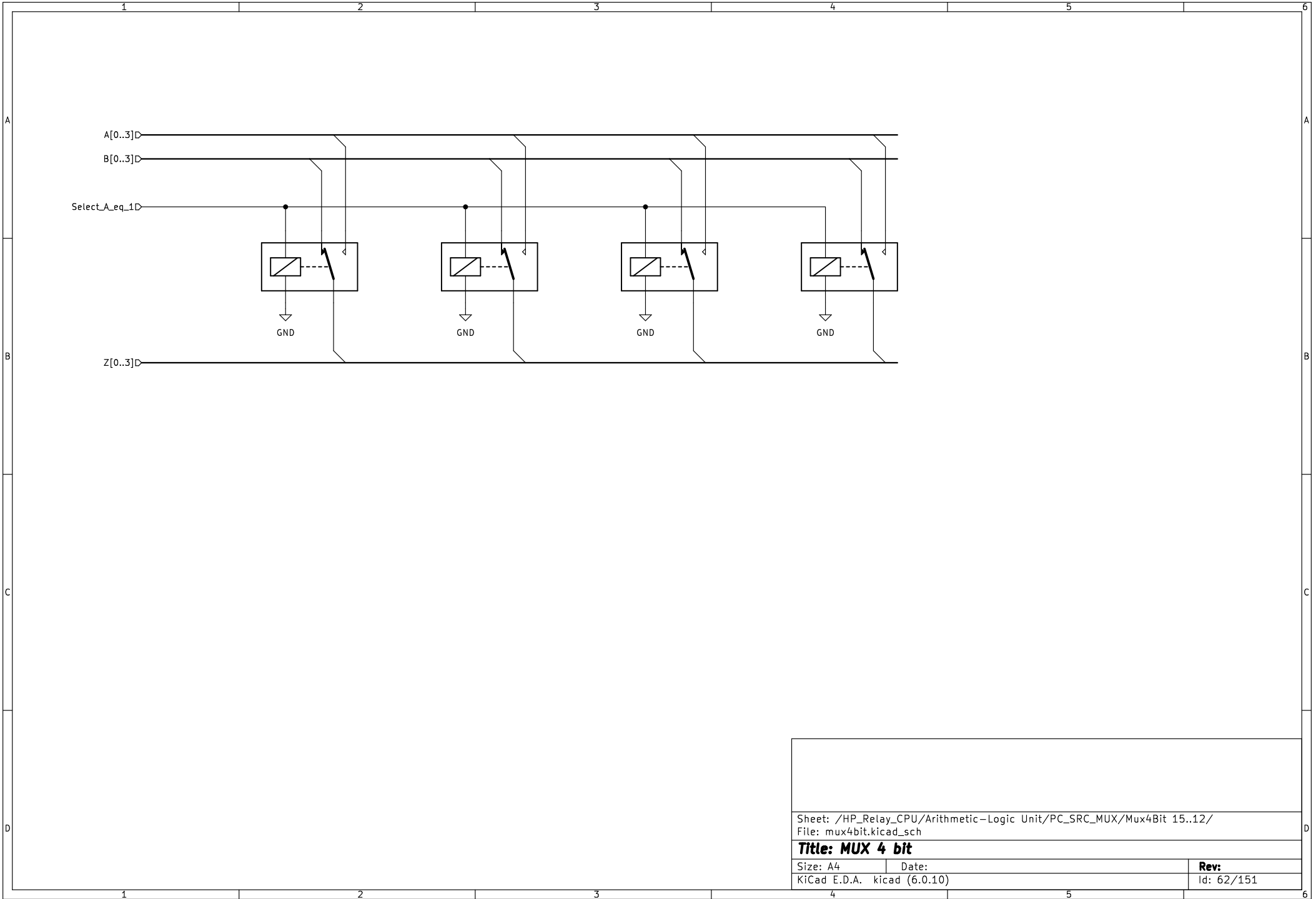




Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/AR/Register4Bit 15..12/
 File: register4bit.kicad_sch

Title: Register Storage for 4 bit

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 30/151

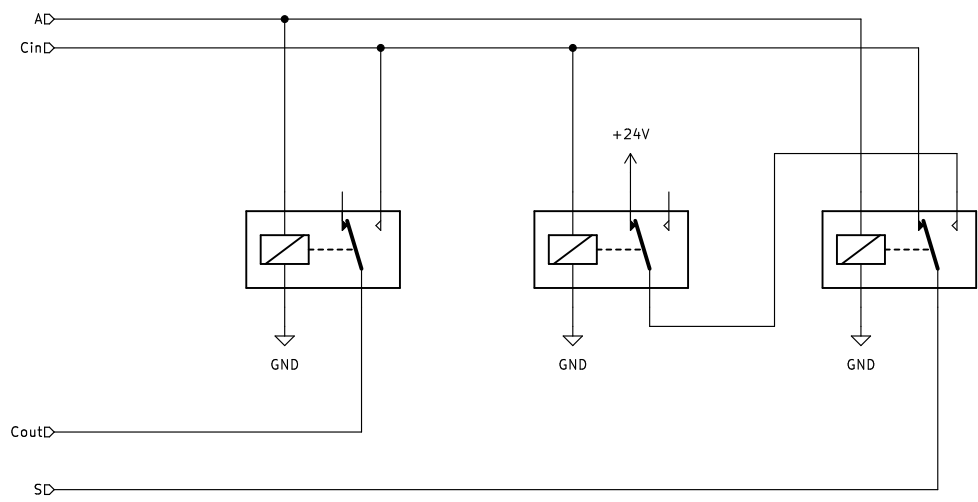


Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/PC_SRC_MUX/Mux4Bit 15..12/
 File: mux4bit.kicad_sch

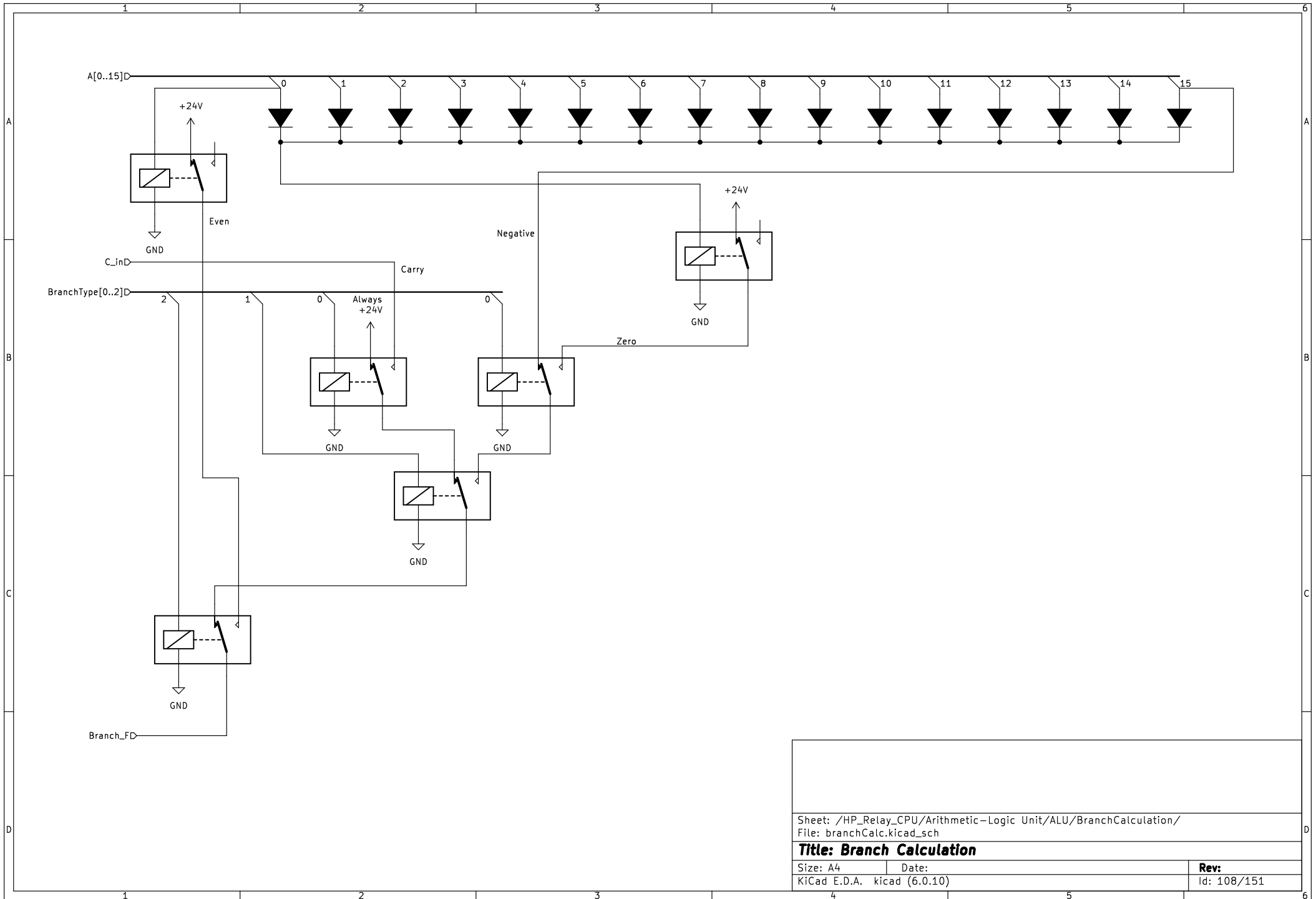
Title: MUX 4 bit

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 62/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/+1 Add/1bitAdd/	
File: 1bitAdd.kicad_sch	
Title: +1 one bit	
Size: A4	Date:
KiCad E.D.A. kicad (6.0.10)	Rev: Id: 94/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/ALU/BranchCalculation/
 File: branchCalc.kicad_sch

Title: Branch Calculation

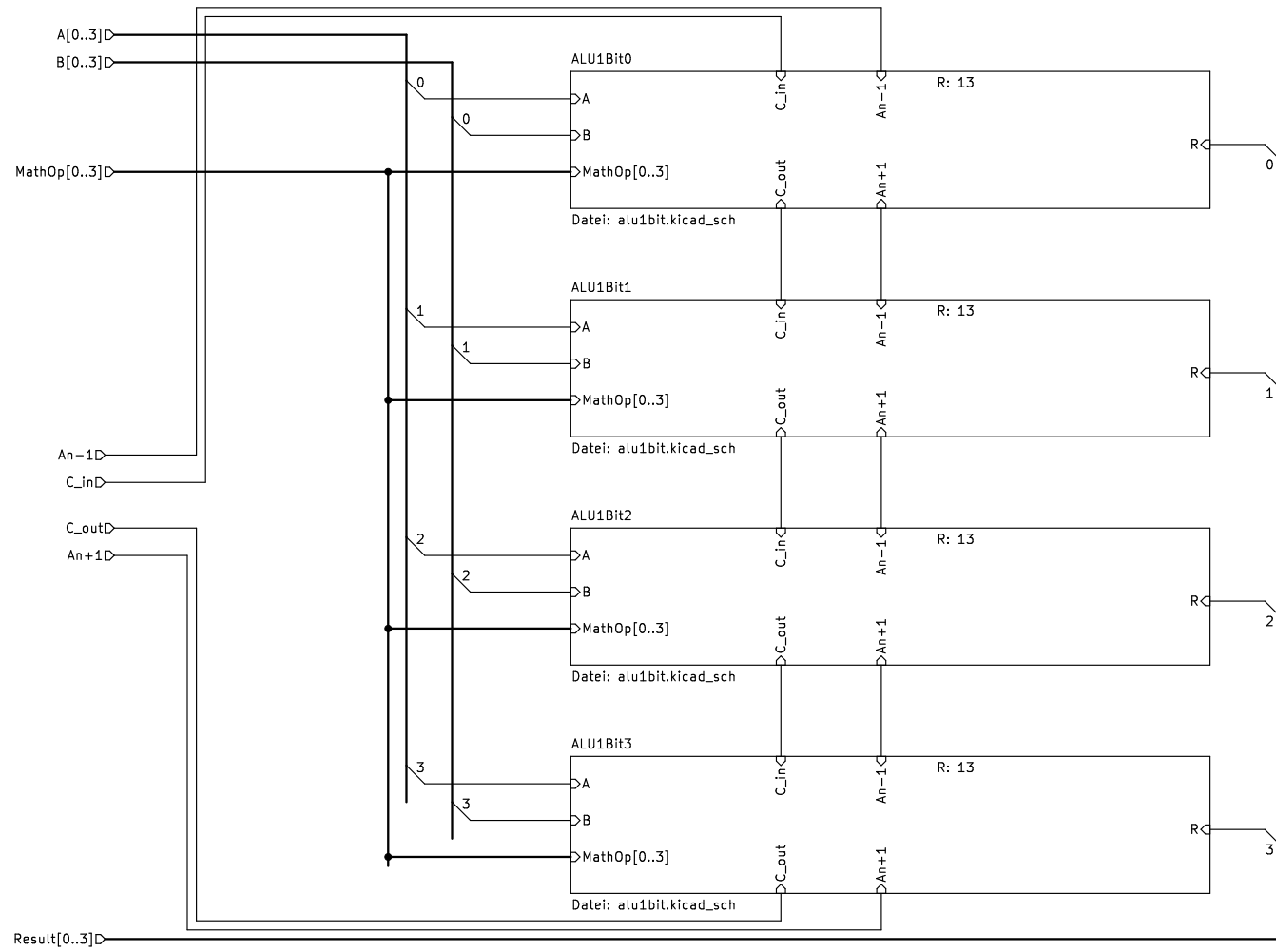
Size: A4

Date:

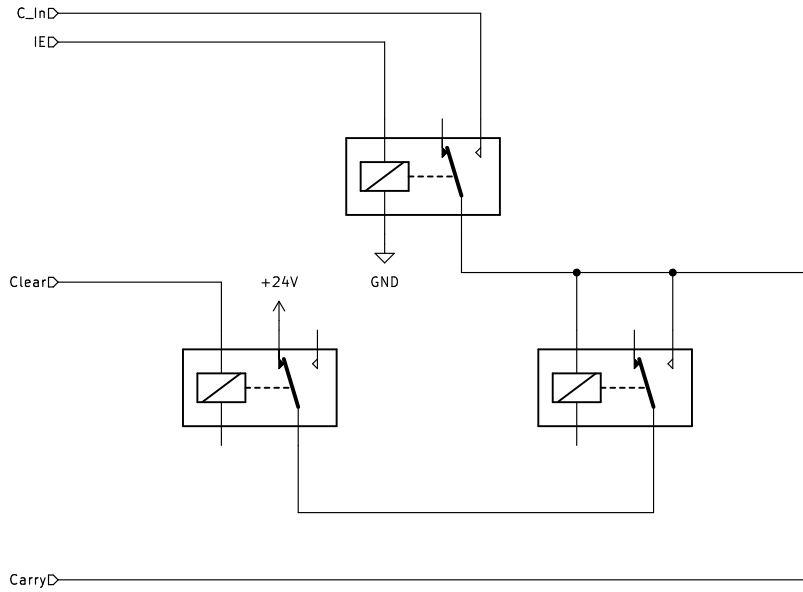
Rev:

KiCad E.D.A. kicad (6.0.10)

Id: 108/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/ALU/ALU4VBit 0..3/		Date:	
File: alu4bit.kicad_sch		Rev:	
Size: A4	KiCad E.D.A. kicad (6.0.10)		Id: 109/151

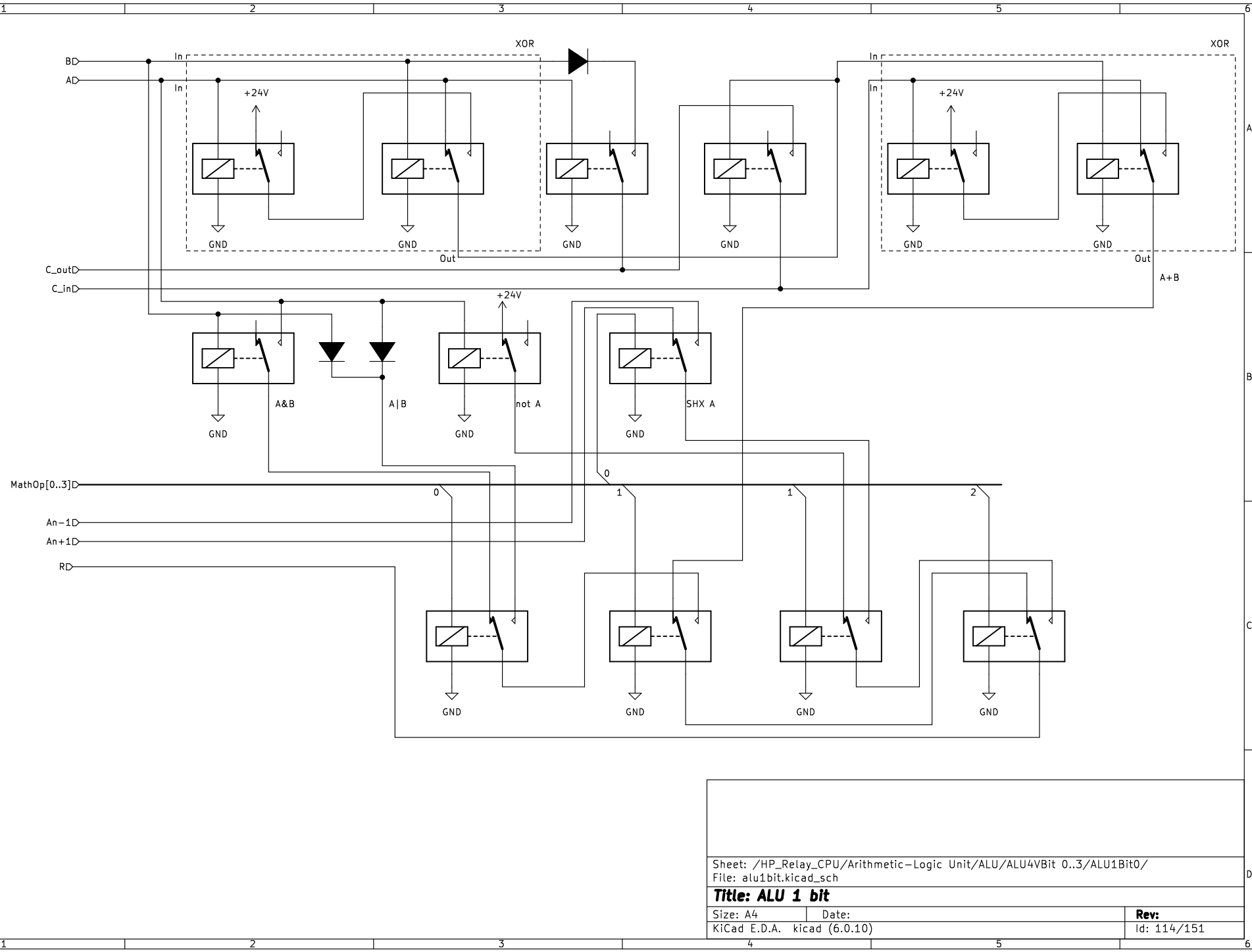


Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/ALU/CarryLogic/
 File: carryLogic.kicad_sch

Title: Carry Logic

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

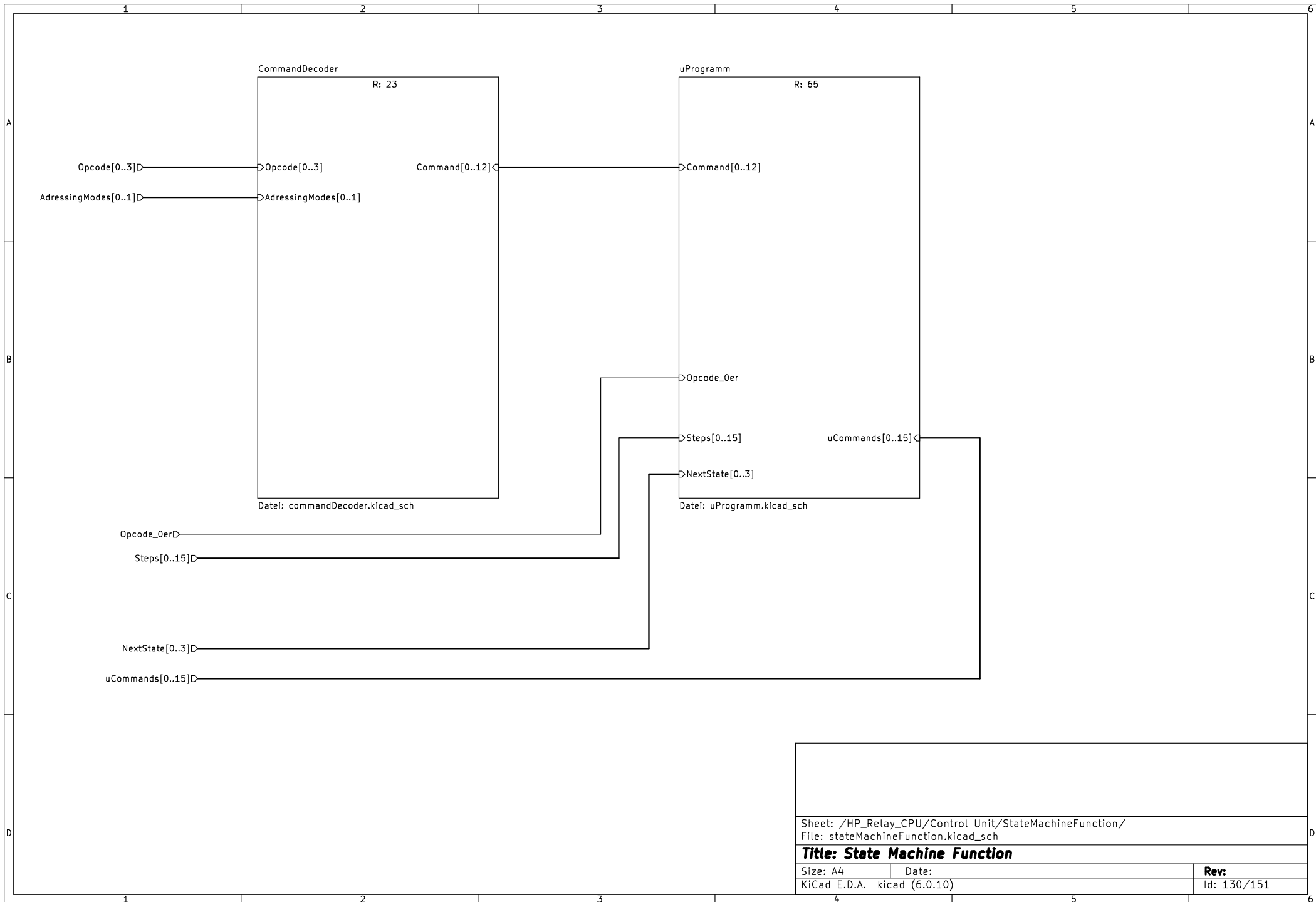
Rev:
 Id: 113/151



Sheet: /HP_Relay_CPU/Arithmetic-Logic Unit/ALU/ALU4VBit 0..3/ALU1Bit0/
 File: alu1bit.kicad_sch

Title: ALU 1 bit

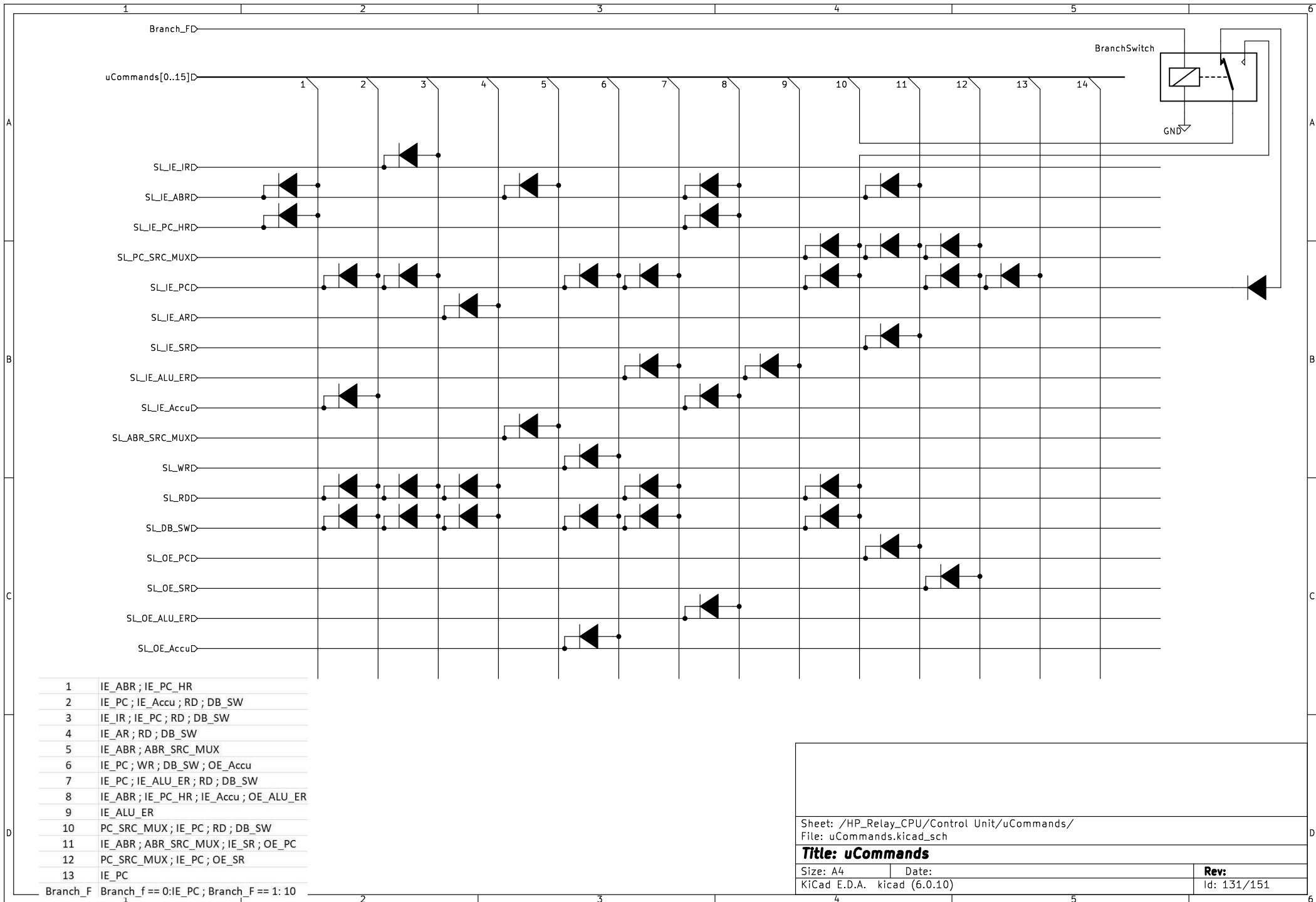
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 114/151

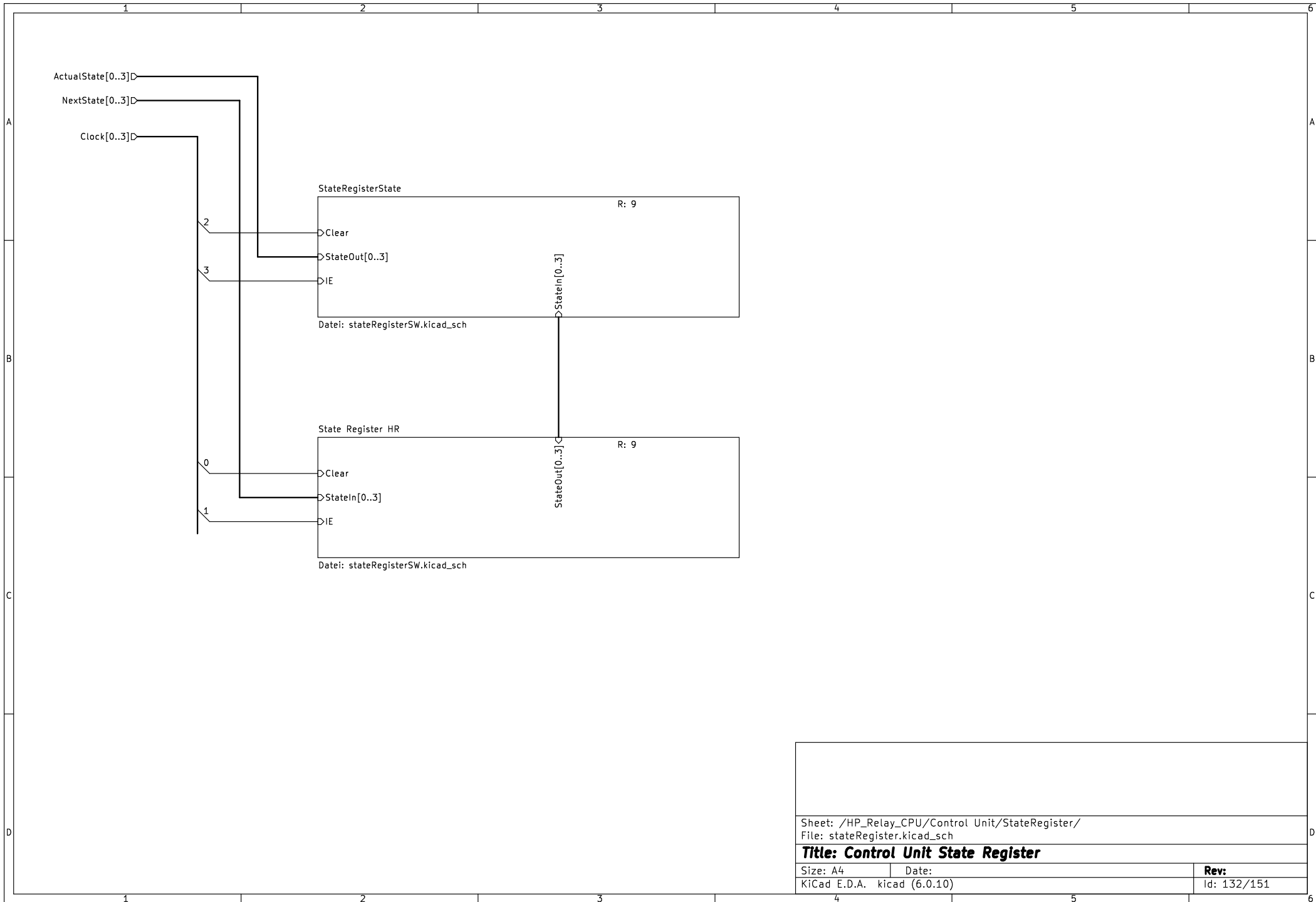


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/
 File: stateMachineFunction.kicad_sch

Title: State Machine Function

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 130/151

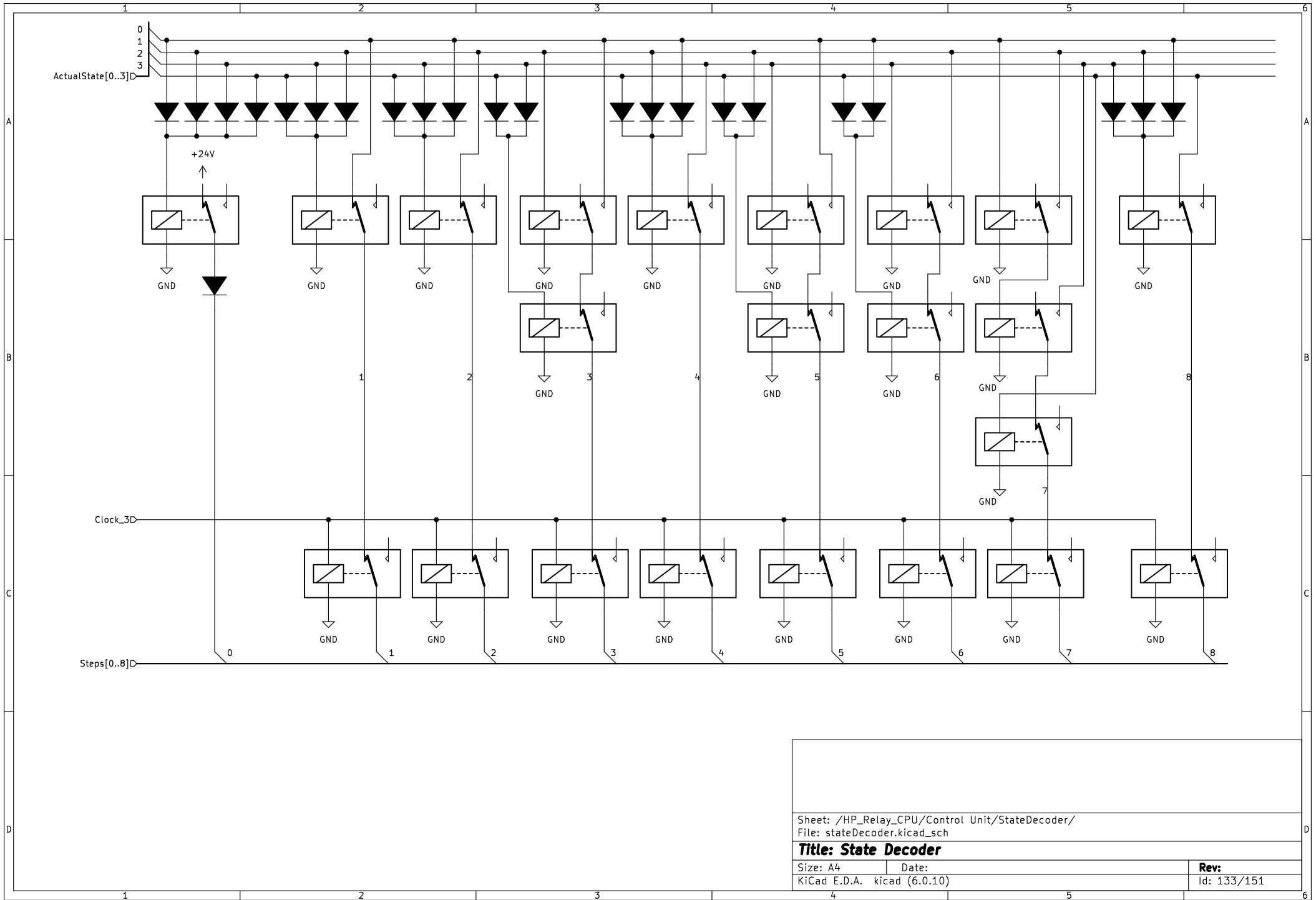




Sheet: /HP_Relay_CPU/Control Unit/StateRegister/
 File: stateRegister.kicad_sch

Title: Control Unit State Register

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 132/151

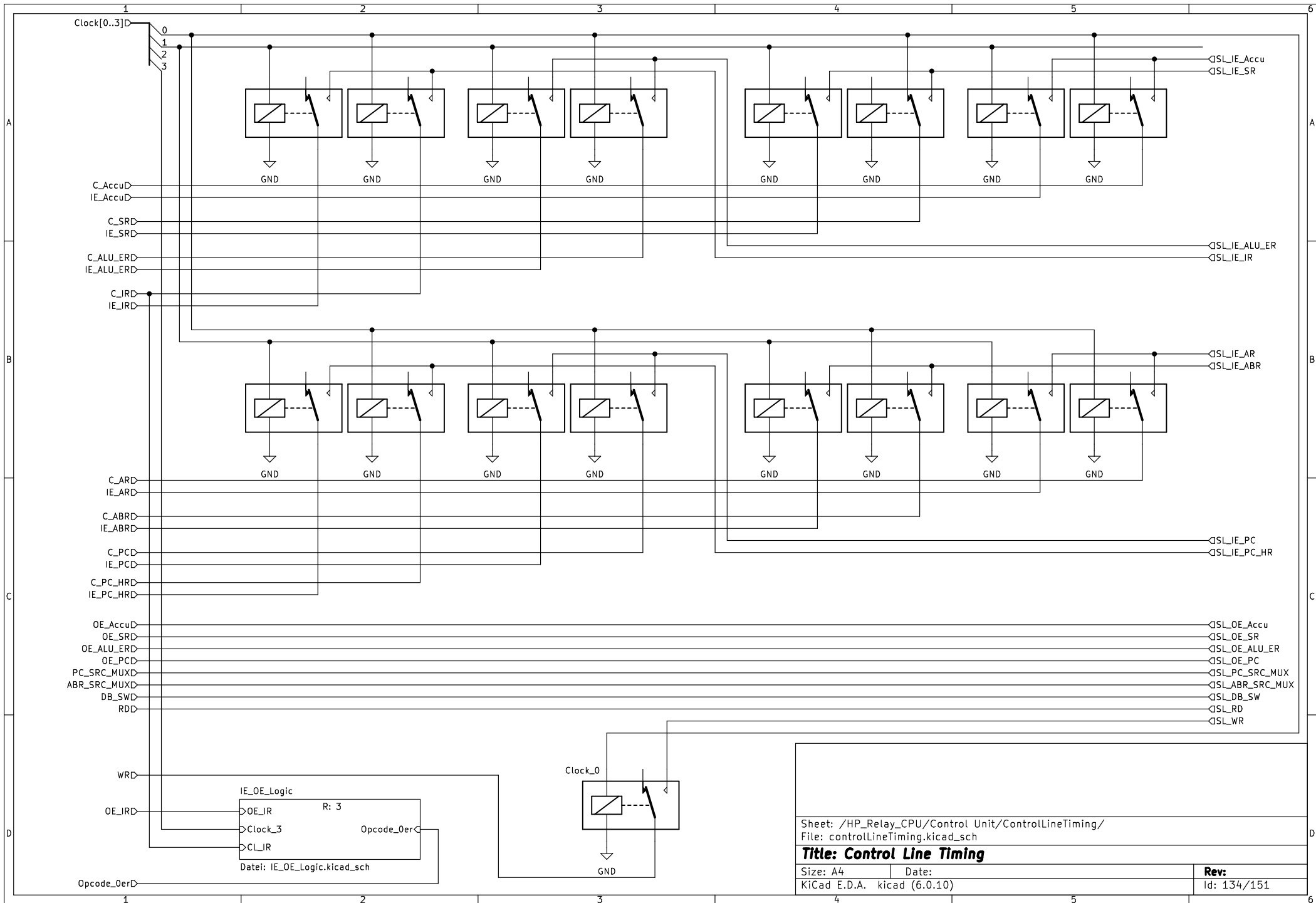


Sheet: /HP_Relay_CPU/Control Unit/StateDecoder/
 File: stateDecoder.kicad_sch

Title: State Decoder

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 133/151

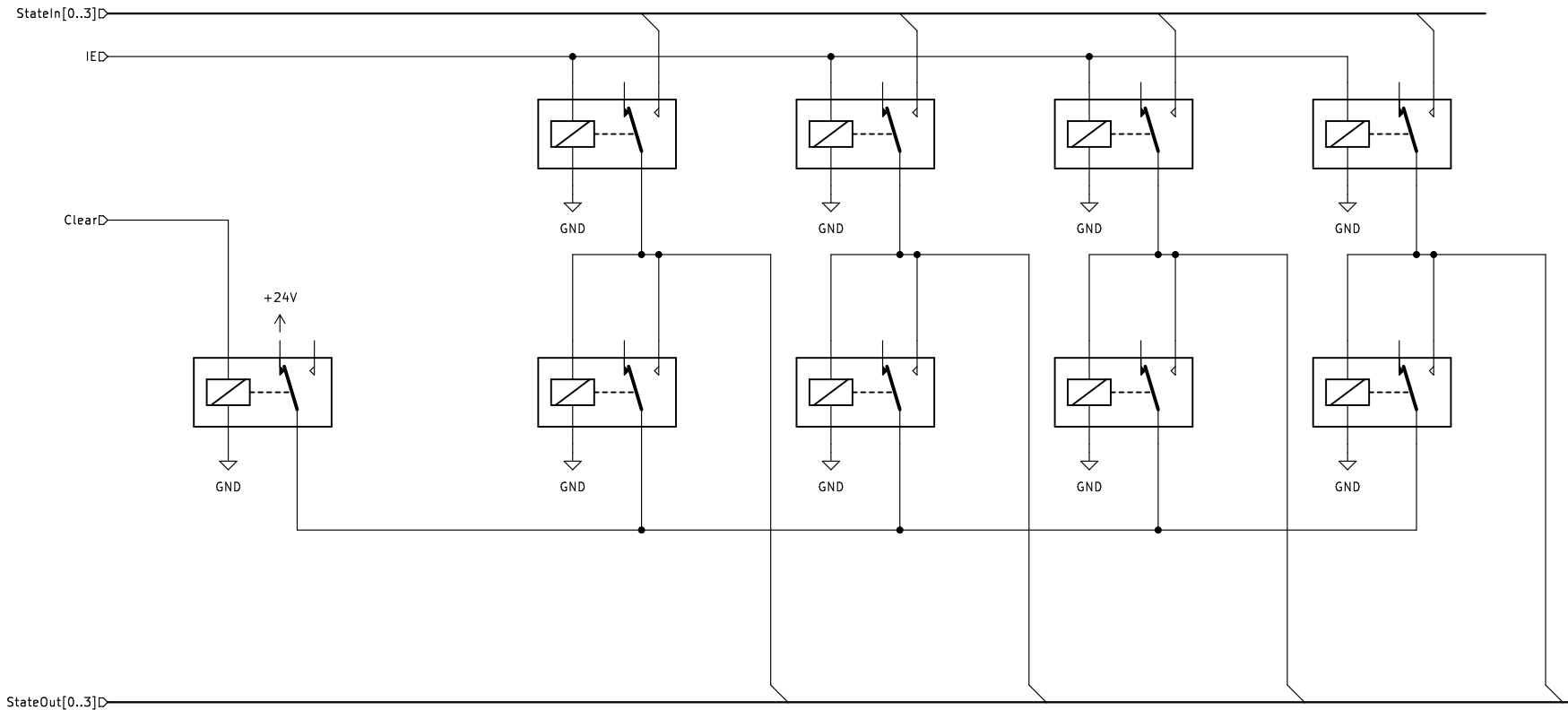


Sheet: /HP_Relay_CPU/Control Unit/ControllineTiming/
 File: controlLineTiming.kicad_sch

Title: Control Line Timing

Size: A4
 KiCad E.D.A. kicad (6.0.10)

Date:
 Rev: 134/151

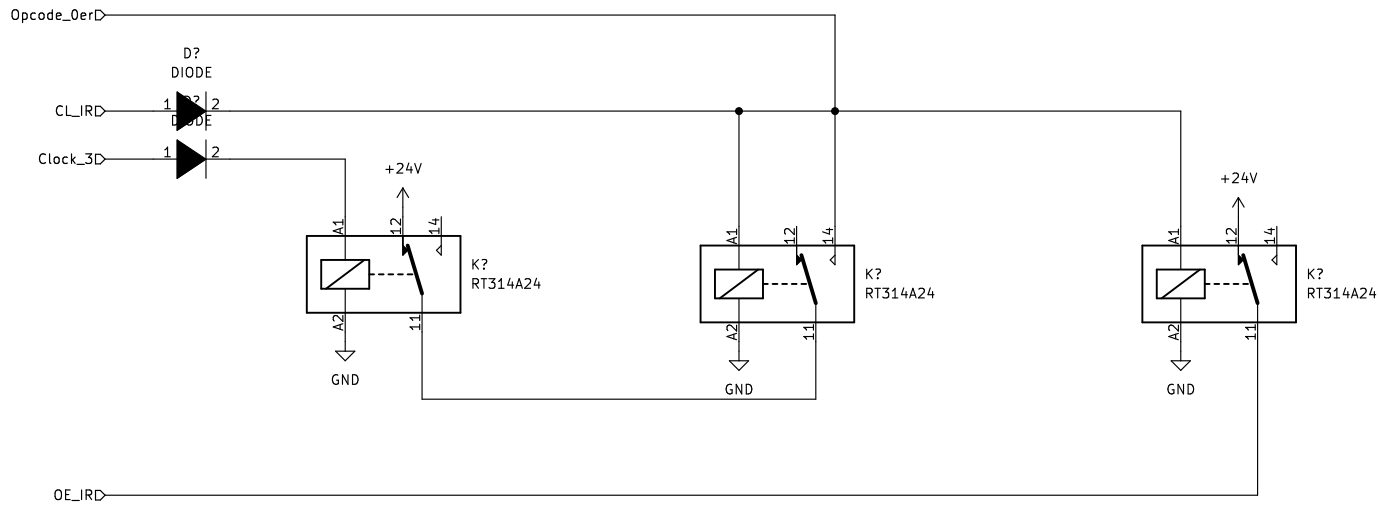


Sheet: /HP_Relay_CPU/Control Unit/StateRegister/StateRegisterState/
 File: stateRegisterSW.kicad_sch

Title: State Register Storage

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 135/151



Sheet: /HP_Relay_CPU/Control Unit/ControllineTiming/IE_OE_Logic/
 File: IE_OE_Logic.kicad_sch

Title: Instruction Register OE Timing

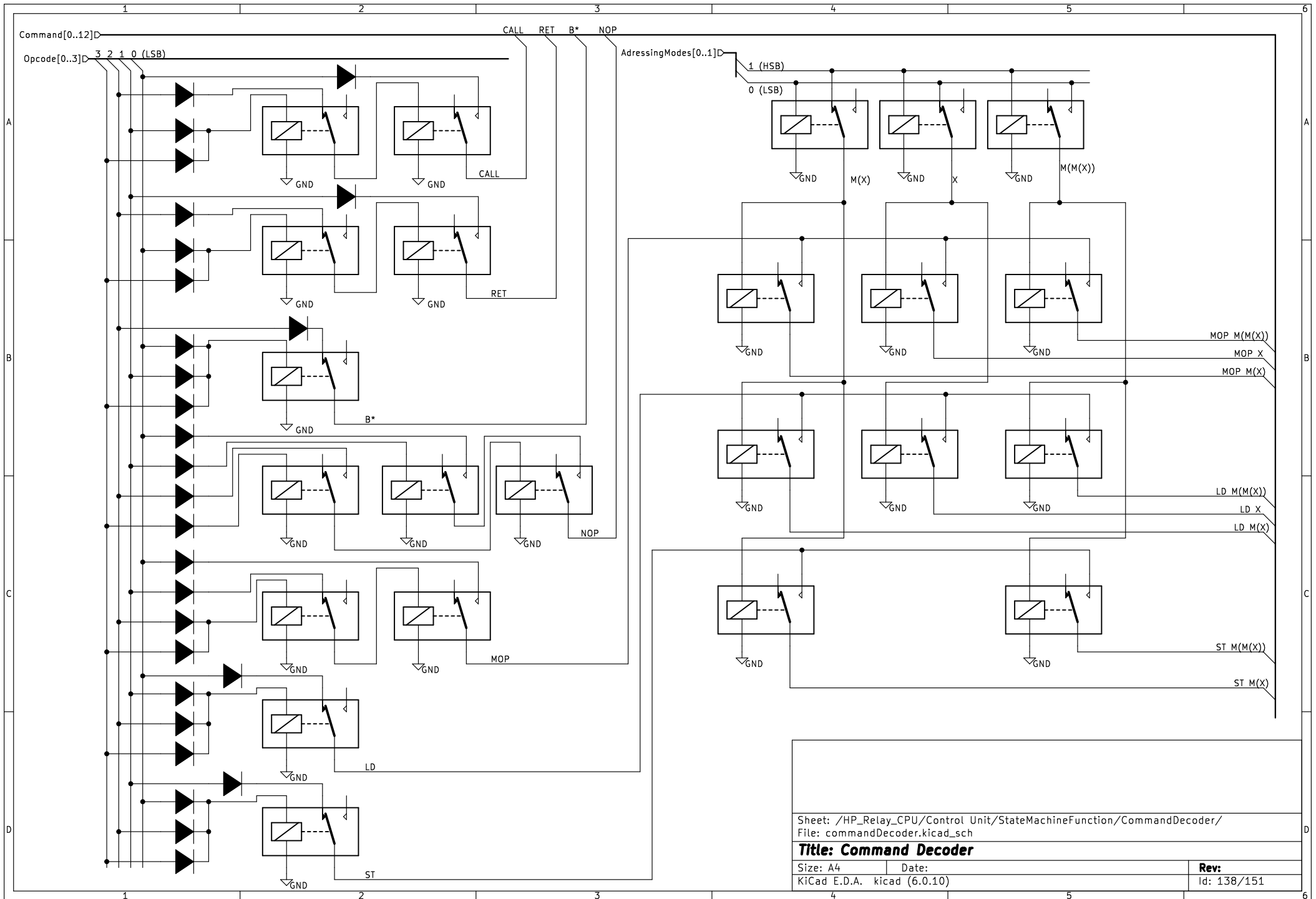
Size: A4

Date:

Rev:

KiCad E.D.A. kicad (6.0.10)

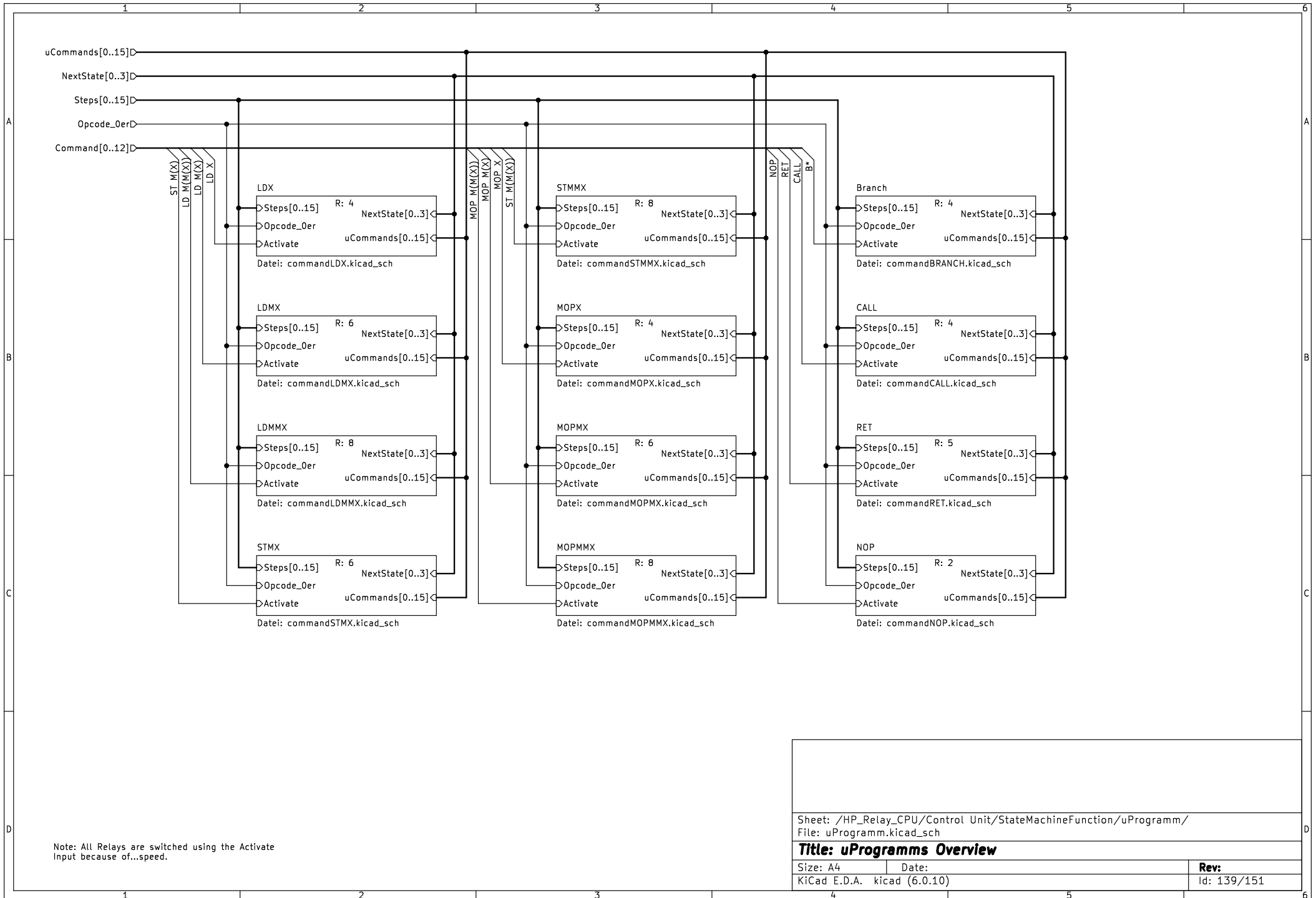
Id: 137/151



Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/CommandDecoder/
 File: commandDecoder.kicad_sch

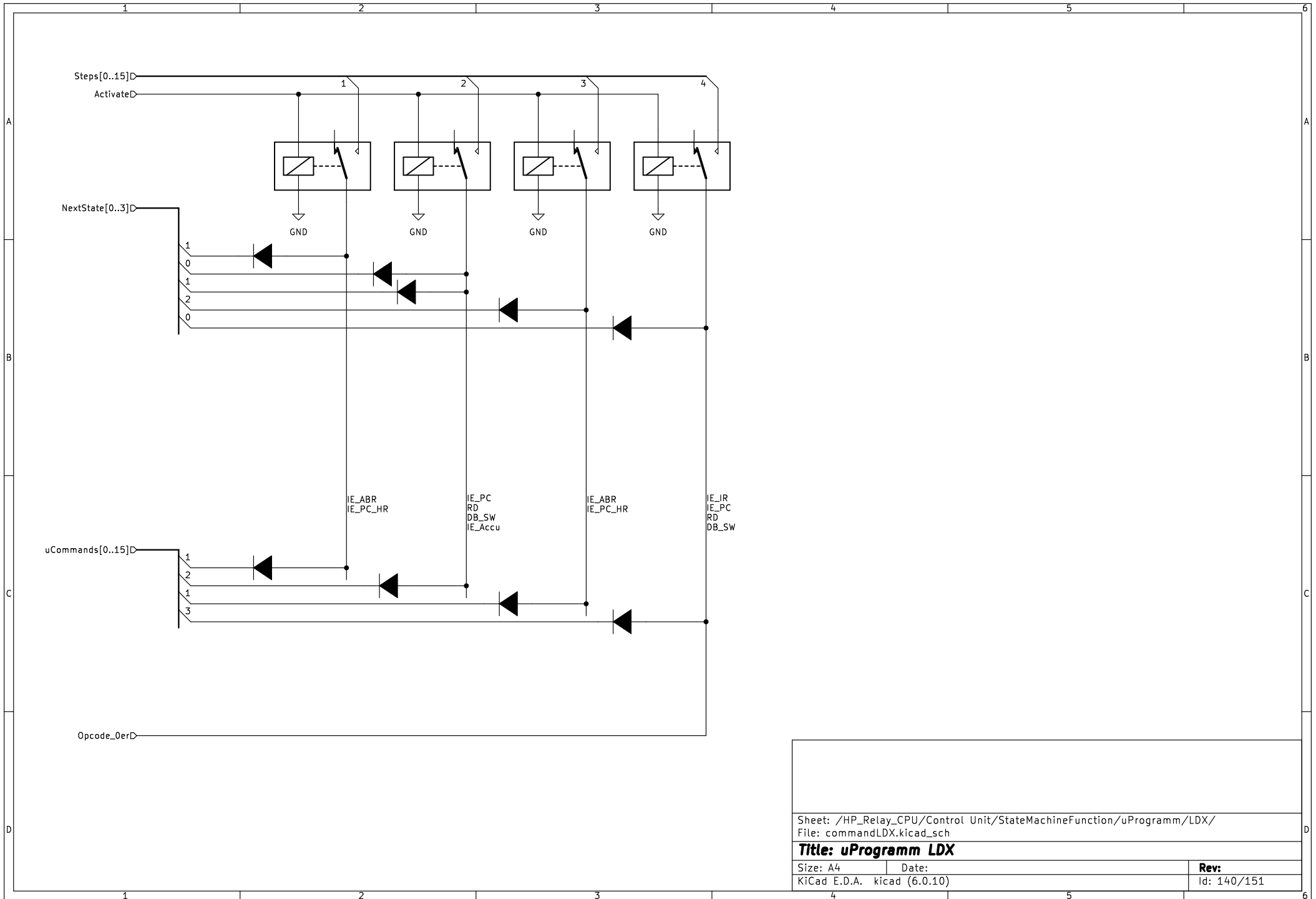
Title: Command Decoder

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 138/151



Note: All Relays are switched using the Activate Input because of...speed.

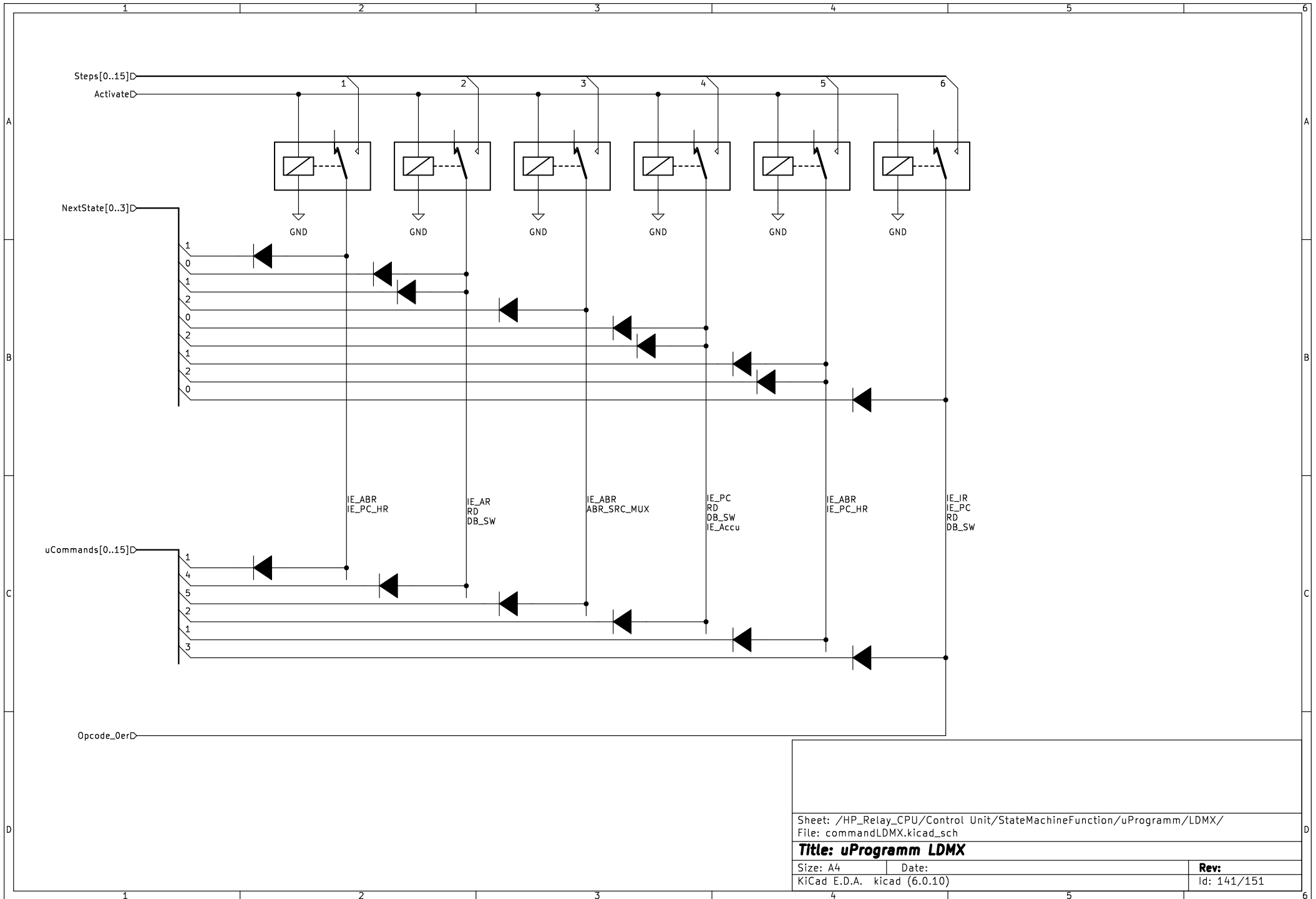
Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/	
File: uProgramm.kicad_sch	
Title: uProgramms Overview	
Size: A4	Date:
KiCad E.D.A. kicad (6.0.10)	Rev: Id: 139/151



Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/LDX/
 File: commandLDX.kicad_sch

Title: uProgramm LDX

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 140/151

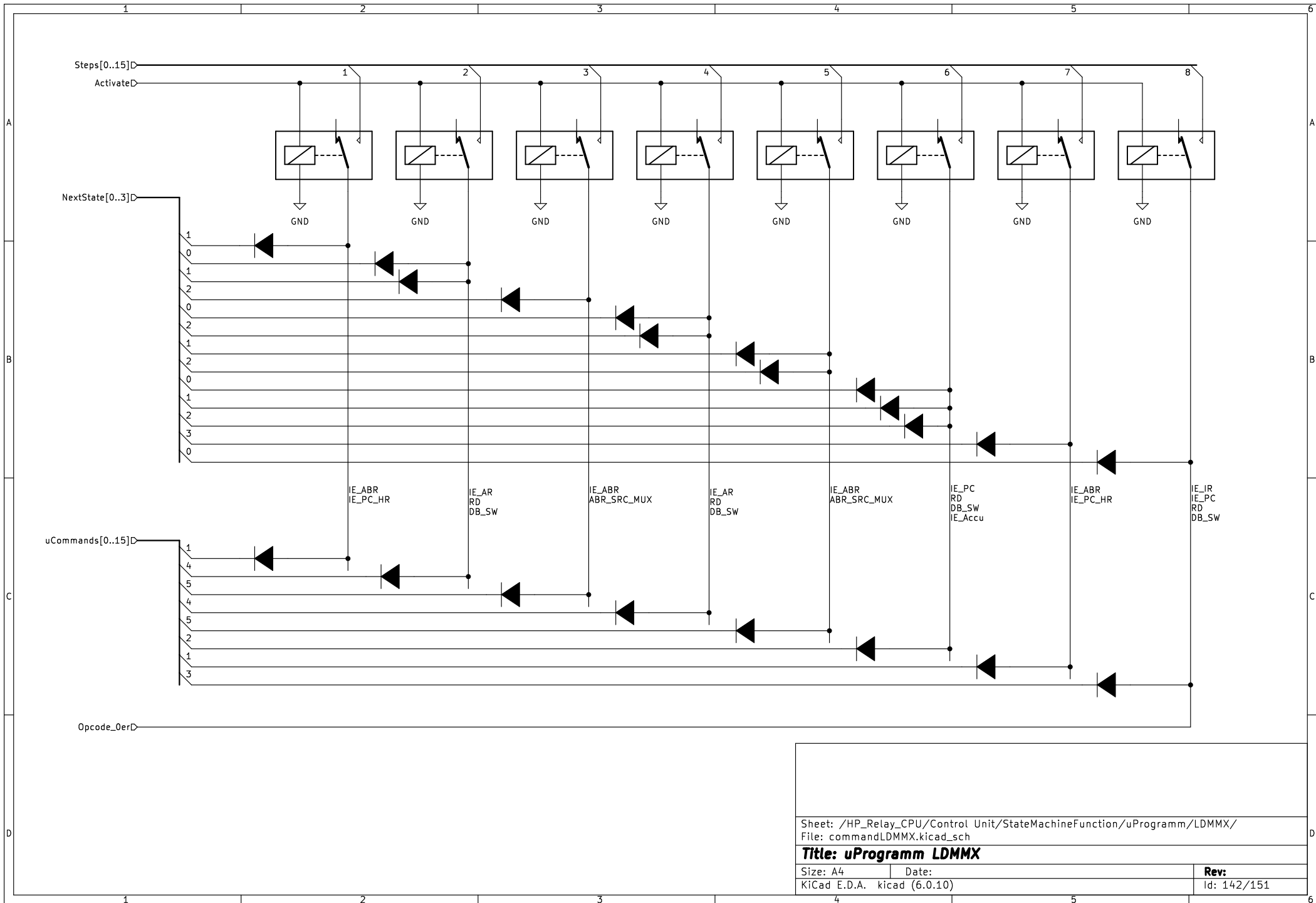


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/LDMX/
 File: commandLDMX.kicad_sch

Title: uProgramm LDMX

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 141/151

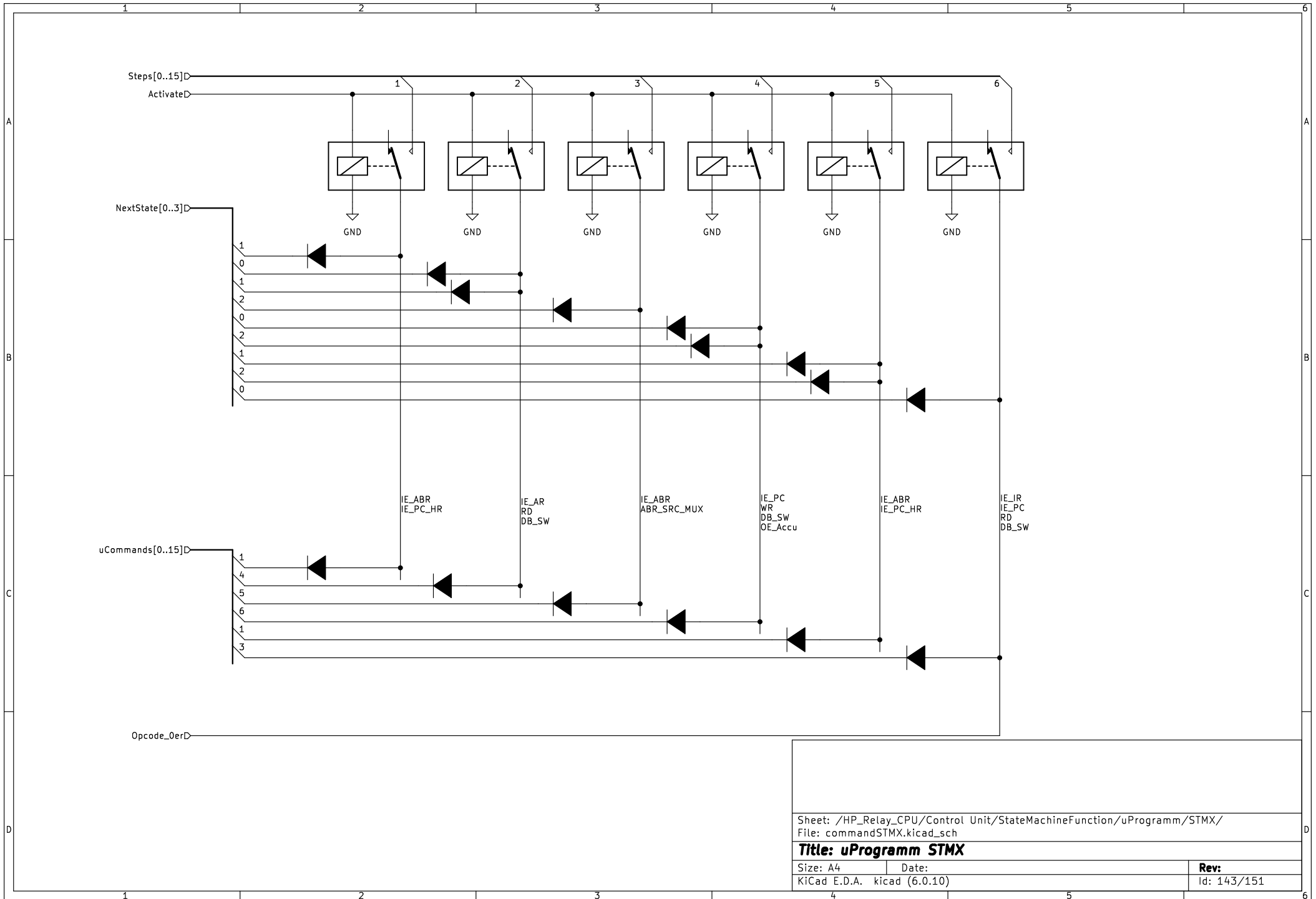


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/LDMMX/
 File: commandLDMMX.kicad_sch

Title: uProgramm LDMMX

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 142/151

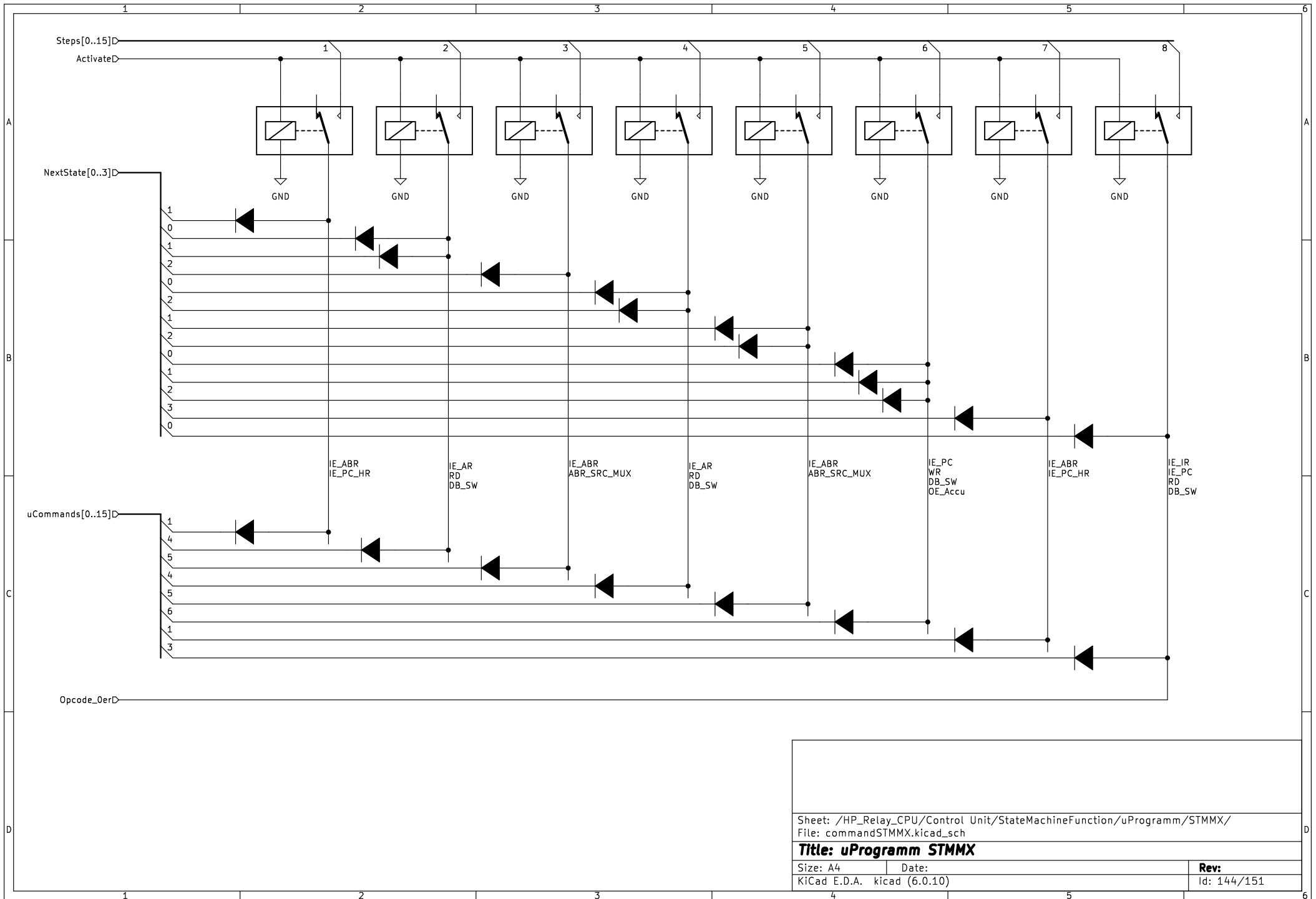


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/STMX/
 File: commandSTMX.kicad_sch

Title: uProgramm STMX

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 143/151

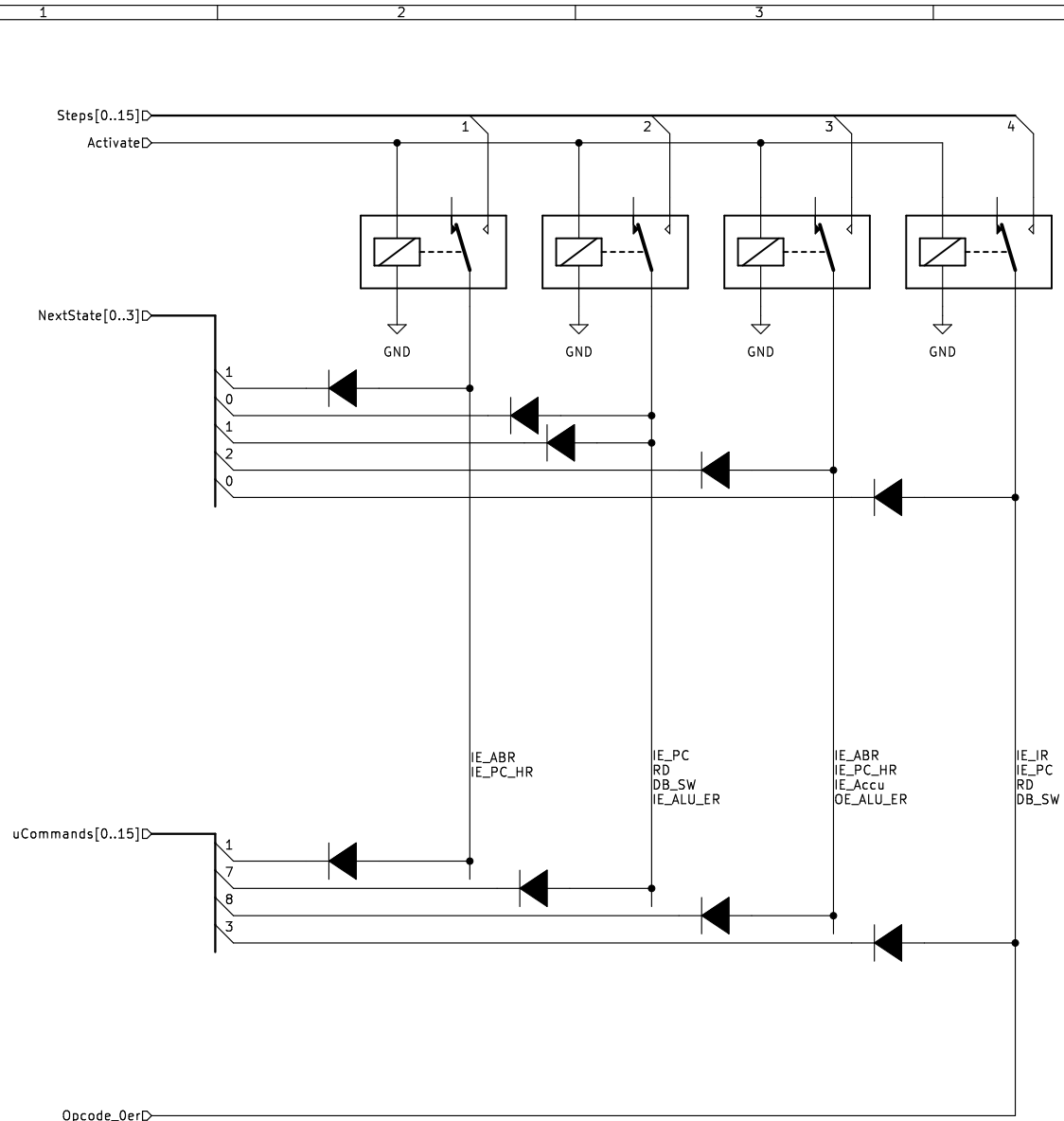


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/STMMX/
 File: commandSTMMX.kicad_sch

Title: uProgramm STMMX

Size: A4 | Date:
 KiCad E.D.A. kicad (6.0.10)

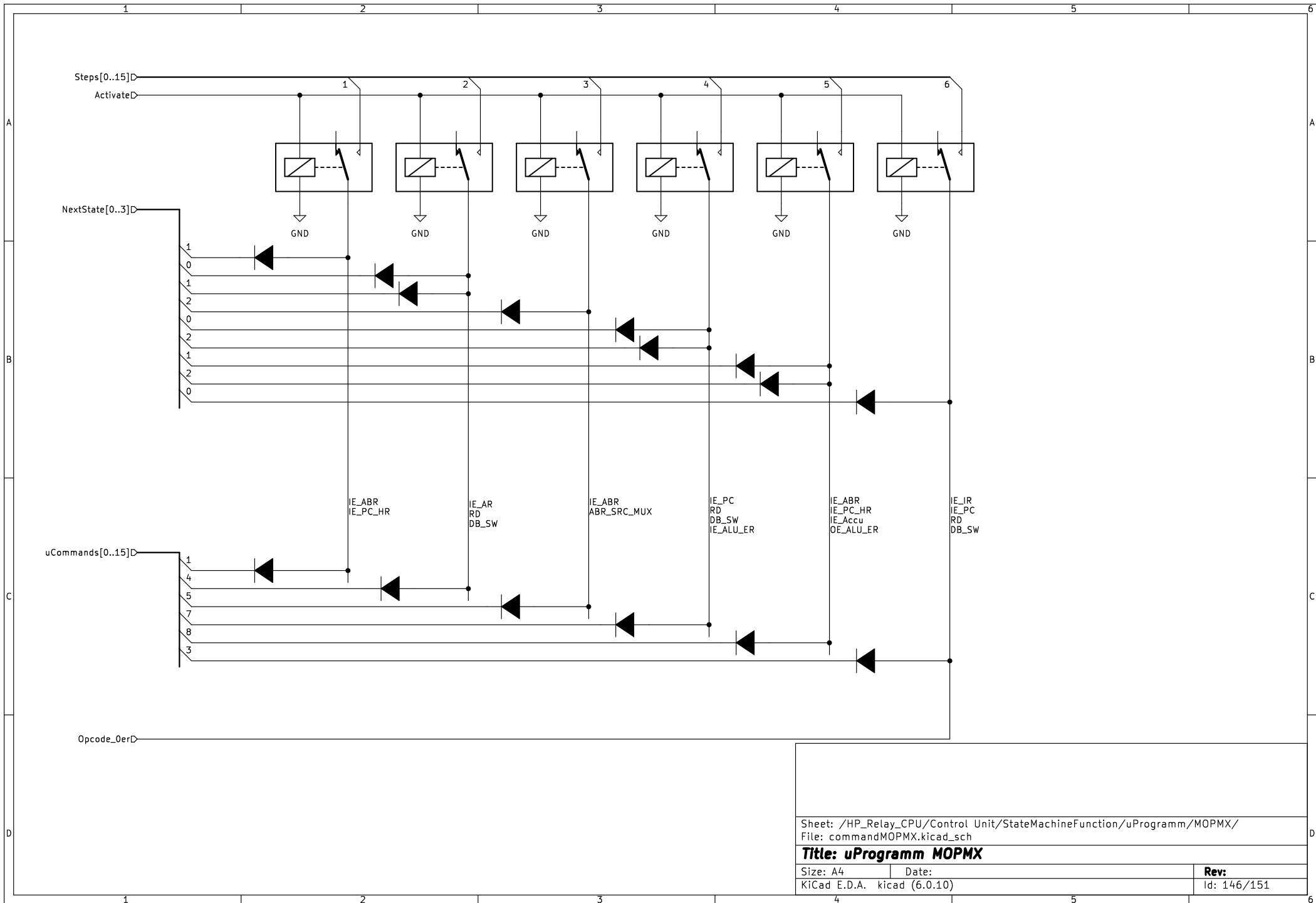
Rev:
 Id: 144/151



Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/MOPX/
 File: commandMOPX.kicad_sch

Title: uProgramm MOPX

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 145/151

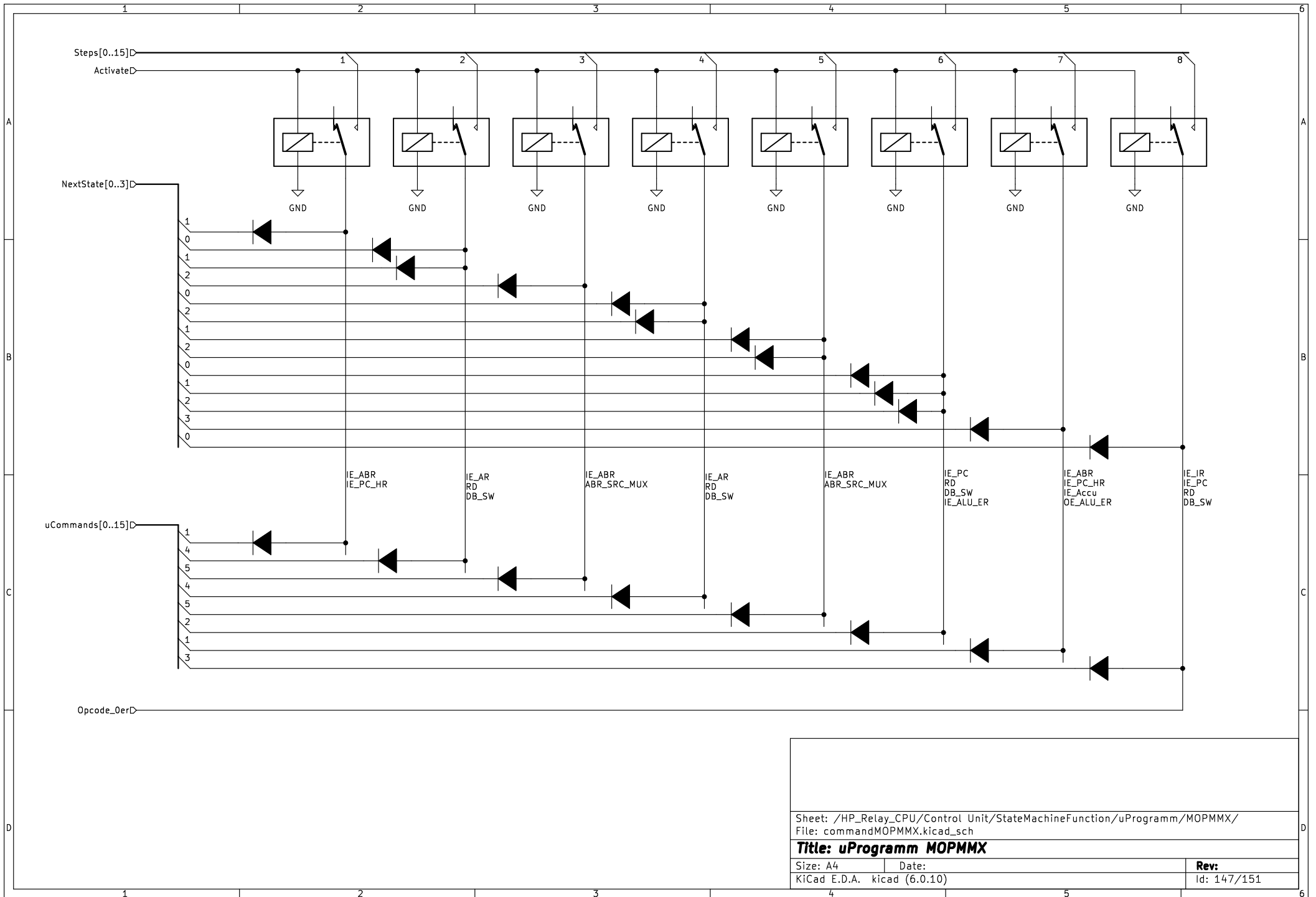


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/MOPMX/
 File: commandMOPMX.kicad_sch

Title: uProgramm MOPMX

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

Rev:
 Id: 146/151

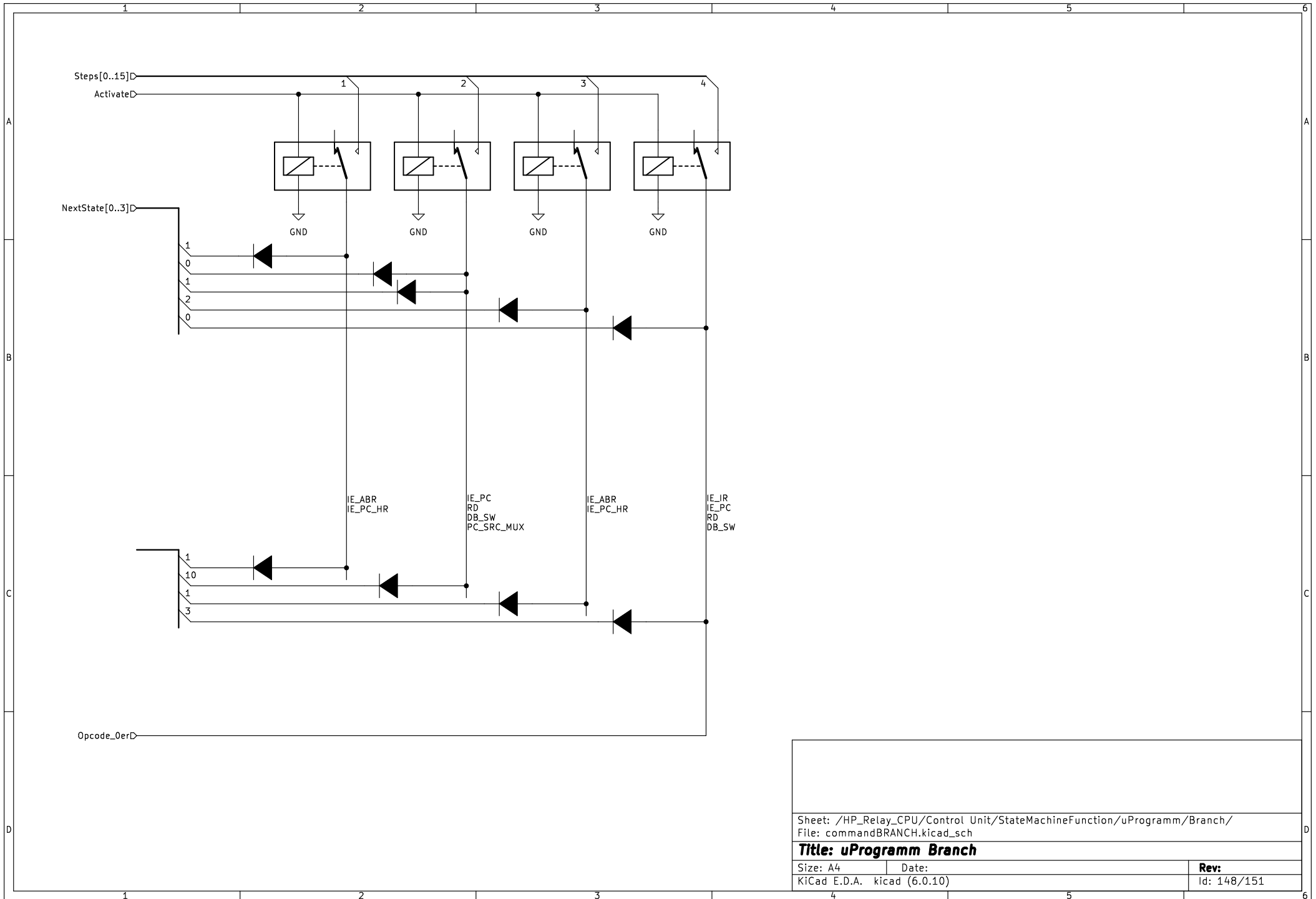


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/MOPMMX/
 File: commandMOPMMX.kicad_sch

Title: uProgramm MOPMMX

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

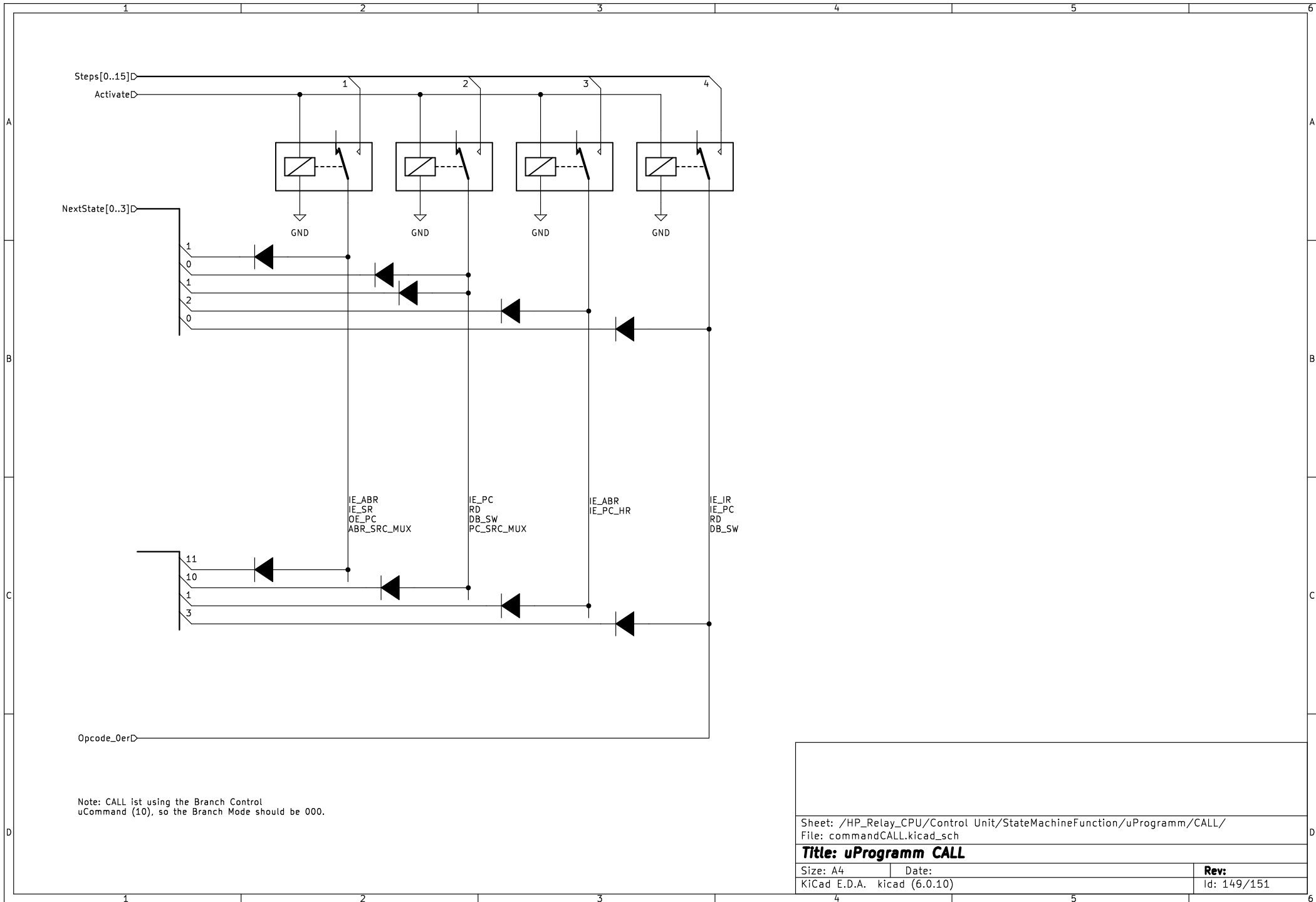
Rev:
 Id: 147/151



Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/Branch/
 File: commandBRANCH.kicad_sch

Title: uProgramm Branch

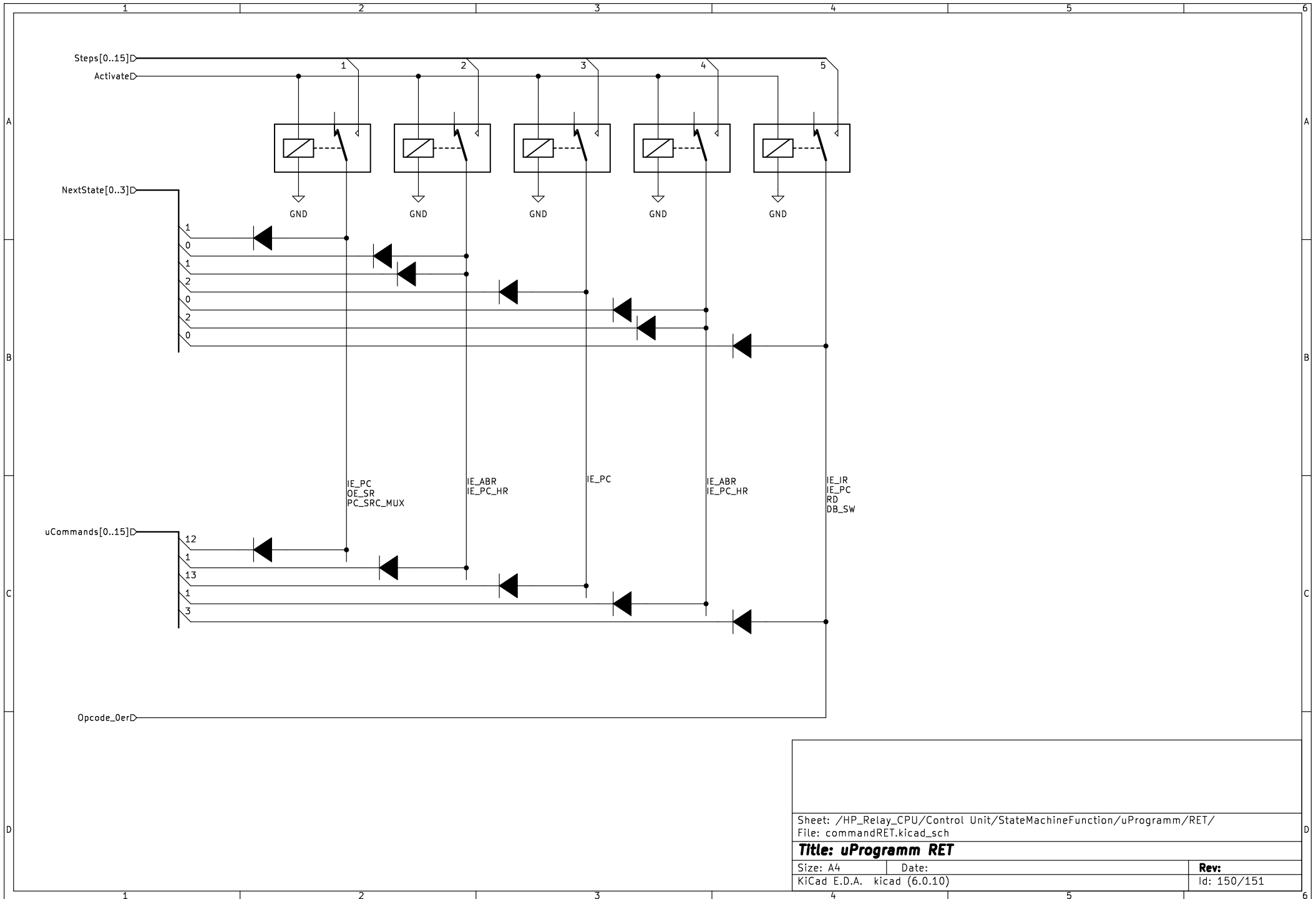
Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 148/151



Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/CALL/
File: commandCALL.kicad_sch

Title: uProgramm CALL

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 149/151

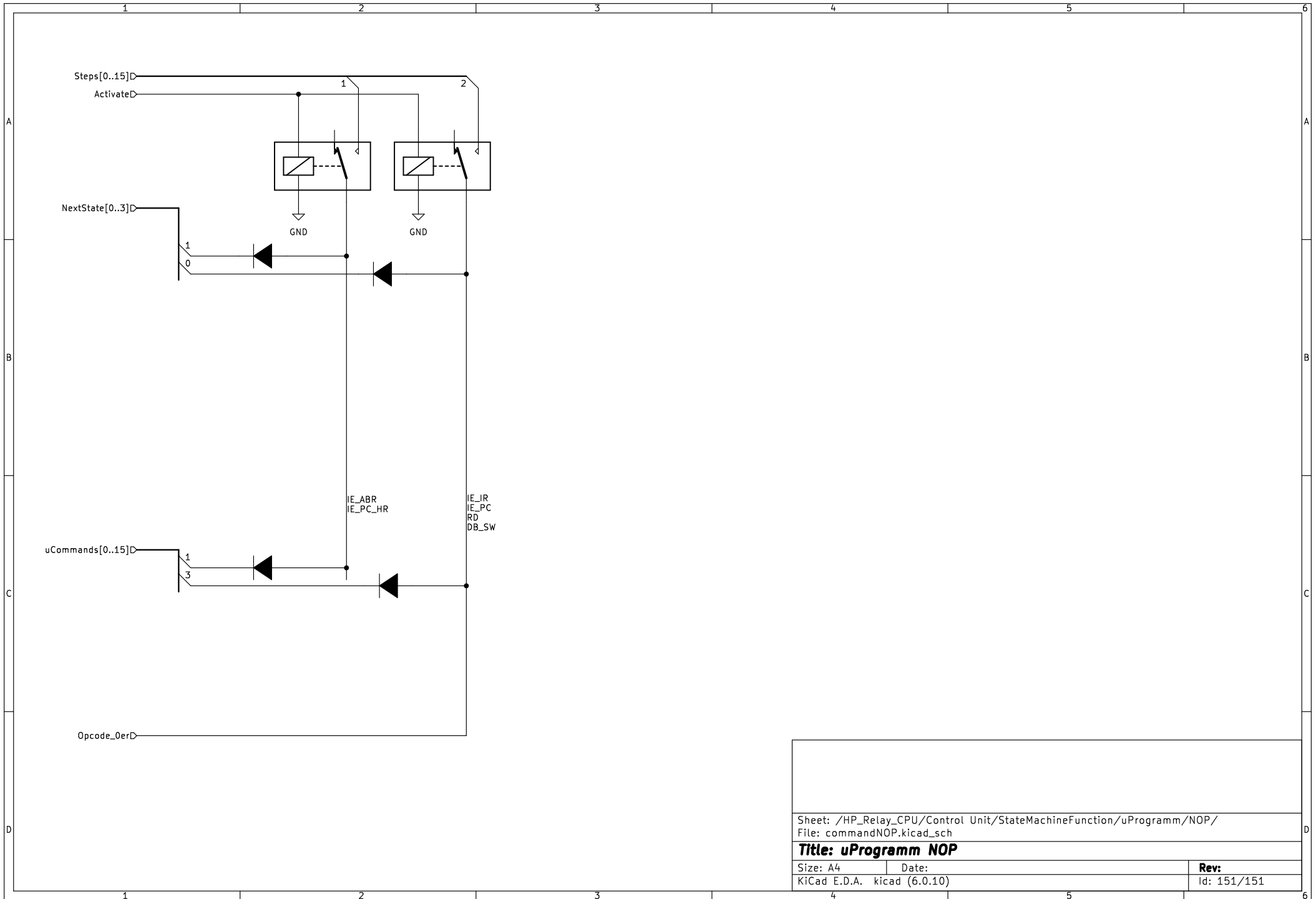


Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/RET/
 File: commandRET.kicad_sch

Title: uProgramm RET

Size: A4 Date:
 KiCad E.D.A. kicad (6.0.10)

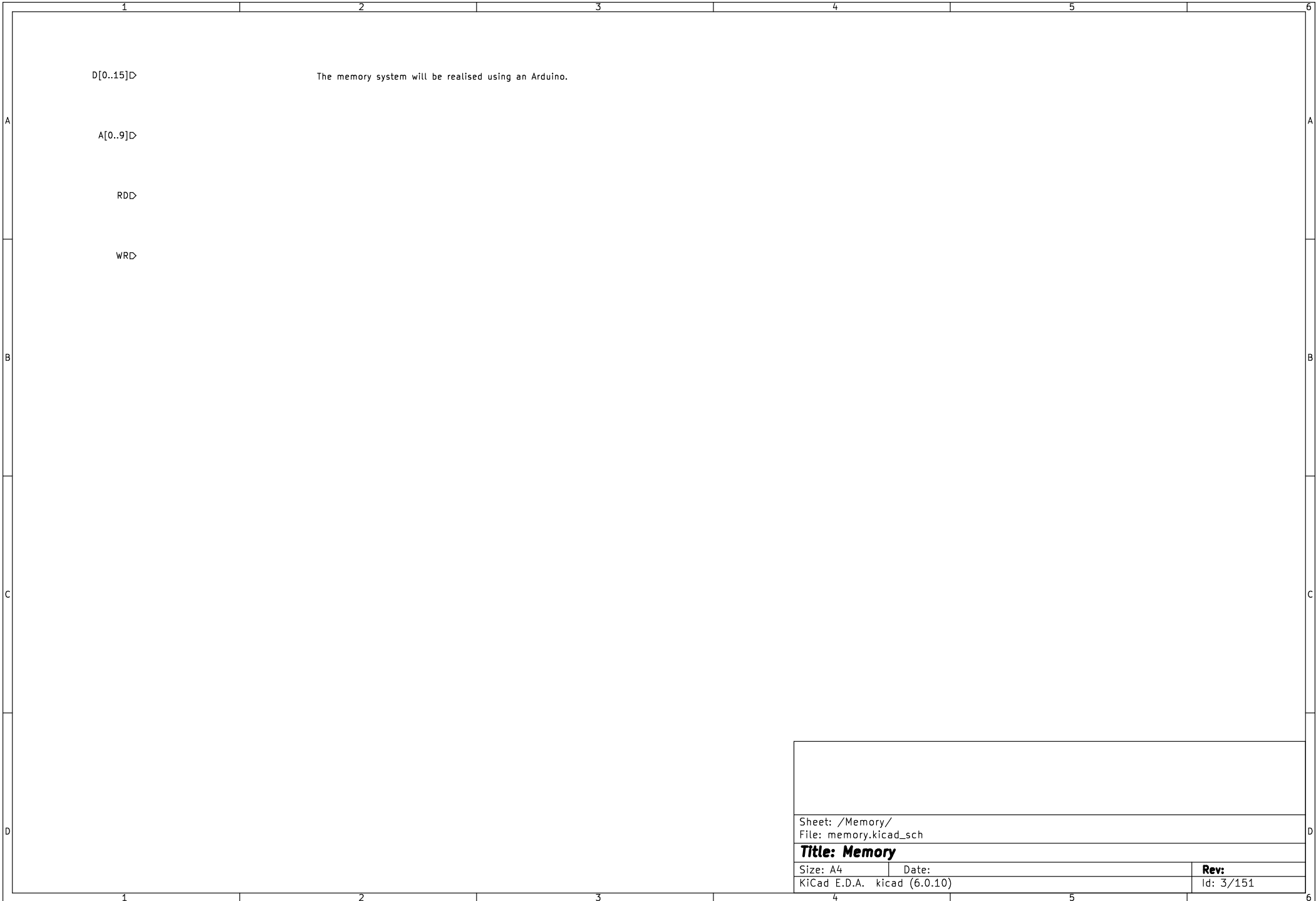
Rev:
 Id: 150/151



Sheet: /HP_Relay_CPU/Control Unit/StateMachineFunction/uProgramm/NOP/
 File: commandNOP.kicad_sch

Title: uProgramm NOP

Size: A4	Date:	Rev:
KiCad E.D.A. kicad (6.0.10)		Id: 151/151



Clock[0..3]D

The Clock system, which delivers 4 clock signals, will not be realised using relays.
An Arduino system will be used, the clock frequency and the intervals between the 4
signals will be find out by experiment.

Sheet: /Clock/	
File: clock.kicad_sch	
Title: Clock	
Size: A4	Date:
KiCad E.D.A. kicad (6.0.10)	Rev: Id: 4/151