

Sheet: /ID Prototype Outputs/  
File: IDPrototypeOutputs.kicad\_sch

**Title:**

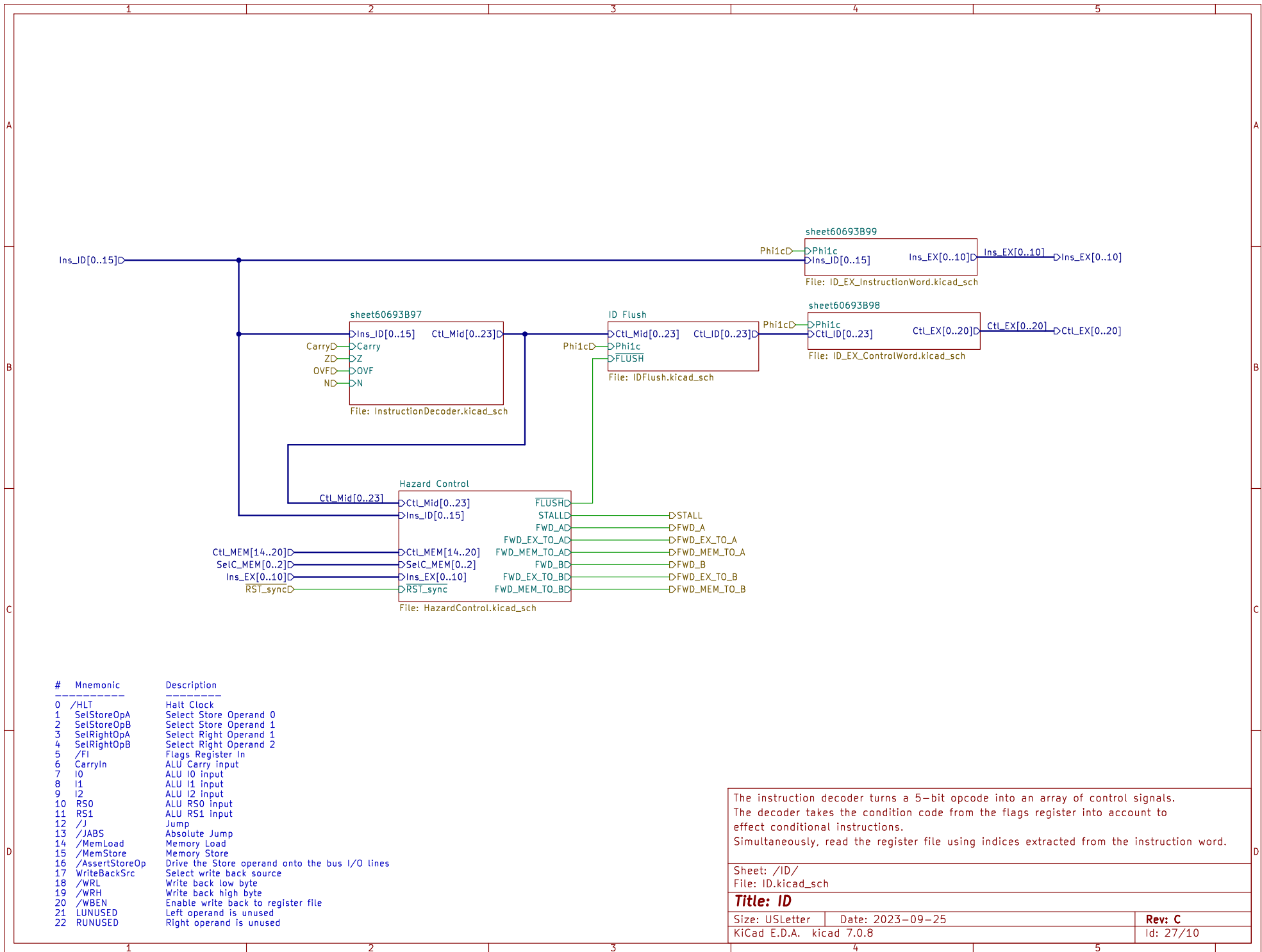
Size: A4

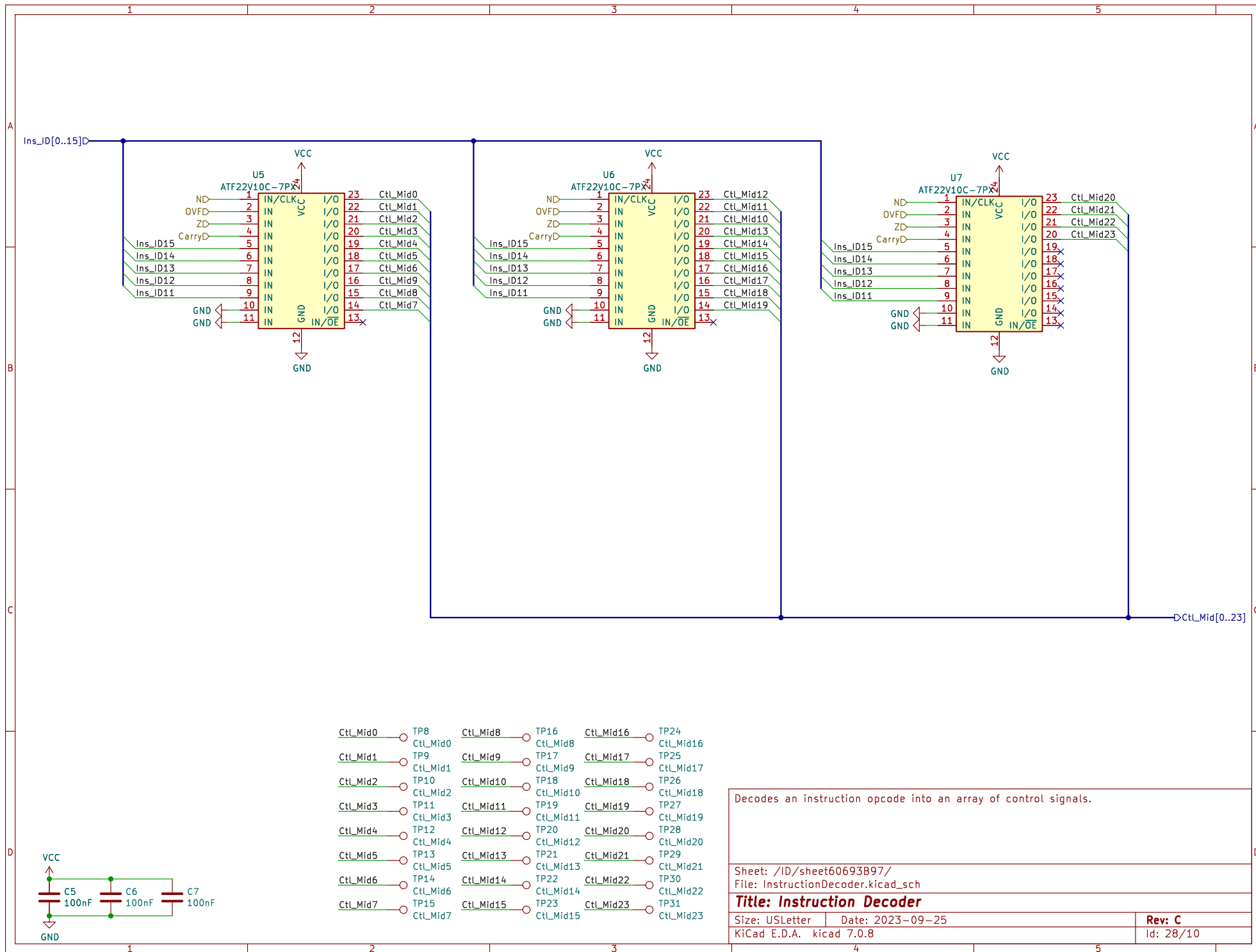
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Ctl_Mid0	TP8	Ctl_Mid8	TP16	Ctl_Mid16	TP24
Ctl_Mid1	TP9	Ctl_Mid9	TP17	Ctl_Mid17	TP25
Ctl_Mid2	TP10	Ctl_Mid10	TP18	Ctl_Mid18	TP26
Ctl_Mid3	TP11	Ctl_Mid11	TP19	Ctl_Mid19	TP27
Ctl_Mid4	TP12	Ctl_Mid12	TP20	Ctl_Mid20	TP28
Ctl_Mid5	TP13	Ctl_Mid13	TP21	Ctl_Mid21	TP29
Ctl_Mid6	TP14	Ctl_Mid14	TP22	Ctl_Mid22	TP30
Ctl_Mid7	TP15	Ctl_Mid15	TP23	Ctl_Mid23	TP31

Decodes an instruction opcode into an array of control signals.

Sheet: /ID/sheet60693B97/  
File: InstructionDecoder.kicad\_sch

**Title: Instruction Decoder**

Size: USLetter Date: 2023-09-25  
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Rev: C  
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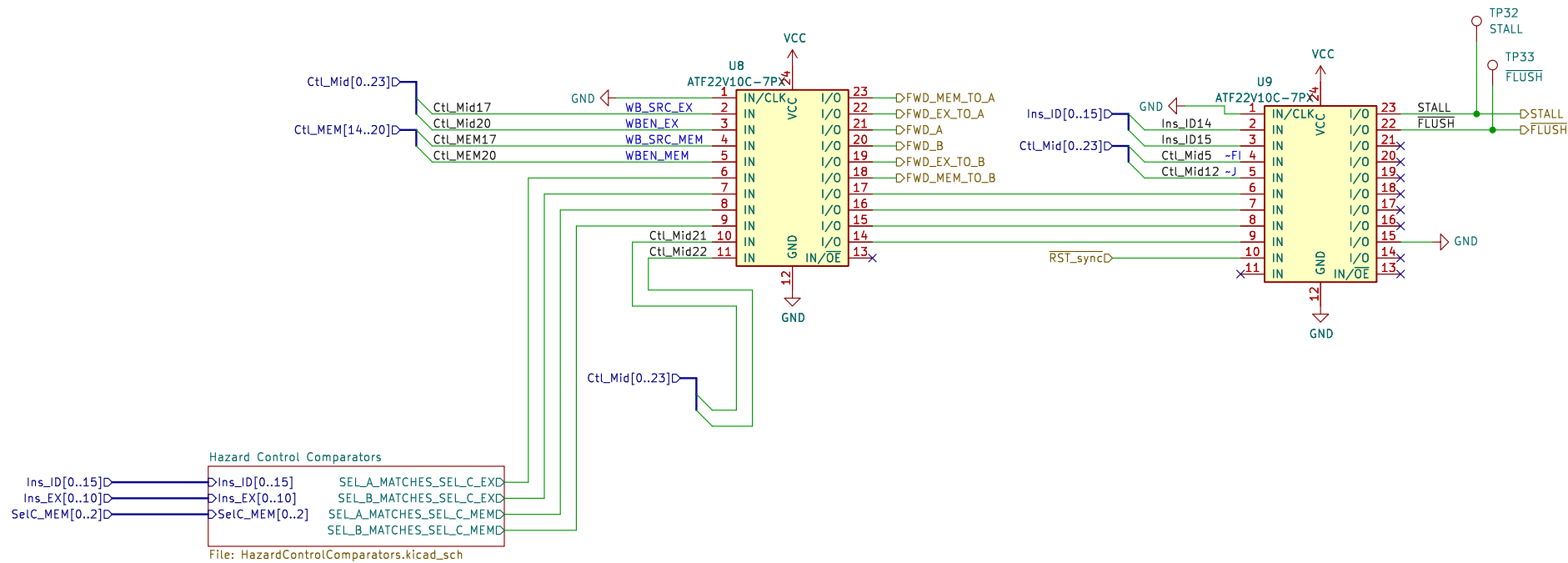
Hazard Control detects several types of hazards and resolves each one either by stalling the pipeline, or by forwarding an operand from a later pipeline stage.

On a jump, the program counter must be allowed to load a new value. At the same time, the ID and IF stages must both be flushed.

If the instruction in EX wants to update the Flags register, and the opcode in ID is determined to be one that wants to make use of the flags, then there is a Flags hazard. In this case, stall the pipeline for one cycle.

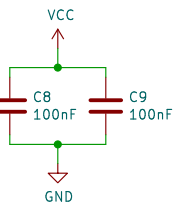
If the Ra or Rb registers refer to the destination register in the EX or MEM stage, and the instructions in the EX or MEM stage want to write back to that register, then there is a RAW error. In this case, forward an operand from a later pipeline stage to supply the EX stage on the next clock cycle.

There's no path to forward the store operand. Cases involving this operand must be resolved by stalling the pipeline.



Hazard Control Comparators

File: HazardControlComparators.kicad\_sch



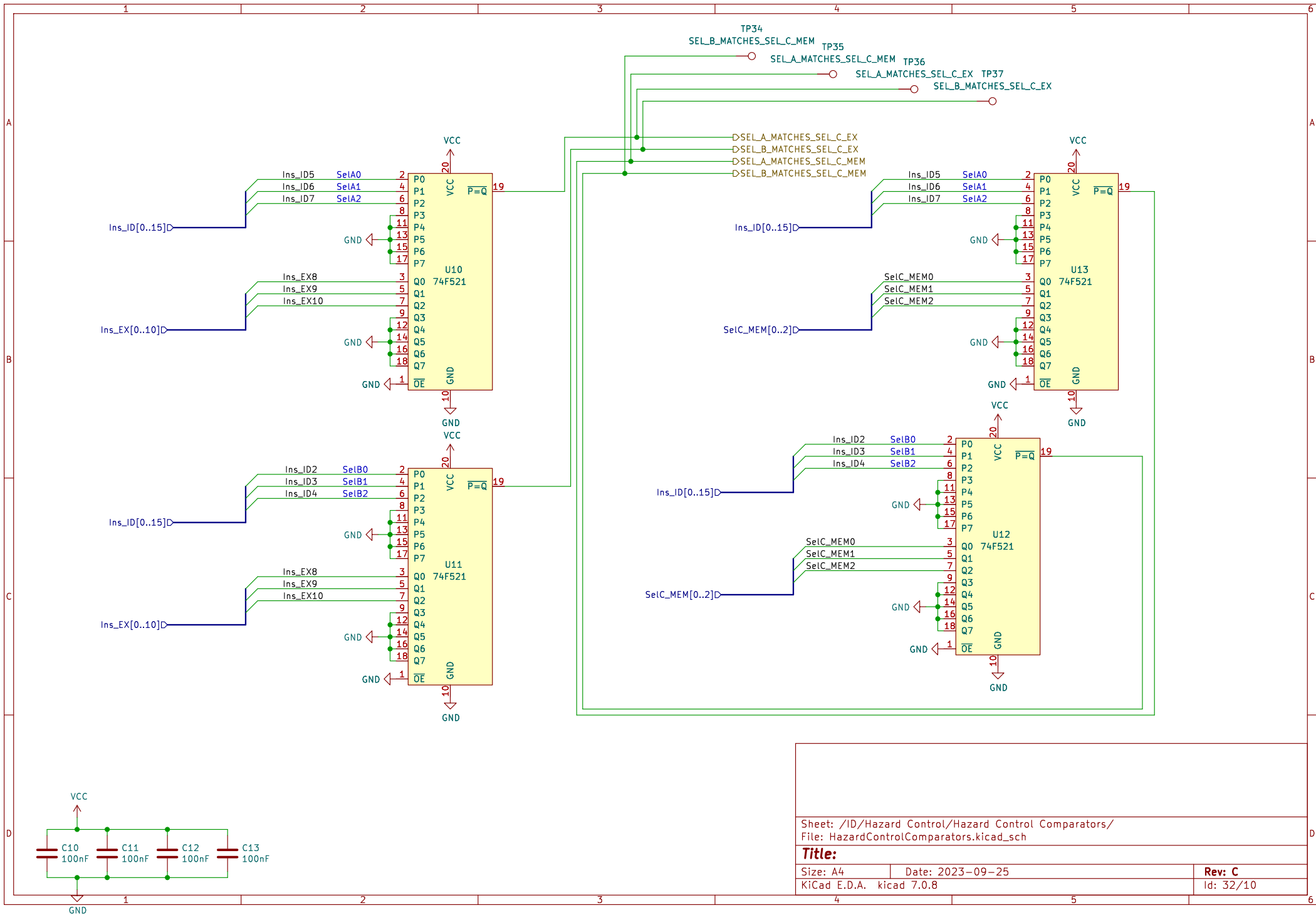
Control logic for dealing with pipeline hazards  
This may stall the pipeline on a hazard. For RAW hazards, it produces signals to control operand forwarding.

Sheet: /ID/Hazard Control/  
File: HazardControl.kicad\_sch

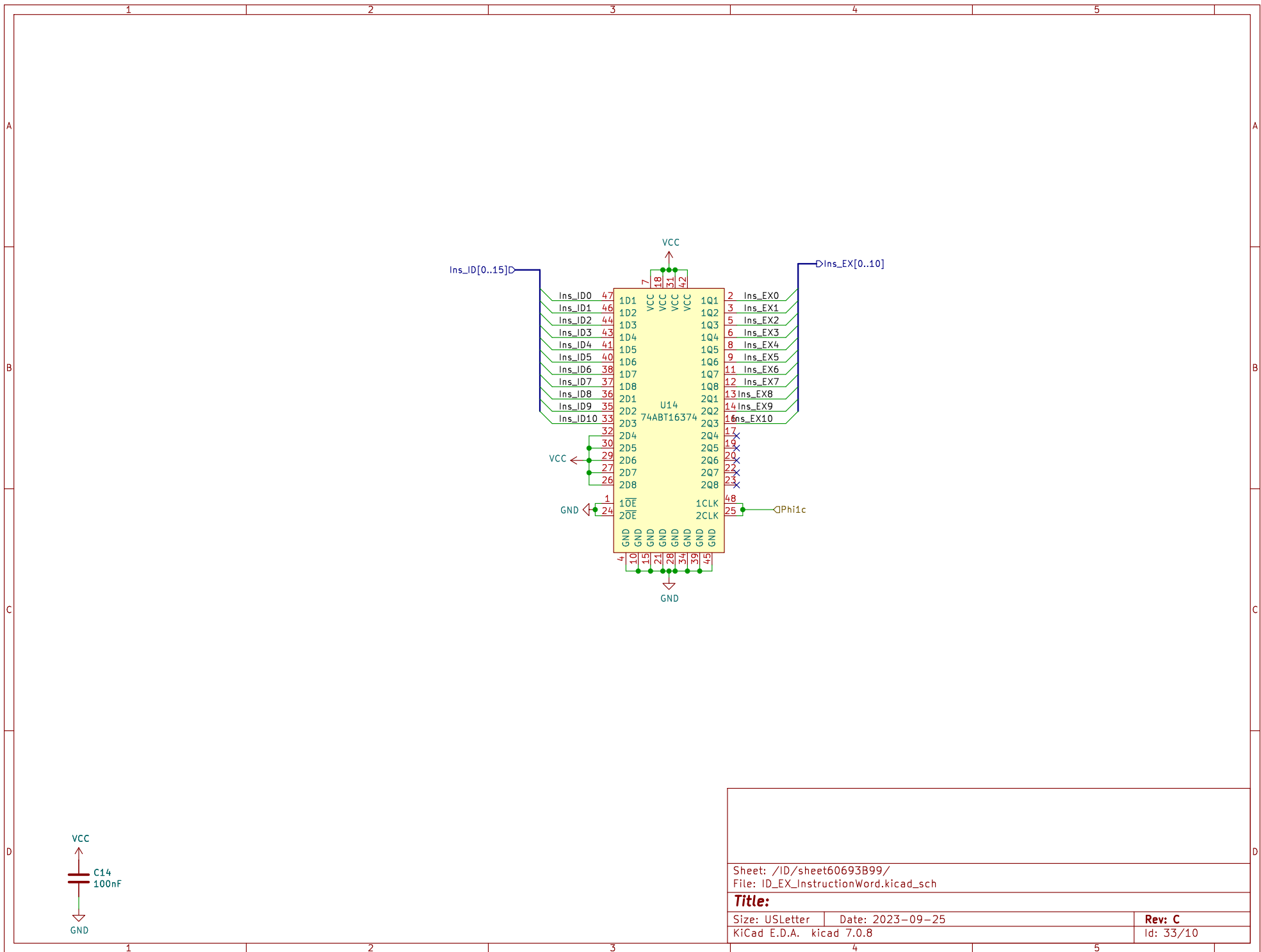
**Title: Hazard Control**

Size: USLetter Date: 2023-09-25  
KiCad E.D.A. kicad 7.0.8

Rev: C  
Id: 31/10







Sheet: /ID/sheet60693B99/ File: ID_EX_InstructionWord.kicad_sch		
<b>Title:</b>		
Size: USLetter	Date: 2023-09-25	Rev: C
KiCad E.D.A. kicad 7.0.8	Id: 33/10	

