

NOTE: Answers should be clear, concise and legible. Specify your assumptions clearly. Do all parts of same question together. Diagrams should be neat. NO MARKS for unnecessary theoretical explanation. Justify your answers

Q1. Consider the circuits given in fig 1 of asynchronous (self timed) DSP data path

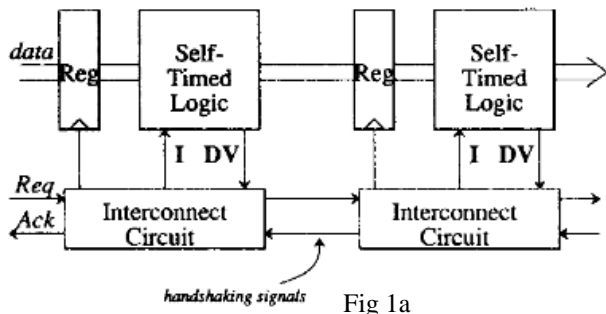


Fig 1a

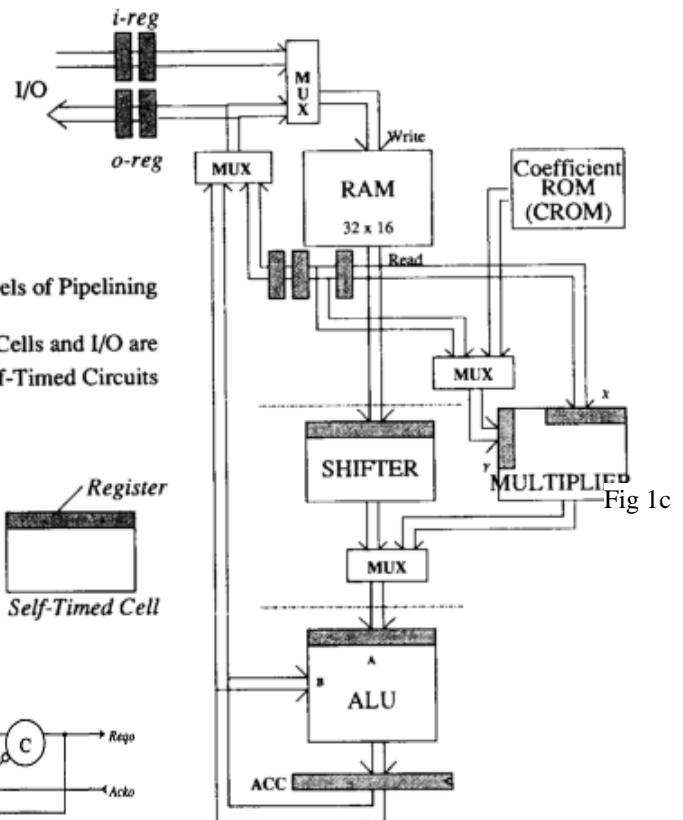


Fig 1b Data path of the asynchronous DSP.

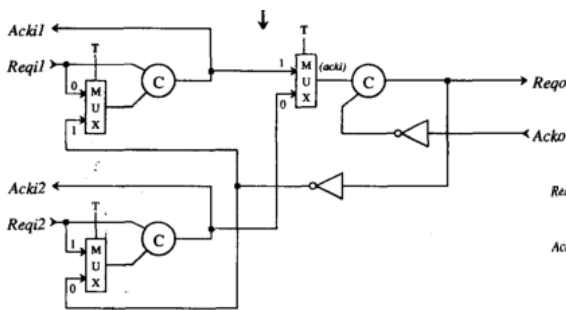


Fig 1c Handshaking circuit for a stage containing a two-input MUX at its input.

Answer the following-----

- Name the protocol implemented
- Design schematic of sum and carry gates used in the self-timed ALU macrocell in fig 1b
- Explain the use of mux in fig 1c
- Explain the operation of handshaking circuit in fig 1a

Q2. For the dual edge triggered flip flop circuit shown in fig 2.

- Describe the major differences in the schematic of fig 2a , 2b and hence describe operation of the each circuit in brief.
- Write expressions for Tsetup and Thold for both positive and negative edge triggered operations for each circuit

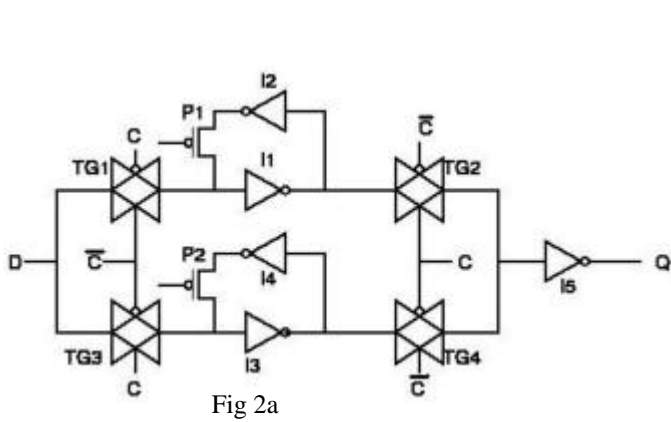


Fig 2a

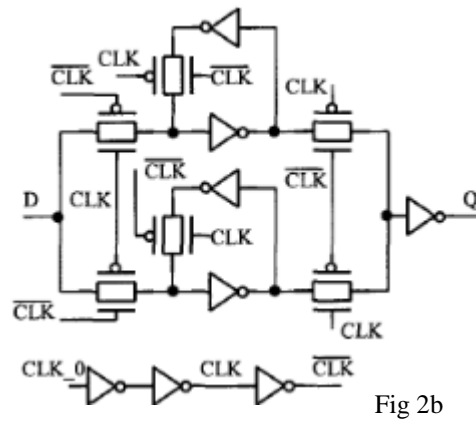


Fig 2b

- c) Assume that fig 2a has a setup time of 50 ps, a hold time of 100 ps, clk to Q/ data to Q delay of 50 ps for ideal clock waveforms. If clk and clk' having a skew of 60ps between them, recalculate for setup, hold, clk to Q delay of flip flop for clk=1 for no functional error

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Q3. Answer the following---

- Write the expression for resistance of an interconnect after the onset of skin effect. Can we minimize the impact of skin effect by increasing metal layer thickness?
- A clock distribution network has a skew of ± 100 ps between two destination points. Skin effect in one of the destination path causes a change in skew by 20%. Neglecting buffer delay, calculate % change in resistance value of that destination path. You may make a valid assumption
- A wire behaving like a LC transmission line has an inverter as the destination end. If the wire has characteristic impedance Z_0 , write the expression for propagation delay of the line

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