**TABLE 1. Datapath for single circuit CPU: quantitive method**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CPU** | PC | | NPC | | | | IM | RF | | | | EXT | ALU | | | MW | | | DM | | MR | |
| PC | NPC | Imm | PC | CMP | RD | PC | A1 | A2 | A3 | WD | In | A | B | Shamt | A | WD | Mem | A | WD | A | Mem |
| addu | **N**  **U**  **L**  **L** | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** | **IM.Istr[20:16]** | **IM.Istr[15:11]** | **ALU.C** |  | **RF.RD1** | **RF.RD2** |  |  |  |  |  |  |  |  |
| lw | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** |  | **IM.Istr[20:16]** | **MR.Out** | **IM.Istr[15:0]** | **RF.RD1** | **EXT.Out[31:0]** |  |  |  |  | **ALU.C** |  |  | **DM.RD** |
| lb | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** |  | **IM.Istr[20:16]** | **MR.Out** | **IM.Istr[15:0]** | **RF.RD1** | **EXT.Out[31:0]** |  |  |  |  | **ALU.C** |  | **ALU.C** | **DM.RD** |
| sw | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** | **IM.Istr[20:16]** |  |  | **IM.Istr[15:0]** | **RF.RD1** | **EXT.Out[31:0]** |  |  | **RF.RD2** |  | **ALU.C** | **MW.Out** |  |  |
| sb | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** | **IM.Istr[20:16]** |  |  | **IM.Istr[15:0]** | **RF.RD1** | **EXT.Out[31:0]** |  | **ALU.C** | **RF.RD2** | **DM.RD** | **ALU.C** | **MW.Out** |  |  |
| addiu | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** |  | **IM.Istr[20:16]** | **ALU.C** | **IM.Istr[15:0]** | **RF.RD1** | **EXT.Out[31:0]** |  |  |  |  |  |  |  |  |
| ori | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** |  | **IM.Istr[20:16]** | **ALU.C** | **IM.Istr[15:0]** | **RF.RD1** | **EXT.Out[31:0]** |  |  |  |  |  |  |  |  |
| beq | **NPC.NPC** | **IM.Istr[15:0]** | **PC.PC** | **ALU.cmp** |  | **PC.PC** | **IM.Istr[25:21]** | **IM.Istr[20:16]** |  |  |  | **RF.RD1** | **RF.RD2** |  |  |  |  |  |  |  |  |
| blez | **NPC.NPC** | **IM.Istr[15:0]** | **PC.PC** | **ALU.cmp** |  | **PC.PC** | **IM.Istr[25:21]** |  |  |  |  | **RF.RD1** |  |  |  |  |  |  |  |  |  |
| jr | **NPC.NPC** |  | **PC.PC** |  | **RF.RD1** | **PC.PC** | **IM.Istr[25:21]** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| jal | **NPC.NPC** | **IM.Istr[25:0]** | **PC.PC** |  |  | **PC.PC** |  |  | **5’d31** | **NPC.PC4** |  |  |  |  |  |  |  |  |  |  |  |
| j | **NPC.NPC** | **IM.Istr[25:0]** | **PC.PC** |  |  | **PC.PC** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| sll | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** |  | **IM.Istr[20:16]** | **IM.Istr[15:11]** | **ALU.C** |  | **RF.RD2** |  | **IM.Istr[10:6]** |  |  |  |  |  |  |  |
| slt | **NPC.NPC** |  | **PC.PC** |  |  | **PC.PC** | **IM.Istr[25:21]** | **IM.Istr[20:16]** | **IM.Istr[15:11]** | **ALU.C** |  | **RF.RD1** | **RF.RD2** |  |  |  |  |  |  |  |  |
| syn |  | **NPC.NPC** | **IM.Istr[25:0]** | **PC.PC** | **ALU.cmp** | **RF.RD1** | **PC.PC** | **IM.Istr[25:21]** | **IM.Istr[20:16]** | **IM.Istr[15:11]**  **IM.Istr[20:16]**  **5’d31** | **ALU.C**  **MR.Out**  **NPC.PC4** | **IM.Istr[15:0]** | **RF.RD1**  **RF.RD2** | **RF.RD2**  **EXT.Out[31:0]** | **IM.Istr[10:6]** | **ALU.C** | **RF.RD2** | **DM.RD** | **ALU.C** | **RF.RD2**  **MW.Out** | **ALU.C** | **DM.RD** |