|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Start State Transitions | | | | | | | |
| ## | Input | | | Current  State | Next  State | Output | |
| A | B | Operation | A op B | Error |
| 0 | a | b | NO-OP | Start | Ready | x | x |
| 1 | a | b | AND | Start | And | a & b | 0 |
| 2 | a | b | OR | Start | Or | a | b | 0 |
| 3 | a | b | XOR | Start | Xor | a ^ b | 0 |
| 4 | a | b | ADD | Start | Add | a + b | 0/1 |
| 5 | a | b | MULT | Start | Mult | a \* b | 0/1 |
| 6 | a | b | SRL | Start | Srl | a >> b | 0 |
| 7 | a | b | NOT | Start | Not | ~a | 0 |
| 8 | a | b | MOD | Start | Mod | a % b | 0/1 |
| 9 | a | b | NAND | Start | Nand | ~(a & b) | 0 |
| 10 | a | b | NOR | Start | Nor | ~ ( a | b ) | 0 |
| 11 | a | b | XNOR | Start | Xnor | ~( a ^ b ) | 0 |
| 12 | a | b | SUBTRACT | Start | Subtract | a - b | 0/1 |
| 13 | a | b | DIVIDE | Start | Divide | a / b | 0/1 |
| 14 | a | b | SLL | Start | Sll | a << b | 0 |
| 15 | a | b | RESET | Start | Ready | 0 | 0 |

Detailed State Transitions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| All State Transitions (Prev-Op = Any one of the 16) | | | | | | | |
| ## | Input | | | Current  State | Next  State | Output | |
| A | B | Operation | A op B | Error |
| 0 | a | b | NO-OP | Any State | Ready | Previous Output | Previous  Error |
| 1 | a | b | AND | Any State | And | a & b | 0 |
| 2 | a | b | OR | Any State | Or | a | b | 0 |
| 3 | a | b | XOR | Any State | Xor | a ^ b | 0 |
| 4 | a | b | ADD | Any State | Add | a + b | 0/1 |
| 5 | a | b | MULT | Any State | Mult | a \* b | 0/1 |
| 6 | a | b | SRL | Any State | Srl | a >> b | 0 |
| 7 | a | b | NOT | Any State | Not | ~a | 0 |
| 8 | a | b | MOD | Any State | Mod | a % b | 0/1 |
| 9 | a | b | NAND | Any State | Nand | ~(a & b) | 0 |
| 10 | a | b | NOR | Any State | Nor | ~ ( a | b ) | 0 |
| 11 | a | b | XNOR | Any State | Xnor | ~( a ^ b ) | 0 |
| 12 | a | b | SUBTRACT | Any State | Subtract | a - b | 0/1 |
| 13 | a | b | DIVIDE | Any State | Divide | a / b | 0/1 |
| 14 | a | b | SLL | Any State | Sll | a << b | 0 |
| 15 | a | b | RESET | Any State | Ready | 0 | 0 |

Top Level State Diagram

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ALU State Transitions | | | | | | | | |
| ## | Input | | | | Current  State | Next  State | Output | |
| A | B | PrevError | Operation | A op B | Error |
| 0 | x | x | x | no-op | Start | Start | x | x |
| 1 | x | x | x | reset | Start | Ready | 0 | 0 |
| 2 | a | b | x | mathFunc | Start | Math | a mathOP b | 0/1 |
| 3 | a | b | x | logicFunc | Start | Logic | a logOP b | 0 |
| 4 | x | x | x | no-op | Logic | Logic | prev. output | 0 |
| 5 | a | b | x | logicFunc | Logic | Logic | a logOP b | 0 |
| 6 | x | x | x | reset | Logic | Ready | 0 | 0 |
| 7 | a | b | x | mathFunc | Logic | Math | a mathOP b | 0/1 |
| 8 | x | x | 0 | no-op | Math | Math | prev. output | 0 |
| 9 | a | b | 0 | mathFunc | Math | Math | a mathOP b | 0 |
| 10 | x | x | 1 | error | Math | Error | x | 1 |
| 11 | x | x | x | reset | Math | Ready | 0 | 0 |
| 12 | a | b | 0 | logicFunc | Math | Logic | a logOP b | 0 |
| 13 | x | x | 1 | reset | Error | Ready | 0 | 0 |
| 14 | x | x | x | no-op | Ready | Ready | 0 | 0 |
| 15 | x | x | x | reset | Ready | Ready | 0 | 0 |
| 16 | a | b | x | mathFunc | Ready | Math | a mathOP b | 0/1 |
| 17 | a | b | x | LogicFunc | Ready | Logic | a logOP b | 0 |