|  |  |  |  |
| --- | --- | --- | --- |
| Signal Name | Direction | Bits | Description |
| clk | in | 1 | clock |
| rst | in | 1 | reset |
| filter\_aud\_in\_lft | in | 16 | left parllel digtal audio |
| filter\_aud\_in\_rgt | in | 16 | right parllel digital audio |
| filter\_aud\_in\_rts | in | 1 | ready to send |
| filter\_aud\_in\_rtr | out | 1 | read to receive |
| filter\_aud\_out\_lft | out | 16 | left parllel digtal audio |
| filter\_aud\_out\_rgt | out | 16 | right parllel digital audio |
| filter\_aud\_out\_rts | out | 1 | ready to send |
| filter\_aud\_out\_rtr | in | 1 | read to receive |
| rf\_filter\_shift | in | 4 | number of bit postions to shift after filter accumulator |
| rf\_filter\_clip\_en | in | 1 | 1- performs clipping 0- no cliping |
| rf\_filter\_coeff# | in | 16 | filter coeffecient |

Filter Block

Interfaces

Functional Requirements

Data Plane Requirements:

* Both filter\_aud\_in\_lft and filter\_aud\_in\_rgt will be outputted from the register block into a FIFO.

Control Plane Requirements:

* If filter\_aud\_in\_rts and filter\_aud\_in\_rtr (x units) are both on data will be sent into transferred into the FIFO. In addition, the rf\_filter\_coeff# will be inputted into a FIFO corresponding with the x unit.
* The accumulator precision will be 40 bits and will be rounded, barrel shifted, and clipped and returned as a 16 bit value.
* Since the accumulator is 40 bits, there is a low chance for overflow

Control and Status Interfaces Bit Description:

* Control Bits:
  + rf\_filter\_clip\_en: if on clipping will be performed
* Status Bits:
  + filter\_aud\_in\_rts: input register asserts ready to send
    - (write enabled)
  + filter\_aud\_in\_rtr: input FIFO asserts ready to receive
    - (fifo is not full)
  + filter\_aud\_out\_rts: accumulator is ready to send
    - (fifo is not empty)
  + filter\_aud\_out\_rtr: output FIFO asserts ready to receive
    - (read enabled)

Micro-architecture

filter\_convolution.v

filter\_accumulator.v

filter\_fifo.v

filter\_round\_shift\_clip.v

Design

Verification