Dedicated processor core for sustained real-time, area-efficient implementation of the FFT/IFFT, Windowed FFT, and FFT-based fast convolution operators. The FFT/WinFFT/Convolver processor core is a complete, self-contained, synthesizable model capable of implementing a variety of transform-based signal processing tasks. Flexibility has been designed into this core to implement any one of the three functions: FFT/IFFT, a windowed FFT, or a merged FFT-Spectral Multiply-IFFT fast convolution. Complex butterfly stages are automatically scaled (AAS method) to avoid internal overflow. The core supports continuous periodic or non-periodic block processing and provides burst processing interface support. Parameterized wordlength datapaths provide high resolution support.

**FUNCTION**

**PARAMETER DESCRIPTION**
- **cwidth**: Twiddle factor wordlength for real or imaginary part
- **intwidth**: Internal butterfly wordlength for real or imaginary part
- **inwidth**: Input wordlength for real or imaginary part
- **mem_type**: Memory implementation
- **number_of_pts**: Number of FFT points
- **outwidth**: Output wordlength for real or imaginary part
- **pipe_subword**: Number of bits in pipeline wordlength
- **rom_synth**: Twiddle ROM implementation
- **round_type**: Type of rounding
I/O Ports

- **clk**: Sample clock
- **dir**: Transform direction (FFT or IFFT)
- **fftin**: Complex input signal
- **fftout**: Complex output signal
- **fftready**: Indicates sample input readiness
- **h_idx**: Frequency index of corresponding hin spectral sample (convolver)
- **hin**: Complex frequency response values of fixed convolution sequence (convolver)
- **h_wen**: Load spectral sample signal (convolver)
- **ovf**: Indicates an overflow condition
- **out_idx**: Index associated with each output sample
- **outvalid**: Indicates valid output interval
- **rst**: Synchronous reset signal
- **sync_in**: Starts an FFT cycle
- **sync_out**: Indicates first valid FFT output sample
- **w_idx**: Time domain index of corresponding win sample (win FFT)
- **w_wen**: Load window coefficients signal (win FFT)
- **win**: Complex window coefficients (win FFT)

Conceptual Diagram

Example Performance Specifications

<table>
<thead>
<tr>
<th></th>
<th>FFT/IFFT1</th>
<th>FFT/IFFT2</th>
<th>FFT/IFFT3</th>
<th>FFT/IFFT4</th>
<th>FFT/IFFT5</th>
<th>FFT/IFFT6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Points</strong></td>
<td>512</td>
<td>512</td>
<td>1024</td>
<td>1024</td>
<td>2048</td>
<td>2048</td>
</tr>
<tr>
<td><strong>Intern (bits)</strong></td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td><strong>Transform Period (µs)</strong></td>
<td>90</td>
<td>40</td>
<td>200</td>
<td>90</td>
<td>440</td>
<td>200</td>
</tr>
<tr>
<td><strong>I/O Sample Rate (Msps)</strong></td>
<td>5.7</td>
<td>12.8</td>
<td>5.1</td>
<td>11.4</td>
<td>4.7</td>
<td>10.2</td>
</tr>
<tr>
<td><strong>Gates</strong></td>
<td>19,400</td>
<td>25,300</td>
<td>21,000</td>
<td>27,000</td>
<td>22,000</td>
<td>29,000</td>
</tr>
</tbody>
</table>

*fast convolution times = 2x single transform times*

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