



### Overview

The **JetFx™-3000** Advanced Real-Time Visual Effect module is a turn-key solution that adds real-time visual effects to a sequence of digital pictures and videos. Based on Jetstream Media Technologies' patent pending technologies, the module generates professional, personalized, and fun visual effects while keeping low power consumption and small gate count.

The IP core is a fully programmable effect generator. Options are available for

- More effect categories
- Multiple-effect stacking
- Title styles and animation
- Scene change detection

The optional embedded software module performs the selecting and the loading of the effects. The software inserts transitions, titles, color filter effects and animations to the sequence of digital pictures / videos, either automatically or according to a programmed sequence.

The core is available for licensing in both source and netlist form.

### Applications

- Digital picture frame
- Portable photo/video viewer
- Digital camera
- Diskless camcorder
- DVD recorder
- TV with memory card playback

### Features

- Turn-key solution consists of
  - Effect generation silicon IP core
  - Effect selection embedded software
- Offloads the embedded processor from the complex effect generation task
- Delivers fun and fancy video effects
- Fully programmable effect generator
- Wide selections of transitions and effects
- Title styles and title animation
- Personalized effects
- Downloadable effects
- Simple user interface
- Real-time video output from small-screen LCD, SD to HD resolution
- IP core interface
  - Native interface
  - OCP interface
- Fully synchronous design
- Core is available in source code or in netlist

### Effect Examples

- Professional Transitions
  - Clip art transitions
  - 3D Rotate, stretch, zoom-pan, tumble-away transitions
  - Warping transitions
  - Broken glass, lightning, falling cow, camera shutter
  - Ball, water ripple, wavy transitions
  - Wipes, push, slide, iris transitions
- Color and Animation Effects
  - Clip art animation and picture frame
  - Color filter effects
  - Color shape animation
- Text Effects
  - Professional title rendering styles
  - Animated title effects
- Overlay
- Stackable effects

## 1. Background

The **JetFx<sup>TM</sup>-3000** is a user-friendly real-time video effect module. The module is a turn-key solution. It consists of an effect generation silicon IP core and an effect selection embedded software. The IP core offloads your embedded processor from the complex calculations required by the effect generation and delivers fun and fancy video effects to consumer devices, at resolutions that go from small-screen LCD, SD to HD resolution. The embedded software provides an easy-to-use experience for effect selection, effect downloading, and personalized effect creation.

As consumers create digital content from camcorders, digital cameras, cell phones, web contents, DVD recorders and other devices, they are looking for new ways to present their content in a unique and exciting way. Today, there are only limited choices available to them. They may either use the limited build-in video effects offered by their capture or playback devices, or they can use a video editor software which requires time consuming transferring of all video contents to a computer before the editing. This also requires additional rendering time for the effect creation on the final video. Furthermore, creating personalized video effects requires a high-level of video editing skills and a considerable amount of editing time. Therefore, neither choice leaves the consumer with a satisfying experience. Consumers are looking for a simple way to add professional and personalized video effects.

At the center of Jetstream Media Technologies' video products is its patent-pending JetFx architecture. With its innovative programmable video effect generator, JetFx is able to perform effect algorithms such as video warping, color filter, 3D rotation, repetition, colored shape animation, clip art animation, and many more in real-time. These effects typically require a series of complex calculations that Jetstream Media Technologies has been able to streamline into a highly efficient IP core.

JetFx<sup>TM</sup>-3000 provides consumers with fun and fancy video effects and an easy-to-use experience while relieving your embedded processor from the effect generation task.

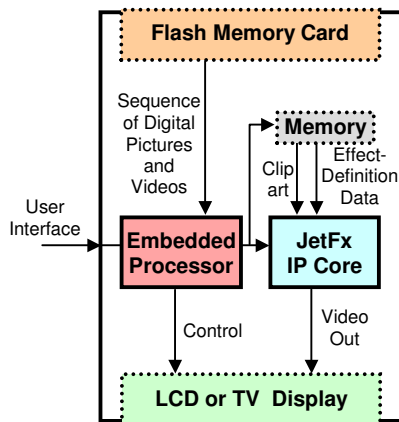
## 2. Functional Description

JetFx<sup>TM</sup>-3000 generates video effects according to effect-definition data. It consists of two components:

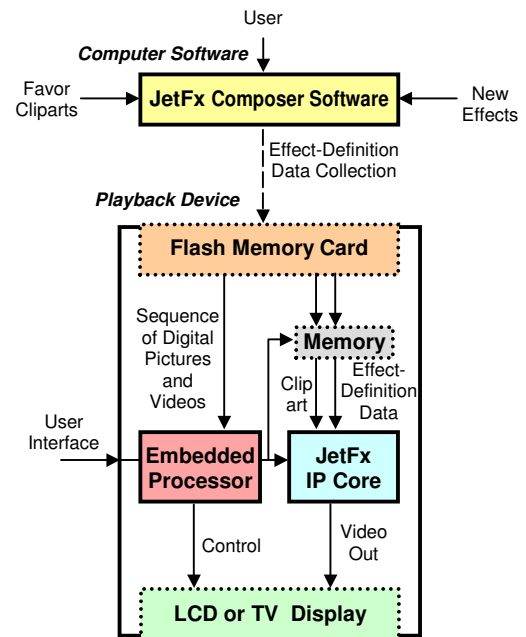
- JetFx embedded sequencer software
- JetFx IP core

Figure 1 illustrates an application example – a playback device with pre-loaded effects. Through simple user interface of the device, users turn on or off the effects, or select a group of effects.

The pre-loaded effects (i.e. their effect-definition data) are stored in the memory permanently. With the help of the embedded processor, the embedded “sequencer” software feeds the JetFx IP core with the effect-definition data from the memory. The memory is also used to store clip arts and images for transitions. Transitions will be inserted when the picture or video changes, while animations may be inserted elsewhere. JetFx IP core receives a sequence of images or video frames and renders the selected effect in the sequence of output video frames.



**Figure 1. JetFx-3000 Application Example Playback Device with Preloaded Effects**



**Figure 2. JetFx-3000 Application Example Playback Device with Personalized Effects**

Figure 2 illustrates another application example – a playback device with personalized effects. In this case there is an optional third component – the JetFx composer software as shown in Figure 2.

With JetFx composer software, users can pick favorite cliparts, e.g. pictures of a pet or a butterfly. In addition, users can select the text, font and rendering style they want to appear in the playback device. The software generates the effect-definition data collection accordingly and stores it in a flash memory card. The memory card also stores the users' digital photos and videos for playback.

Similar to the last example, the embedded processor feeds the JetFx IP core with the effect-definition data from the memory. The JetFx IP core receives a sequence of images or video frames and renders the selected effect in the sequence of output video frames.

Each component is described in detail in the next section.

## 2.1 JetFx Composer Software

The composer software running from a computer performs the following functions:

- It stores the effect definition data to flash memory
- It creates of effect-definition data collection
- It allows the download of effects
- It easily creates text from a wide selection of professional title styles and fonts
- It easily creates clip art animations
- It easily creates clip art-based transitions.

## 2.2 JetFx Embedded Sequencer Software

The embedded effect sequencer software performs the following functions:

- Reads the effect definition data from flash memory
- Feeds the JetFx IP core with the effect definition data
- Uses the downloaded clip art to create animated transitions and effects.

## 2.3 JetFx IP Core

The JetFx IP core receives effect-definition data via the embedded processor and generates the effect accordingly. Its block diagram is shown below. It is followed by a brief functional description of each block.

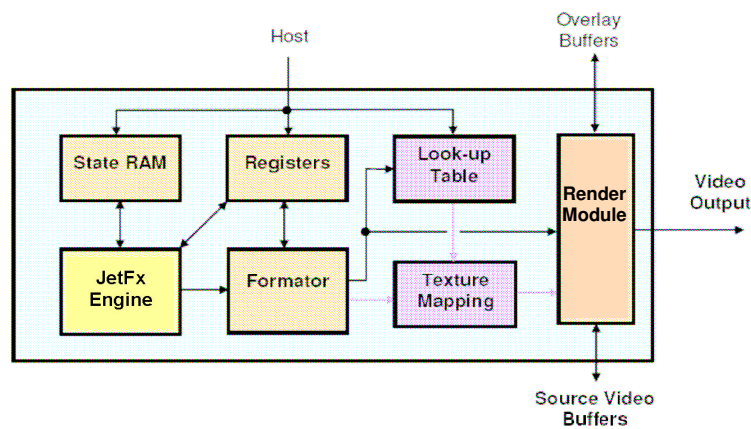


Figure 3. JetFx IP Core Block Diagram

The **JetFx Engine** performs computationally intensive calculations needed to manipulate pixels according to the effect definition data received from the host. Its functions are:

- Computes rendering data for texture mapping, highlight and shading
- Performs warping and transformation
- Creates geometries and shapes
- Allows for selective repetition of effects across the video screen.

The **State RAM** stores effect definition data before the effect begins. During the effect, it stores the modified effect definition data for the next frame or next field.

**Registers** store additional effect-definition parameters.

The **Formator** converts the output of the JetFx Engine into pixel coordinates and look-up table index. It manipulates data to assist many animated effects. It also performs a visibility test for output pixels within an animated object.

**Texture Mapping** finalizes the source pixel coordinates. It adjusts the coordinates using offset. It also tests source coordinates within a tile area in the source video.

The **Look-Up Table** stores additional effect related data.

The **Render Module** performs the following functions:

- Receives colors of pixels from the video buffer and overlays bitmap buffer
- Performs color filter effects
- Creates the right color according to highlight, shading, shadow, anti-aliased edge.

### 3. Core IO

Two sets of core IO pin-out diagrams and pin descriptions are listed in this document.

- The pin-out of OCP wrapper for JetFx (i.e. Open Core Protocol, [www.ocpip.org](http://www.ocpip.org))
- The native pin-out of JetFx.

The pin-out consists of two parts: master part and slave part. When receiving the effect-definition data, JetFx acts as a OCP slave. Once the effect rendering begins, the Render Module acts as a master to receive video data.

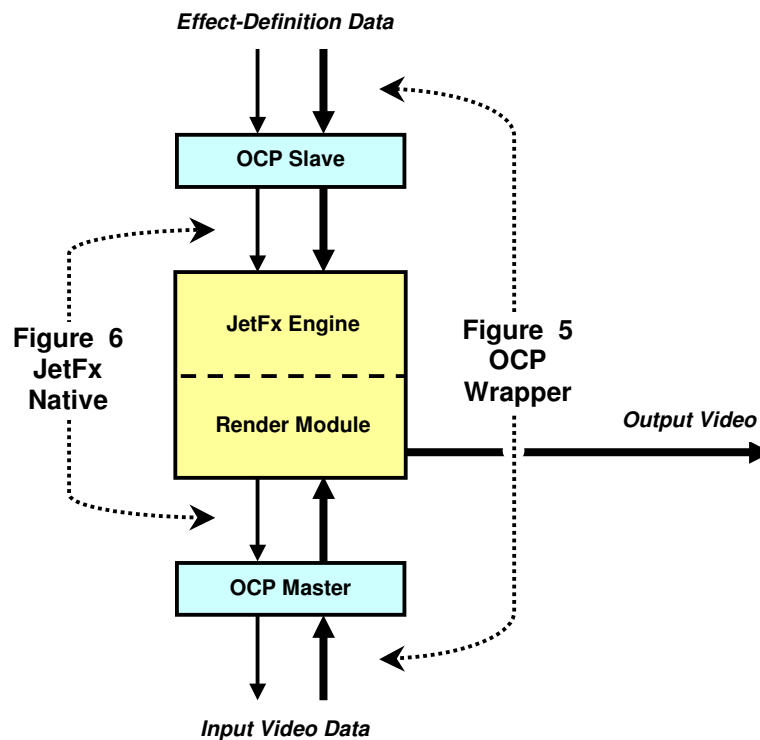


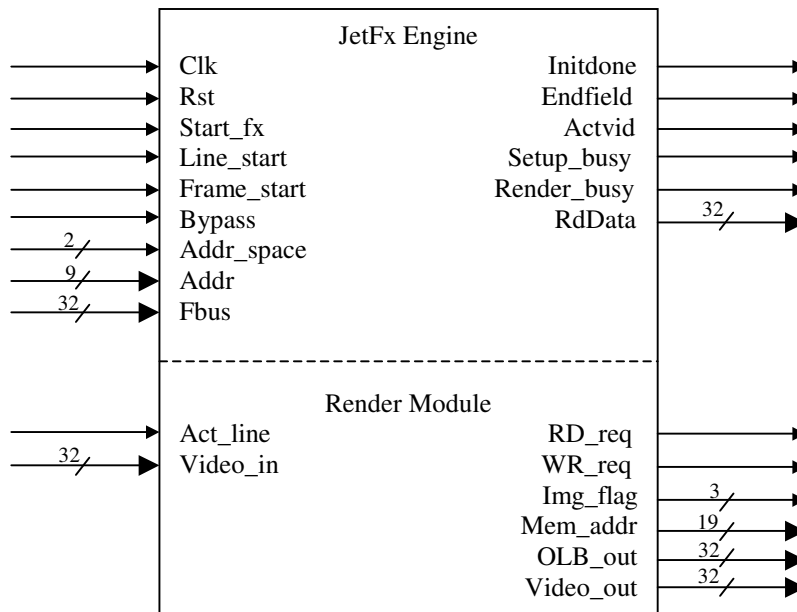
Figure 4. OCP Master and Slave



**OCP Master I/O Pins**

<b>Signal from Slave – Inputs from Bus Interface Wrapper</b>			
ScmdAccept	1	I	1 means slave accepts master's transfer request
SData	32	I	Data returned by the slave
SResp	2	I	Response field from the slave
<b>Signal to Slave – Inputs to Bus Interface Wrapper</b>			
MCmd	3	O	Transfer command generated by the master
MAddr	19	O	Read/Write address generated by the master
MAddrSpace	3	O	Indicates which video buffer is to be read/written
MData	32	O	Write data generated by the master
MDataValid	1	O	Write data valid
Video_in	32	O	Pixel color read from memory
Output_video	32	O	Pixel color output

**3.2 JetFx Native Interface to OCP Wrapper**



**Figure 6**

**JetFx Interface to Slave Wrapper I/O Pins**

<b>Signals to JetFx Engine</b>			
Clk	1	I	Global clock
Rst	1	I	System reset
Start_fx	1	I	Begin Fx
Line_start	1	I	Start of scan line
Frame_start	1	I	Start of frame
Bypass	1	I	Bypass mode for the video
Addr_space	2	I	To select registers, state RAM or look-up table
Addr	9	I	Address for registers, state RAM or look-up table
Fbus	32	I	Effect-definition data loading bus
<b>Signals from JetFx Engine</b>			
Initdone	1	O	Indicate that the initialization process is completed
Endfield	1	O	End of video field
Actvid	1	O	Video output pixel enable
Setup_busy	1	O	Loading data from external master
Render_busy	1	O	Rendering the current video frame/field
RdData	32	O	Read data bus for observability

**Render Module interface to Master Wrapper I/O Pins**

<b>Signals to Render Module</b>			
Act_line	1	I	Active region of line
Video_in	32	I	Video read from SRAM or DRAM
<b>Signals from Render Module</b>			
RD_req	1	O	Read signal
WR_req	1	O	Write signal
Img_flag	3	O	To select different video buffers
Mem_addr	19	O	Memory address of video buffer
OLB_out	32	O	Overlay buffer write data
Video_out	32	O	Pixel color output

### Implementation Results

An example of implementation statistics for the JetFx<sup>™</sup>-3000 with OCP wrapper is shown below.

Xilinx Family	Device	Slices	BRAM	I/O
Virtex-II Pro <sup>™</sup>	XC2VP20-7	3251	5	248

### Support

Ninety days of phone and email technical support are included. Additional maintenance and support options are available.

### Verification

The JetFx<sup>™</sup>-3000 IP core has been thoroughly simulated and verified on Xilinx FPGA hardware.

### Deliverables

The core is available in soft IP form, either as a Netlist or HDL Source. The deliverables include:

- For **Netlist Licenses** : Target specific net list
- For **HDL Licenses** : Fully synthesizable RTL Verilog source
- Test bench
- User documentation
- Optional hardware video effects demo board (Xilinx-based) available.

### More Information

For more detailed information on this or any other Jetstream Media Technologies products and services, please contact us and we will be pleased to discuss how we can assist you with your individual requirements.

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