



Mobile Graphics Solutions



Overview

The Think2D Graphics Engine is a Graphics subsystem for SoC and Mobile Devices for the acceleration of 2D content.



It is capable of targeting multiple types of surfaces, seamlessly move raster images, accelerate drawing of lines and filled rectangles and perform alpha blending in all surface modes.



Ease of System integration is ensured by utilising industry standard AHB bus interface.



Acceleration features can be immediately exploited by using the DirectFB framework.

Features

- ▶ Modular Design based in AMBA interface for easy SoC Integration
- ▶ AMBA 1xSlave for Register Programming
- ▶ AMBA 2xMaster for Connection to Framebuffer and source surfaces
- ▶ Pure Synthesizable Verilog RTL
- ▶ High Performance Rendering Engine 1-2 pixels/clock cycle
- ▶ Evaluation board (Altera FPGA) available
- ▶ Command List DMAs to minimise CPU overhead
- ▶ Blending, Colour keying, Dithering, Image Scaling/Rotation
- ▶ 2D Drawing Engine
 - ▷ Pixel Drawing
 - ▷ Line Drawing (any direction)
 - ▷ Filled Rectangles
- ▶ Colour formats
 - ▷ RGBA8888
 - ▷ RGB565
 - ▷ RGBA5551
 - ▷ RGBA4444
 - ▷ Lum8
 - ▷ A8
 - ▷ A1
 - ▷ YUV (YUY2, UYVY)
 - ▷ Colour format conversions
- ▶ Full Alpha Blending
 - ▷ Porter-Duff Blending modes
 - ▷ DirectFB Blending Modes
 - ▷ Configurable Clipping Rectangle
 - ▷ Destination Colour keying
- ▶ Blitter Engine

Think 2D Graphics Accelerator

Core	Think 2D
Resolution	any*
Speed	up to 2 pixels / clock
Process	Independent RTL
Rectangle Fill	✓
Line Drawing	✓
Pixel Draw	✓
Triangle Draw (gouraud shaded)	optional
32 bit formats RGBA8888, ARGB etc.	✓
16 bit formats RGB5551, 565, 4444 etc.	✓
8 bit Grayscale, 332 etc.	✓
Alpha support	✓
Blitter	✓
Stretched Blit	✓
Source color key	✓
Destination color key	✓
Dithering support	✓
Image Scaling	✓
Porter - Duff Blending	✓
90, 180, 270 deg rotations	✓
Mirror X, Mirror Y	✓
Colour format conversions	✓
Negative addressing	✓
YUY2 support for video	✓
Clip Window	✓
Configurable Endianness	0
AHB Master DMA I/f	✓
AXI Master DMA I/f	optional
Synthesizable RTL	✓
Linux Kernel Drivers	✓
DirectFB 1.4 Drivers	✓
Qt 4.6/4.7 support	✓
Available	now

✓ Standard feature, 0 Design Time option, - Not Available, * up to 32768 x 32768

Software Support

- ▶ Linux
- ▶ DirectFB
- ▶ Qt

Blitter

- ▶ High performance DMA Blitter moves raster images in memory
- ▶ Colour Conversion to image format on-the-fly
- ▶ Direct Support for transparency to improve performance and quality
- ▶ Source Colour Keying
- ▶ Supports 90, 180, 270, Mirror-x, Mirror-y degrees rotation

Applications

- ▶ PDA (Personal Data Assistants)
- ▶ Mobile Phones (low-end)
- ▶ GPS Navigators
- ▶ InCar Information/Entertainment
- ▶ Low-end 2D Game Machines
- ▶ Set-Top Boxes
- ▶ Remote Display Boards

Benefits

- ▶ Pure Synthesizable RTL
- ▶ Software Kernel Drivers
- ▶ Minimal host CPU utilisation

Blitter

- ▶ High performance DMA Blitter moves raster images in memory
- ▶ Image format Colour Conversion on-the-fly
- ▶ Stretching on the x and y axis
- ▶ Source Color Keying

2D Drawing Engine

- ▶ Pixel Drawing
- ▶ Line Drawing (any direction)
- ▶ Filled Rectangles

Pixel Blending / Clipping

- ▶ Configurable Clipping Rectangles
- ▶ Porter-Duff Blending on any source/destination colour surface

Colour Formats

- ▶ RGBA8888
- ▶ RGB565
- ▶ RGBA5551
- ▶ RGBA4444
- ▶ RGBA332
- ▶ L8
- ▶ YUV
- ▶ custom

VGA/LCD Controller (optional)

- ▶ Support of RGB888, RGB565, L8, 8-bit palette modes and others
- ▶ Supports any resolution including 320x200, 640x480, 800x600, 1024x768 and higher, depending on silicon performance
- ▶ Internal AHB DMA Engine
- ▶ Support for 256 pseudocolour
- ▶ Configurable timing using Modeline parameters
- ▶ Configurable number of HW Sprites for Pointers and Cursors

SNAPSHOTS

Rotating Pictures

Blitting



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