

# Isabel: SAGA Video Core



## Overview

The SAGA Core contains the **Isabel** Core, which is a hugely improved version of the graphics chipset (AGA) that was used in classic Amigas.

**Isabel** provides both **chunky** and **planar (native)** screen modes.

**Planar (native) modes** are only available in Core version  $\geq$  GOLD3 (as in the Vampire Standalone).

## Features

- **Chunky plane** that can be displayed on its own by any dedicated RTG driver.
- Supported **resolutions**: Any valid mode from 320×200 to 1920×1080.
- Supported **color depths**: 8, 15, 16, 24, 32 bits.
- Supported **pixel formats**: CLUT8, RGB15, RGB16, RGB24, RGB32, YUV422.
- Hardware-accelerated video playback.
- Picture-in-picture support, for embedding a virtual screen in a window.
- **Fast** Akiko C2P routines. <sup>1)</sup>
- FrameBuffer can be **any address** from accessible FastRAM.
- FrameBuffer can be **Read and Write**, for Direct Hardware drawings.
- Ability to turn on **scanlines** in certain modes.

## Planar (Native) Graphics

- Support for **all original AGA modes**.
- New enhanced mode with **10 planes**.
  - Two of those planes can be switched to **chunky** mode.
  - All planes are controllable by Copper.
  - Both **little-endian** and **big-endian** representations are allowed.
- Support for **all original AGA “hardware sprite” features**.
- New enhanced **“hardware sprite” features**.
  - **16** sprite DMA channels are available.
  - Sprites can be up to **32 pixels wide**.
  - Each sprite can have **16 colors**, with its own, independent palette.

- Collision detection is done for each sprite pair **separately**.
- Thanks to **sprite indirection**, you can change a sprite's data extremely fast, just by changing a pointer instead of copying a whole memory region.
- Support for **all original AGA Copper features**.
- New enhanced **Copper features**.
  - You can perform a 32-bit move with a **single** instruction, which **doubles** the speed.
- **Third** playfield.
- Support for up to **12 MB** of ChipRAM.
- **Fast** screen updates due to accessing ChipRAM at FastRAM speeds.
- **High memory bandwidth** thanks to 128-bit DMA.
- **Fast** Blitter operations.
- Support for Atari planar modes.

## Chunky VIDEO registers

The FrameBuffer of the Chunky Video Mode can be **any** address from accessible FastRAM, by specifying the SAGA\_VIDEO\_PLANEPTR register. The FrameBuffer is **Readable and Writable**, for faster Direct Hardware drawings.

Register	Name	Access	Size	Description
DFF1EC	<a href="#">saga_video_planeptr</a>	W	ULONG	Set the SAGA Video <b>FrameBuffer Address</b>
DFF1F4	<a href="#">saga_video_mode</a>	W	UWORD	Set the SAGA Video <b>Mode</b>

The Chunky Video mode can accept virtually any resolution from 320×200 (LowRes) to 1920×1080 (1080p). The video engine can be dynamically reconfigured at any time by filling a valid ModeLine.

Register	Name	Access	Size	Description
DFF1F8	<a href="#">saga_video_pllw</a>	W	UWORD	Set the SAGA ModeLine <b>PIXELCLOCK</b>
DFF1FA	<a href="#">saga_video_pllr</a>	R	UWORD	Set the SAGA ModeLine <b>PIXELCLOCK</b>
DFF300	<a href="#">saga_video_hpixel</a>	W	UWORD	Set the SAGA ModeLine <b>HPIXEL</b>
DFF302	<a href="#">saga_video_hsstrt</a>	W	UWORD	Set the SAGA ModeLine <b>HSSTRT</b>
DFF304	<a href="#">saga_video_hsstop</a>	W	UWORD	Set the SAGA ModeLine <b>HSSTOP</b>
DFF306	<a href="#">saga_video_htotal</a>	W	UWORD	Set the SAGA ModeLine <b>HTOTAL</b>
DFF308	<a href="#">saga_video_vpixel</a>	W	UWORD	Set the SAGA ModeLine <b>VPIXEL</b>
DFF30A	<a href="#">saga_video_vsstrt</a>	W	UWORD	Set the SAGA ModeLine <b>VSSTRT</b>
DFF30C	<a href="#">saga_video_vsstop</a>	W	UWORD	Set the SAGA ModeLine <b>VSSTOP</b>
DFF30E	<a href="#">saga_video_vtotal</a>	W	UWORD	Set the SAGA ModeLine <b>VTOTAL</b>
DFF310	<a href="#">saga_video_hvsync</a>	W	UWORD	Set the SAGA ModeLine <b>HVSYNC</b>

When the SAGA\_VIDEO\_MODE is set to SAGA\_VIDEO\_FORMAT\_CLUT8, a palette should be defined by filling the 256-color lookup table. Each color is 32-bits long, in the ARGB format.

Register	Name	Access	Size	Description
DFF400	<a href="#">saga_video_clut</a> [0]	W	ULONG	Set the SAGA CLUT8 <b>Color #001</b>
DFF7FC	<a href="#">saga_video_clut</a> [255]	W	ULONG	Set the SAGA CLUT8 <b>Color #256</b>

## Chunky ModeLine description

[Universal ModeLine Calculator](#) (UMC for AmigaOS 3.x, available on Aminet) can be used to generate a valid ModeLine for a given resolution. For example, we can ask UMC for a valid ModeLine for a 800x600@60Hz resolution. Just type the following line (add the - - rbt option for a reduced framebuffer):

Example of a **standard** ModeLine:

```
> umc 800 600 60
```

```

          "MODENAME"      PIXELCLOCK HPIXEL  HSSTRT  HSSTOP  HTOTAL  VPIXEL  VSSTRT
VSSTOP  VTOTAL  HVSYNC
Modeline "800x600@60" 38.400000 800    832    912    1024    600    604
608    625    -HSync +VSync

```

Example of a **reduced** ModeLine:

```
> umc 800 600 60 --rbt
```

```

          "MODENAME"      PIXELCLOCK HPIXEL  HSSTRT  HSSTOP  HTOTAL  VPIXEL  VSSTRT
VSSTOP  VTOTAL  HVSYNC
Modeline "800x600@60R" 35.500000 800    848    880    960    600    603
607    618    -HSync +VSync

```

ModeLine values description:

Attribute	Short	Description
PIXELCLOCK	Bandwidth (MHz)	How many dots it can output per second.
HPIXEL	Width	Number of horizontal pixels drawn to the visible part of the screen.
HSSTRT-HPIXEL	Front Porch	Amount of black pixels drawn to the right of the screen.
HSSTOP-HSSTRT	Sync Pulse	Amount of time it takes to start another line.
HTOTAL-HSSTOP	Back Porch	Amount of black pixels drawn to the left of the screen.
VPIXEL	Height	Number of vertical pixels drawn to the visible part of the screen.
VSSTRT-VPIXEL	Front Porch	Amount of black pixels drawn on the bottom of the screen.
VSSTOP-VSSTRT	Vertical Sync	Amount of time it takes to move back up to the first line of the screen.
VTOTAL-VSSTOP	Back Porch	Amount of black pixels drawn to the top of the screen.
HVSYNC	Flags	Sync Polarity. HSync on High Byte, VSync on Low Byte.

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<sup>1)</sup> Akiko C2P is only available on the Vampire 1200 V2 and the Vampire Standalone, because it is only

useful for AGA-compatible Amigas.

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