

Elpin Systems'

VGA Core Development Tools

Overview

Current PC graphics architecture requires that the vendor, while providing a high-resolution, accelerated, cost effective graphics solution, must also provide at least a minimal level of compatibility with the VGA standard. This is demonstrated time and again when even the newest versions of the most popular PC operating systems, such as Windows NT, OS/2, and Windows 95, require VGA compatibility during initialization and critical error handling. Even if a graphics chip set is targeted at specific sectors of the PC industry (e.g. 3D or MPEG video), vendors are expected and therefore *are required to provide a VGA-compatible solution*.

Since VGA compatibility is a necessary piece, but is not the main feature of most graphics solutions, it is important to develop a VGA core as accurately and quickly as possible without distracting attention away from the main focus of the graphics product: namely, price and performance. For development teams with an existing VGA model or with internal VGA expertise, the **VGA Core Test Suite** provides an excellent way of checking the design against a compatible standard. For development teams starting without a VGA model, the **VGA Core Sample Implementation** provides a working model that is capable of producing "golden image" files for comparison with simulation output.

By providing a well-documented description of the VGA, a development team can design an implementation that best fits their environment and best suits their target market.

VGA Core Test Suite

Features

- 92 Compatibility Tests
 - Each bit of the standard VGA is tested for functionality
 - Tests each VGA controller separately (CRTC, GDC, Sequencer, Attribute Controller, RAMDAC)
 - BIOS independent
 - Includes inter-block testing
 - Includes undocumented registers
 - Includes BIOS fonts and parameter tables
 - Includes table of contents and index for easy look up of tests
 - Compatibility standard is the IBM PS/2 Model 70
- Each test is documented and pseudo-coded for easy translation to simulation environments
- All tests use an "abstraction layer" for VGA accesses (memory and I/O) for easy porting to simulation environments
- Each test is implemented in "C" for easy modification and execution on existing hardware
- Source code included
- Training available

Description

"VGA Compatibility" is defined as behavior that is functionally similar to that of the motherboard VGA on the IBM PS/2 Model 70. Variations from this standard are defined as "incompatibilities" except during initialization of an adapter VGA where the differences are documented in the "Setup" chapter.

All of the tests are "functional tests"; that is, they test the functionality and behavior of a particular portion of the VGA. Some tests are very simple, such as the "CRTC Write Protect" test. Specifically, this test verifies access to various CRTC registers based on the write protect bit in CRTC index 11h. Other tests are more complex, such as the "Panning" test. This test verifies the interplay of the vertical sync pulse and several internal counters involving pixel panning, byte panning, and address start.

Description (cont.)

All tests direct access the VGA hardware. Although VGA BIOS behavior is mimicked in many of the tests, **no VGA BIOS calls** (including mode sets) are made during the tests.

The tests are compiled and tested using Microsoft Visual C++ 1.5 for the physical tests. When linked to the **VGA Core Sample Implementation**, Microsoft Visual C++ 2.0 and 4.0 have also been used. The tests make no judgment as to the importance of a given VGA feature, only testing how that feature should behave.

VGA Core Sample Implementation

Features

- Links into **VGA Core Test Suite** for verification
- Entire VGA is modeled (except states with real time dependence)
- Implemented in "C++" for easy modification and testing
- Screen output is in a standard image file format (Windows BMP's)
 - Screen output generation available on any frame
 - Includes golden images for all tests (in "small frame" and "standard frame" formats)
 - Generates 8-bit (pre-RAMDAC) or 24-bit (post-RAMDAC) images
 - Timing data (sync, blank) can be included in image data
- Complete documentation
 - Includes register specification
 - Includes functional block diagram
 - Documents each functional block
- Bitmap Comparison Utility
- Training available

Description

The entire register and memory interface is modeled in a linkable library. Several functions are provided to assist in linking to the library for I/O writes, I/O reads, video memory writes, and video memory reads. Other "management" functions are provided to set the type of image to be generated, to generate a frame (create a .BMP file), and to set a given state (e.g. wait for vertical retrace).

Each block of the VGA is emulated in functional modules as close to the original VGA as possible. The **VGA Core Sample Implementation** is compiled and tested using Microsoft Visual C++ 1.5 but has also been tested with versions 2.0 and 4.0. The model makes no judgment as to the importance of a given VGA feature, only describing how that feature behaves.

Other Elpin Systems, Inc. Products

- VGA BIOS w/ VESA BIOS Extensions (VBE 3.0)
- VGA BIOS Test Program
- ANSI.SYS
- VGA Diagnostics Tool
- VGA Core RTL Model

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