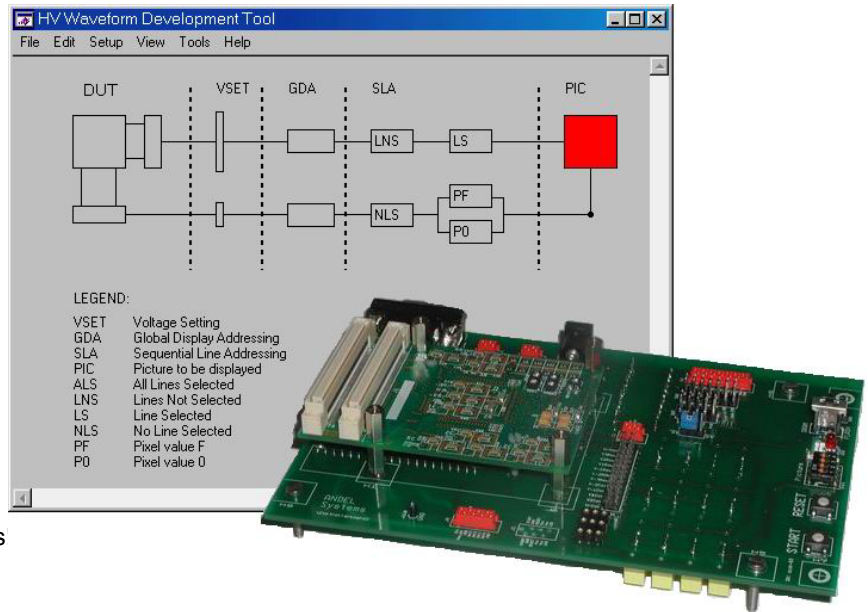


Features

- GUI interface under Windows
 - Drive scheme editor
 - Waveform editor
 - Import of Bitmap
 - Energy calculation
 - Hardware Driver Kit
 - RS232 interface
 - Fast speed connector for display
 - Possibility for external voltage sources
 - Powered by Alpha3D driver chip
 - 1/16 VGA waveform generator
 - 7 HV row levels + gnd
 - 5 HV col levels +gnd
 - gnd to 100V line drive
 - 4-bit PWM gray levels for columns
 - 12 integrated 3.0V → 100 V generators
- ⇒ Maximum flexibility in waveform synthesis



Description

The Waveform Development Tool addresses the unique needs of “non-volatile reflective display systems”-developers. It consists of a 120X160 output waveform generator, based on our special developed Alpha3D chip, and a user-friendly GUI under Windows®. Intended for developing and prototyping different types of high-voltage display systems, it features maximum flexibility in waveform synthesis in order to achieve maximum optical performance at minimum power consumption.

The GUI interface under Windows®

The **Drive Scheme Editor** allows the user to synthesize the driving schemes simply by connecting different types of icons, on the screen. This is illustrated in the picture above. Each icon represents certain functionality. By double clicking on the icons, their properties can be modified in a pop-up window. By concatenating the available icons in a correct way, existing driving schemes as well as new driving schemes can be synthesized very fast.

The different waveforms are entered using the **Waveform Editor** shown. Each line time can be divided in an arbitrary number of time steps. Single- and multi-line driving schemes are possible allowing conventional and dynamic driving schemes. It also features a method to create PWM gray levels.

A **Picture Editor** allows importing images using the popular BMP format.

As an option, a tool can be included to calculate the energy required to put an image on the Display Under Test (DUT) using the specified driving schemes and waveforms.

Hardware Driver Kit

For easy interchange and upgrade, the hardware driver kit consists of three separate PCB boards, stacked on each other using fast speed connectors.

The **µcontroller board** at the bottom communicates with the PC using a standard RS232 interface and buff-

ers the data in SRAM or FLASH prior to controlling the Alpha3D chip.

The Alpha3D ASIC is mounted on a separate **carrier board** and contains the necessary side electronics for the HV generation.

The **interface board** (not shown on picture) connects with the carrier board using a 280-pin fast speed connector, making it easy exchangeable. The standard interface board has flat cable connectors. Custom interface boards can be made however containing e.g. flex connectors or other interface solutions. This allows maximum flexibility towards the display interconnect choice.

Due to its small portable size (6.3” x 3.9” x 2.8”), the hardware driver board is ideal to drive demonstrators on e.g. display product exhibitions.

Alpha3D driver chip

The Alpha3D ASIC is specially designed for the “Waveform Development Tool” and small volume prototyping. It contains all the necessary electronics to test the designed driving schemes on a real display. For more technical details, the reader is referred to the preliminary product information of Alpha3D.

⇒ All these features are incorporated on a single platform to shorten the design and optimisation cycle time of reflective non-volatile display systems and the corresponding new display addressing schemes.

HV Waveform Development Tool



Functional description

The software

The following icons are currently available in the **Drive Scheme Editor**:

-**DUT** (Display Under Test): Contains the display properties.

-**DR** (Driver): The rectangles on the right-hand side and below the DUT represent the row and column driver respectively.

The other available icons define the driving scheme. They can be concatenated in arbitrary order and are executed in time from left to right:

VSET (Voltage Setting): Charges the internal DC/DC generators of the common row and column voltages at their set value and waits a set time before continuing.

GDA (Global Display Addressing): Addresses all the rows, respectively columns with the defined row/column waveform.

SLA_BW (Sequential Line Addressing, Black/White): Addressing scheme where 1 row receives the waveforms defined in the LS (Line Select) icon and all the other rows receive the waveforms defined in the LNS (Line Non Select) icon. The selected row sequentially shifts from the top to the bottom row. Each column receives the waveform defined in the P0 or PF icon, depending if the corresponding pixel in the selected image line is 0 or F (black/white). The image to be displayed is defined in the first PIC (Picture) icon following the SLA in the chain. This allows making Black/White driving schemes. It is possible to include before or after the LS icon an arbitrary number of PRE or POST icons. The rows preceding or following the selected row will then receive the corresponding waveforms, allowing e.g. dynamic driving schemes.

SLA_PWM (Sequential Line Addressing, PWM modulation): Is the same as SLA_BW, except that each column receives a waveform that is $N/15^{\text{th}}$ of the line time the value defined in P0 and $(15-N)/15^{\text{th}}$ of the line time the value defined in PF with $0 \leq N \leq 15$ the corresponding pixel value in the selected image line. This allows gray values. In this mode, no PRE or POST icons can be included.

PIC (Picture Editor): Defines the image that is to be displayed on the display using the driving scheme before the PIC icon. Allows importing pictures in the popular BMP format. Extra functionality is foreseen such as color filters and positioning.

These icons are a base set and can be concatenated as desired making existing or new driving schemes. New icons and functionality can be implemented on request.

The **Waveform Editor** pops up if one of the waveform icons (LS, LNS, PRE, POST, P0, PF) is double-clicked and allows editing the shape of the waveform. The available voltages are defined in the preceding VSET icon but can also be modified interactively in the waveform editor. Each line time can be divided in an arbitrary number of time steps allowing multi-phase driving schemes. The smallest time-step at this time equals 1ms for a full size (120x160) display.

The hardware

The Waveform Development Tool can address displays of maximum 120 rows and 160 columns.

Each row output is a multiplexing circuit selecting one voltage out of 7 high-voltage common row lines or a GND.

Each column output is a multiplexing circuit selecting one voltage out of 5 high-voltage common column lines or GND.

Each output can source max. 4mA and sink max. 1.5mA, the gnd switch can sink max. 12mA.

For a small voltage difference between a common line and a row/column output, the equivalent resistance is approximately 1.25k Ω for sourcing and 5k Ω for sinking.

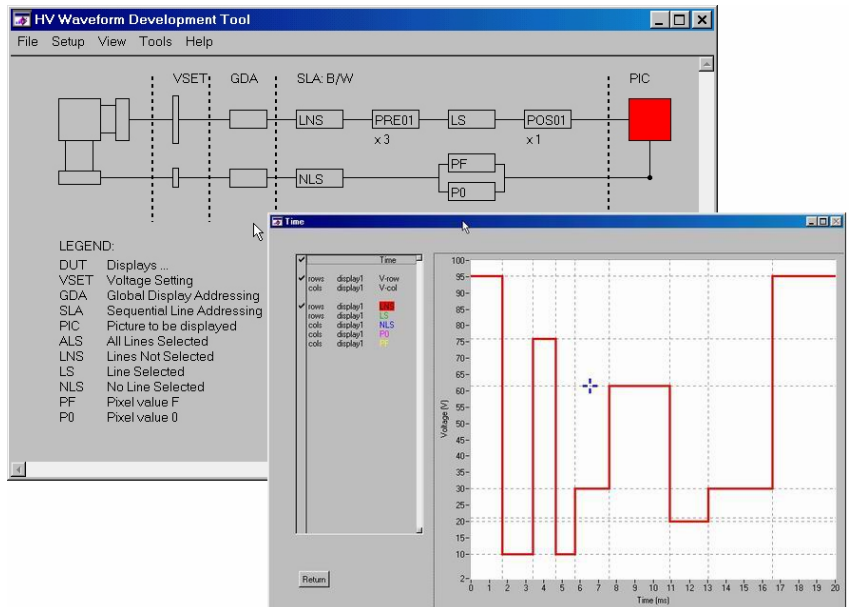
The safe operating range of the transistors in the row/column output is 0-100V. Below 0V, malfunctioning will occur. Above 100V degradation or even breakdown may occur.

The common row/column lines can use the 12 internal DC/DC converters or external voltage sources.

The DC/DC generators can generate voltages up till 110V. For safe operating, the maximum voltage is limited to 100V.

There are two modes for the internal DC/DC converters using the default frequency, coils and output capacitors:

- Mode 1: The converter can generate voltages between 3-100V
Maximum current 180 μ A @ 100V, 700 μ A @ 50V, 1.5mA @ 25V.
- Mode 2: The converter can generate voltages between 5-100V
Maximum current 800 μ A @ 100V, 2.2mA @ 50V, 5.0mA @ 25V.



HV Waveform Development Tool



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