

IGLOO[®] Video Demo Kit

User's Guide

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Printed in the United States of America

Part Number: 50200160-0

Release: April 2009

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Introduction

The IGLOO Video Demo Kit is a versatile development platform that demonstrates Actel's IGLOO FPGAs as flexible liquid crystal display (LCD) controllers for various functions. Additional reference designs are provided with the demo kit for the customer to use in developing customized display functions using IGLOO FPGAs. With Flash*Freeze power measurement circuitry in place, the power consumption of the device can be validated on this platform. The kit can help shorten product development cycle by leveraging the interchangeability of various LCD display and possible applications.

Customized LCD Controller

Unlike the LCD controller chips in the market with dedicated predefined functions, IGLOO FPGAs can implement a flexible LCD controller that includes processor offloading, customized display interface, post video manipulation, etc. Depending on the LCD controller, the features can range from simple to complex.

Simple LCD Controller Design

Figure 1 shows the block diagram of a simple LCD controller implemented in an Actel IGLOO FPGA. The device communicates to a processor via a customized interface, loads and retrieves data from the off-chip frame buffer storage area on SDRAM, produces video timing data, and sends the image to the LCD. IGLOO FPGAs can also use pulse width modulation (PWM) to control the backlight of the LCD, which can reduce the overall power consumption of the display system.

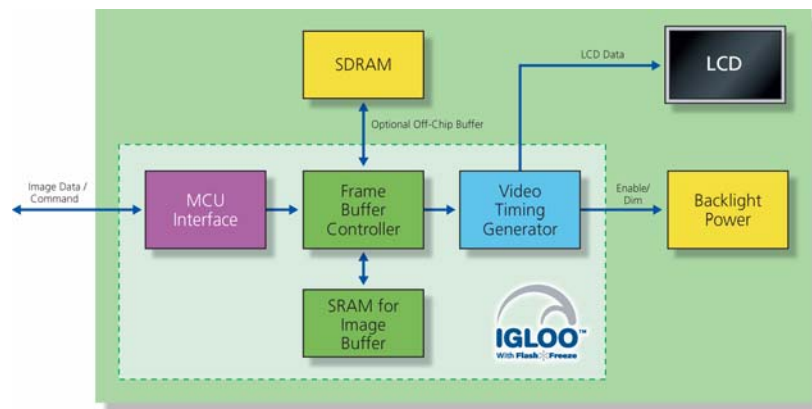


Figure 1 · Simple LCD Controller Design

Depending on the complexity of the processor interface and the architecture of the frame buffer, a simple LCD controller can be implemented in a small device, such as an A3P060 device with 1,536 tiles.

Complex LCD Controller Design

Figure 2 shows an example of a complex LCD controller. The FPGA interfaces with several components and takes part in processing and MUXing of video data to be driven out onto the display. The FPGA functions can include de-interlacing, color conversion, frame buffer interface, video MUXing, alpha blending, image scaling, generating OSD (on-screen display), and image rotation. Devices ranging from A3P400 to A3P3000 are available for LCD controller functions, depending on the complexity of the features required.

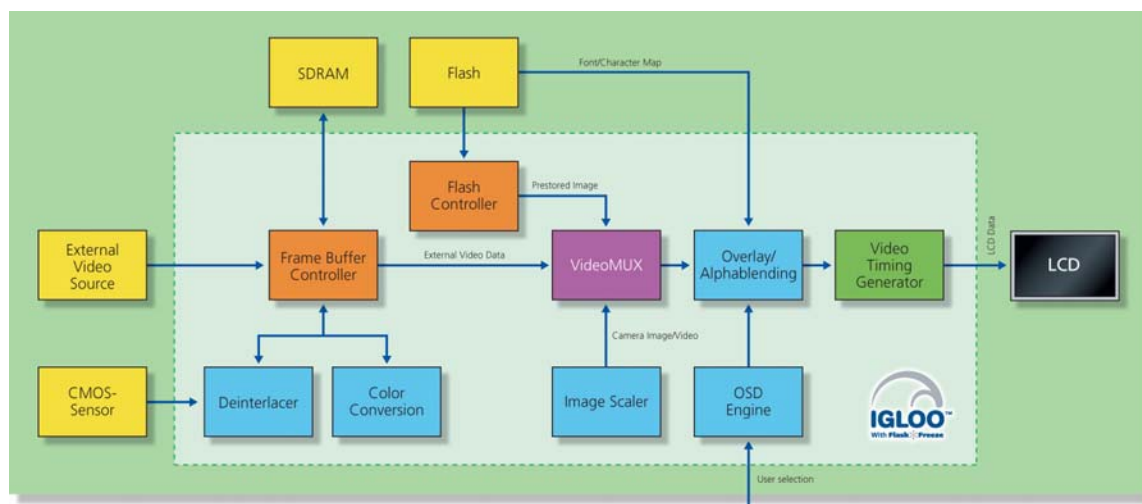


Figure 2 · Complex LCD Controller Design

Hardware Components

The IGLOO Video Demo Kit consists of two main components: the IGLOO video board and an LCD adapter board (sold separately). The IGLOO video board is the main processing unit. The LCD adapter board plugs onto the video board for display and does not contain any control logic (Figure 1-1). Separating the IGLOO video board from the LCD adapter board provides the flexibility to develop custom LCD adapter boards to plug onto the video board.



Figure 1-1 · IGLOO Video Demo Kit 5.5" NEC LCD (left) and 7" Toshiba LCD (right)

Kit Contents

Basic hardware contents:

- IGLOO video board
- LCD adapter board
- 12 V power supply adapter (included with purchase of the IGLOO video board)

Optional hardware items:

- FlashPro3 programmer (used to program IGLOO FPGA)
- DVI-D cable (used to connect video source to board via DVI)
- Aptina™ CMOS sensor head board (used to provide camera input)
- USB A/B cable (used to load images onto the board)

IGLOO Video Board

The IGLOO video board (Figure 1-2 on page 8) is the main processing board, mounted with an IGLOO FPGA that can be designed and implemented to become a flexible LCD controller. The IGLOO video board consists of the following components and interfaces:

Main components:

- IGLOO AGL600-FG256 device
- DVI receiver
- 2 MB × 32 SDRAM
- 64 MB SPI flash
- USB microcontroller
- Switching regulators
- 2 kbit EEPROM (contains VESA EDID v1.3 information)

Main interface:

- 50-pin connector to LCD adapter board
- DVI-D interface
- RJ45 connector for 2 × 4 pairs of LVDS TX
- Bit connector for CMOS sensor
- USB 2.0 type B connector
- Pin JTAG header for FPGA programming

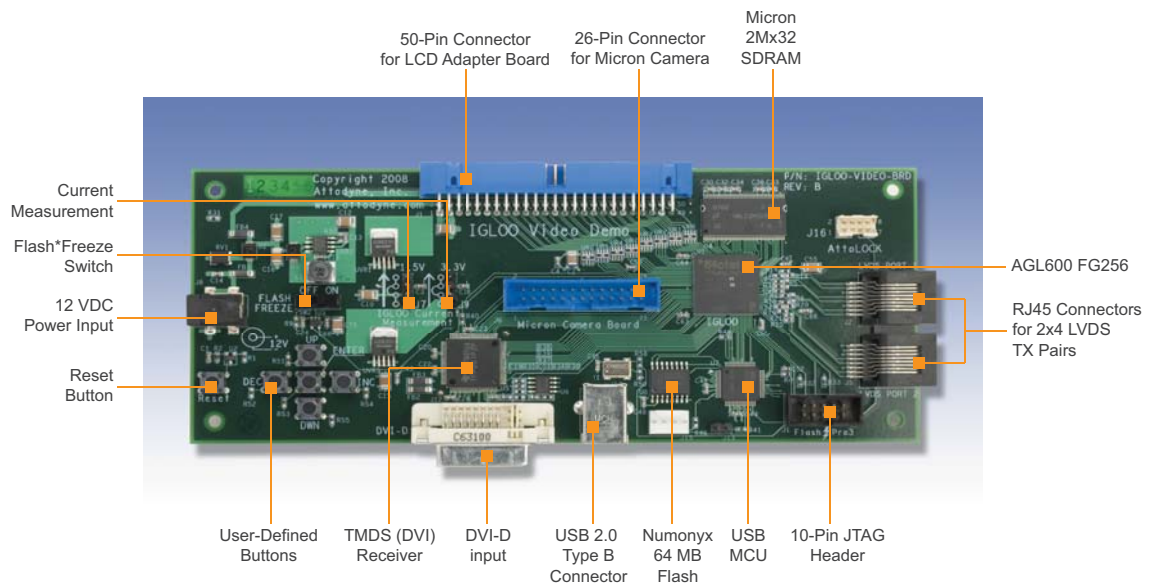


Figure 1-2 · IGLOO Video Board

LCD Adapter Board

The LCD adapter board connects to the IGLOO video board via the 50-pin connector and provides a display output. The modular design of this kit enables you to design a customized adapter board with target LCD, shortening design and test cycle.

There are two variations of LCD adapter boards available for the IGLOO Video Demo Kit. You can also design an adapter board for your own LCD that plugs onto the IGLOO video board.

Main components:

- LCD panel:
 - 800 × 480 7" Toshiba LCD (part number: LTA070A320F; [Figure 1-3 on page 9](#))
 - 320 × 240 5.5" NEC LCD (part number: NL3224BC35-20; [Figure 1-4 on page 10](#))
- Display-specific data connector
- Backlight inverter for LCD with CCFL
- Power-sequencing circuitry
- 2 kbit EEPROM (contains VESA information)



Figure 1-3 · 800 × 480 7" Toshiba LCD

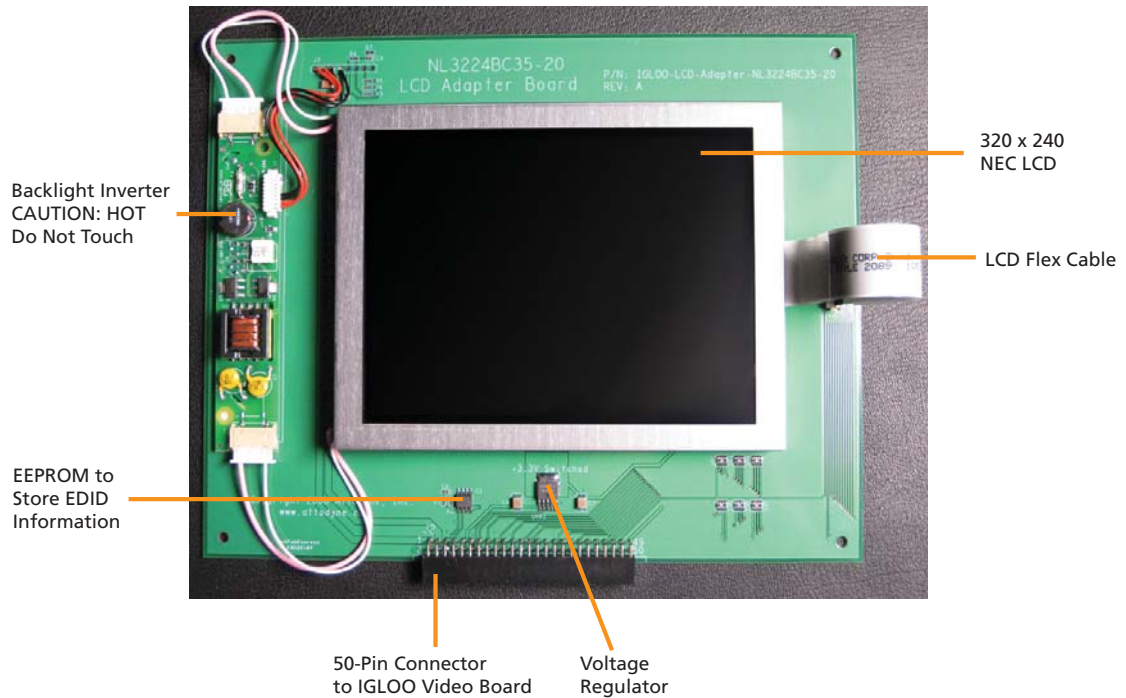


Figure 1-4 · 320 × 240 5.5" NEC LCD

IGLOO FPGA

Actel's IGLOO low-power flash devices span a wide range of densities, from the smallest (AGL015) to the largest (AGL3000). IGLOO FPGAs have a Flash*Freeze feature that can put the device into a sleep mode, consuming as little as 5 μ W. Refer to the Actel website for more information: www.actel.com/products/iglooseries.

Flash*Freeze

For power-sensitive applications, a complete power analysis can be performed with the demo kit. Provisions to independently measure the FPGA core and I/O power consumption allow confirmation of estimates.

Upon assertion of the Flash*Freeze signal, all activity inside the FPGA is frozen in the current state and the I/Os tristate. Operation returns to normal as soon as the Flash*Freeze signal is released. Significant power can be saved in portable devices incorporating a display when the display and its associated backlight circuit are shut down. The video demo kit demonstrates this capability by using a Flash*Freeze switch.

SDRAM

The 2 MB × 32 SDRAM on-board is used for off-chip frame buffer storage. Typically, most LCDs are 18 bits per pixel; some LCDs with higher color depth support 24 bits per pixel. Since the width of the SDRAM is 32 bits, it can store one pixel at each address location. Actel provides a special video frame buffer controller that efficiently accesses the SDRAM for video storage, as part of the display reference design.

SPI Flash and USB MCU

64-MB on-board flash stores images and font data. Contents of the flash can be loaded via USB.

DVI Receiver

Digital visual interface (DVI) sources connect to the IGLOO video board via J12, which is a DVI-D compliant connector. DVI is based on transition-minimized differential signaling (TMDS). U5, a TMDS receiver chip, converts the TMDS video to single-ended LVTTTL RGB pixel data.

User Buttons

A RESET button performs a system reset of the FPGA. The five on-board user buttons (UP, DWN, DEC, INC, and ENT) are used in the demos to interact with the FPGA and provide user selection, such as interfacing with the on-screen display and the selecting mode of the video source.

LVDS TX Pairs

LVDS ports 1 and 2 each contain four LVDS TX pairs. The two ports are provided to directly drive the LCDs with an LVDS interface. Other uses include sending video some distance over Cat-5 cable.

Power Supply

The IGLOO video board needs a 12 V DC supply. The power to the LCD adapter is supplied through the 50-pin board-to-board connector.

Board-to-Board Connection

A standard 100-mil pitch 50-pin connector is used for connecting the LCD adapter board to the video board. [Table 1-1](#) shows the pin description for the 50-pin connector.

Table 1-1 · Pin Descriptions

Pin Number	Pin Name	Description
1	+12V	+12 V DC power for backlight circuit
2	+12V	+12 V DC power for backlight circuit
3	GND	Board ground
4	GND	Board ground
5	nDPWR_EN	Active Low power enable for display
6	+5V	+5 V DC power from switch
7	DPA_CLK	Display information clock (EEPROM)
8	DPA_DAT	Display information data (EEPROM)

Table 1-1 · Pin Descriptions (continued)

Pin Number	Pin Name	Description
9	DPA_BLEN	Backlight enable (turns backlight ON/OFF)
10	DPA_BLBRT	Backlight brightness PWM
11	GND	Board ground
12	DB_7	Blue data bit 7
13	DB_6	Blue data bit 6
14	DB_5	Blue data bit 5
15	DB_4	Blue data bit 4
16	DB_3	Blue data bit 3
17	GND	Board ground
18	DB_2	Blue data bit 2
19	DB_1	Blue data bit 1
20	DB_0	Blue data bit 0
21	DG_7	Green data bit 7
22	DG_6	Green data bit 6
23	GND	Board ground
24	DG_5	Green data bit 5
25	DG_4	Green data bit 4
26	DG_3	Green data bit 3
27	DG_2	Green data bit 2
28	DG_1	Green data bit 1
29	GND	Board ground
30	DG_0	Green data bit 0
31	DR_7	Red data bit 7
32	DR_6	Red data bit 6
33	DR_5	Red data bit 5
34	DR_4	Red data bit 4
35	GND	Board ground
36	DR_3	Red data bit 3
37	DR_2	Red data bit 2
38	DR_1	Red data bit 1
39	DR_0	Red data bit 0
40	DDE	Display data enable

Table 1-1 · Pin Descriptions (continued)

Pin Number	Pin Name	Description
41	GND	Board ground
42	DHS	Display horizontal synchronization
43	DVS	Display vertical synchronization
44	DCLK	Display pixel clock
45	GND	Board ground
46	nDRST	Active Low reset for display
47	SP2	Special signal 2 (display-dependent function)
48	SP1	Special signal 1 (display-dependent function)
49	+3.3V	+3.3 V DC regulated power
50	+3.3V	+3.3 V DC regulated power

256-Pin FBGA Package Pin Assignments for AGL600 Devices

For information on the 256-pin FBGA package and pin assignments and functions for AGL600 devices, refer to the Package Pin Assignment section of the *IGLOO Low Power Flash FPGAs* datasheet (www.actel.com/documents/IGLOO_DS.pdf).

Board Schematics

For detailed board schematics, refer to *IGLOO Video Demo Kit Schematics*, available at www.actel.com/documents/IGLOO_VIDEO_DEMO_KIT_SCHEMATICS.pdf.

Board Description and Usage

The IGLOO video board receives data from either a DVI-D source or a Aptina CMOS camera (26-pin connector provided on the board), and gives out display signals through the 50-pin board-to-board connector or through the RJ45 connectors for the 2x4 LVDS TX pairs. The FPGA can retrieve data from 64 MB flash via the SPI interface and can be loaded via USB with photo images, character maps, starting image, and more.

Example Application Firmware

Several reference designs (Table 2-1) have been developed on the IGLOO Video Demo Kit to showcase the flexible LCD controller in Actel FPGAs.

Table 2-1 · Example Application Firmware

Reference Design	Supported LCD Board		Power Supply	Laptop/PC	DVI Cable	Camera Board and Flex Cable	USB Cable
	5.5"	7"					
IGLOO-VIDEO-BOARD DVI Input to LCD	✓	✓	✓	✓	✓	N/A	N/A
IGLOO-VIDEO-BOARD Upscaling	✓	✓	✓	✓	✓	N/A	N/A
IGLOO-VIDEO-BOARD Digital Photo Viewer	✓	✓	✓	Optional	N/A	N/A	Optional
IGLOO-VIDEO-BOARD Video and Still-shot Camera	✓	✓	✓	N/A	N/A	✓	N/A
IGLOO-VIDEO-BOARD Three-Source Video MUXing	✓	N/A	✓	✓	✓	✓	Optional

IGLOO-VIDEO-BOARD DVI Input to LCD Reference Design

Showcases the FPGA as an LCD controller receiving inputs from a DVI-D source. When configured, the IGLOO video board acts as an extended monitor displaying video data on the LCD adapter board. You can download the reference design at www.actel.com/documents/IGLOO_VIDEO_BOARD_DVItoLCD_RefDes_AN.pdf.

IGLOO-VIDEO-BOARD Upscaling Reference Design

Showcases the FPGA as an LCD controller with a 2X video upscaling capability. When configured, the IGLOO video board acts as an extended monitor displaying video data on the LCD adapter board, with images toggling between 2X and original size. You can download the reference design at www.actel.com/documents/IGLOO_VIDEO_BOARD_Upscaling_RefDes_AN.pdf.

IGLOO-VIDEO-BOARD Digital Photo Viewer Reference Design

Showcases the FPGA as an LCD controller with digital photo slide show capability. When configured, the IGLOO video board acts as digital photo frame rotating through images loaded in by the user. You can download the reference design at www.actel.com/documents/IGLOO_VIDEO_BOARD_PhotoViewer_RefDes_AN.pdf.

IGLOO-VIDEO-BOARD Video and Still-shot Camera Reference Design

Showcases the FPGA as an LCD controller interfacing with the camera and the LCD. When configured, the IGLOO video board acts as a digital camera, showing video or capturing still shot images on the LCD. You can download the reference design at www.actel.com/documents/IGLOO_VIDEO_BOARD_VideoCam_RefDes_AN.pdf.

IGLOO-VIDEO-BOARD Three-Source Video MUXing

Showcases the FPGA as an LCD controller with the capability of MUXing three different video sources. When configured, you can select the video source for the LCD: DVI, digital camera, or digital images stored in the SPI flash. You can download the reference design at www.actel.com/documents/IGLOO_VIDEO_BOARD_3SourceMUX_RefDes_AN.pdf.

Product Support

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From Northeast and North Central U.S.A., call **650.318.4480**

From Southeast and Southwest U.S.A., call **650.318.4480**

From South Central U.S.A., call **650.318.4434**

From Northwest U.S.A., call **650.318.4434**

From Canada, call **650.318.4480**

From Europe, call **650.318.4252** or **+44 (0) 1276 401 500**

From Japan, call **650.318.4743**

From the rest of the world, call **650.318.4743**

Fax, from anywhere in the world **650.318.8044**

Actel Customer Technical Support Center

Actel staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions. The Customer Technical Support Center spends a great deal of time creating application notes and answers to FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

Actel Technical Support

Visit the [Actel Customer Support website \(www.actel.com/custsup/search.html\)](http://www.actel.com/custsup/search.html) for more information and support. Many answers available on the searchable web resource include diagrams, illustrations, and links to other resources on the Actel web site.

Website

You can browse a variety of technical and non-technical information on Actel's [home page](http://www.actel.com), at www.actel.com.

Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. Several ways of contacting the Center follow:

Email

You can communicate your technical questions to our email address and receive answers back by email, fax, or phone. Also, if you have design problems, you can email your design files to receive assistance. We constantly monitor the email account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support email address is tech@actel.com.

Phone

Our Technical Support Center answers all calls. The center retrieves information, such as your name, company name, phone number and your question, and then issues a case number. The Center then forwards the information to a queue where the first available application engineer receives the data and returns your call. The phone hours are from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. The Technical Support numbers are:

650.318.4460
800.262.1060

Customers needing assistance outside the US time zones can either contact technical support via email (tech@actel.com) or contact a local sales office. [Sales office listings](#) can be found at www.actel.com/contact/offices/index.html.

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