intel®

iSBX™ 275
## VIDEO GRAPHICS CONTROLLER

- **Complete video graphics display controller on an iSBX™ MULTIMODULE™ board**

- **Interfaces to either black and white or color raster scan display monitors**

- **50 Hz or 60 Hz frame rate operation**

- **On-board refresh memory supports 512 × 512 black and white or 256 × 256 eight color display resolution**

- **High level drawing commands include line, arc, circle, rectangle, character, area fill, pan and scroll**

- **Includes Intel's 82720 Graphic Display Controller**

- **Compatible with industry standard iSBX™ bus interface**

- **Light pen interface**

The iSBX 275 Video Graphics Controller (VGC) allows the user to add high level video display capability to his/her computer system with minimal cost and effort. The iSBX 275 module provides a completely self-contained bit-mapped graphics subsystem on a 3″ × 7″ iSBX MULTIMODULE board. This same subsystem supports either black and white or eight color displays.

In addition, iSBX 275 VGC off-loads the system CPU from many of the graphics drawing functions. Under the control of the Intel 82720 Graphics Display Controller (GDC), the iSBX 275 board directly supports high level drawing commands which includes lines, arcs, circles, rectangles, characters, area fill, pan and scroll.

The iSBX 275 MULTIMODULE board is compatible with any computer board or system product supporting the industry standard iSBX bus; this includes most board and system products from Intel. Applications for the iSBX 275 VGC include video displays for industrial operator stations, engineering work stations, videotex, business presentation systems and other information display systems.
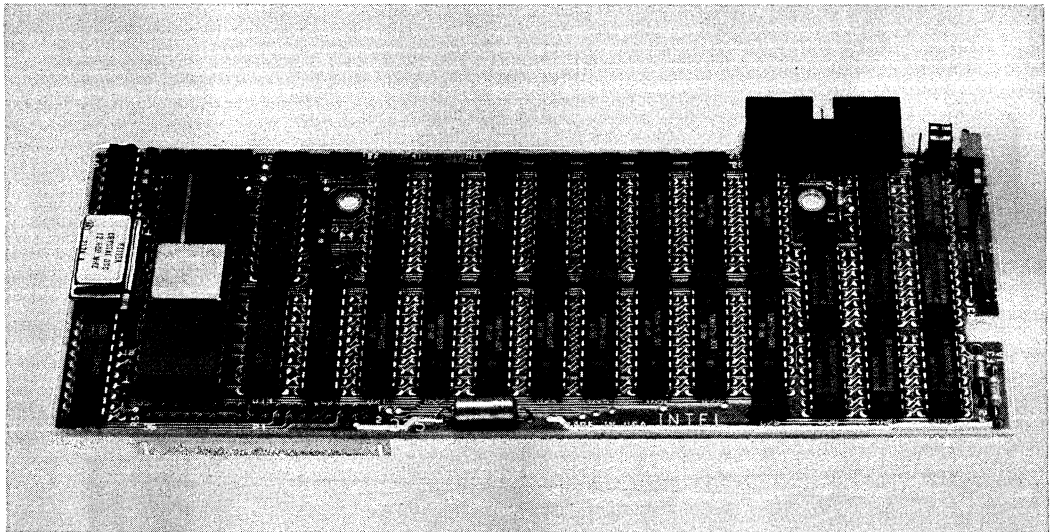
FUNCTIONAL DESCRIPTION

iSBX™ Interface

The iSBX 275 VGC communicates with the host board through the iSBX bus. The iSBX bus is a standard I/O expansion bus interface (mechanical and electrical) for any microprocessor system. The iSBX standard interface allows system designers to optionally add incremental I/O functionality after the host microprocessor architecture is complete. In the case of the iSBX 275 VGC, the host board passes commands, data and status to and from the 82720 controller via two iSBX bus I/O ports.

The software interface consists of a series of high level commands passed to the 82720 controller. Table 1 contains a summary of 82720 software commands.

CRT Controller

The Intel 82720 is an intelligent graphics controller designed to be the heart of a raster-scan computer graphics display system. The 82720 performs all the basic timing needed to generate the raster display and manage the display memory. In addition, the 82720 supports several high level graphics figure drawing functions.

Table 2 lists several CRT vendors compatible with the iSBX 275 VGC.

Display Screen

The iSBX 275 VGC contains 32K bytes of high speed display memory, all of which is under the control of the 82720. The 82720 takes care of both writing and reading data to and from the screen and refreshing the screen.

The on-board display memory is organized as 16K words of 16-bits each. The 82720 reads or writes 16-bits of display data at a time. When displaying, the 82720 starts at the top left hand corner of the screen and sequences down the screen toward the bottom right hand corner.

In B&W mode all 16K, 16-bit words are treated as a contiguous block of memory, where a logical "1" in memory is displayed as an illuminated pixel.

In the color mode, three color planes, Red, Blue and Green, exist sequentially in memory but are displayed simultaneously. Each plane consists of 4K, 16-bit words where a logical "1" in a plane illuminates the corresponding color in that particular pixel.
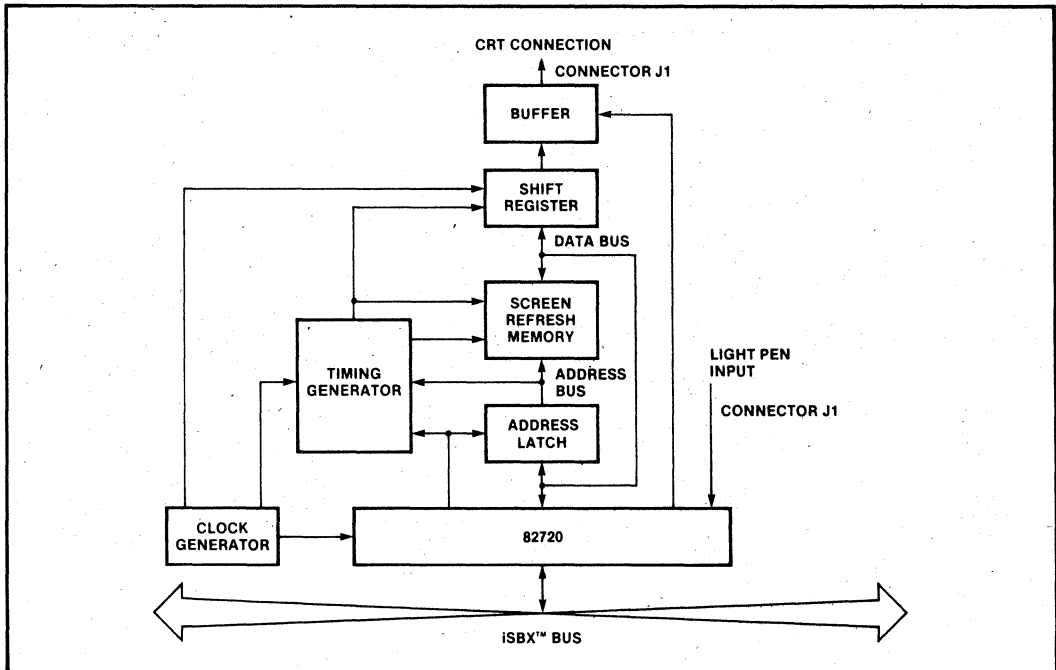

Figure 1. iSBX™ 275 VGC Block Diagram

Table 1. 82720 Command Summary

Video Control Commands	
RESET:	Resets the GDC to its idle state.
SYNC:	Specifies the video display format.
CCHAR:	Specifies the cursor and character row heights.
Display Control Commands	
START:	Ends idle mode and unblanks the display.
BCTRL:	Controls the blanking and unblanking of the display.
ZOOM:	Specifies zoom factors for graphics character writing.
CURS:	Sets the position of the cursor in display memory.
PRAM:	Defines starting addresses and lengths of the display areas and specifies the eight bytes for the graphics character.
PITCH:	Specifies the width of the X dimension of display memory.
Drawing Control Commands	
WDAT:	Writes data words or bytes into display memory.
MASK:	Sets the mask register contents.
FIGS:	Specifies the parameters for the drawing processor.
FIGD:	Draws the figure as specified above.
GCHRD:	Draws the graphics character into display memory.
Data Read Commands	
RDAT:	Reads data words or bytes from display memory.
CURD:	Reads the cursor position.
LPRD:	Reads the light pen address.

Table 2. CRT's (B&W and Color)[1]

Type	Vendor	Model #
B&W	Ball Brothers	TTL 120
	Motorola	M3570
	TSD	MDC-15
Color	Ball Brothers	7-015-0131
	IDT	19AC
	CONRAC	5711C13
	HITACHI	HM-2719/2713, HM-1719/1713
	NEC	1202DH
	MITSUBISHI	C-3419

[1]NOTE: This in no way constitutes an endorsement by Intel Corporation of these companies' products.

CRT Interface

The iSBX 275 VGC will interface to many B&W and RGB (Red, Green and Blue) color display monitors. For B&W monitors, the iSBX 275 board provides TTL level signals for video, vertical sync and horizontal sync or combined sync. When operating in the color mode, the iSBX 275 board provides TTL level 75 ohm line drivers for Red, Green, and Blue Video and a combined sync allowing 8 different colors to be displayed.

Composite video is not provided on the iSBX 275 MULTIMODULE board; however, with minimal external circuitry, composite video can be added (sample composite video circuit designs are included in the iSBX 275 Hardware Reference Manual).
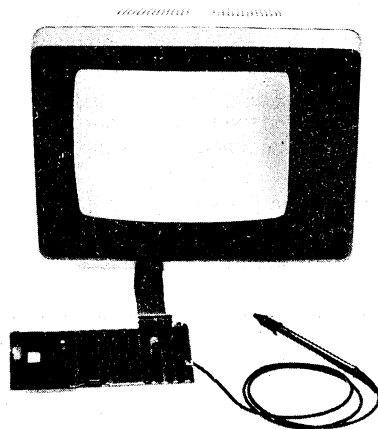
Light Pen Interface

Light pen I/O devices may be directly interfaced to the iSBX 275 VGC. A light pen input or "hit" is triggered on the rising edge of the light pen signal and is indicated by a status bit in the 82720. The memory address of the light pen hit is obtained with a LPRD (Light Pen Read) command.

Table 3 lists a light pen vendor whose product interfaces to the iSBX 275 VGC.

Table 3. Light Pens[1]

Vendor	Model #
Information Control Co.	LP-700

[1]NOTE: This in no way constitutes an endorsement by Intel Corporation of this company's products.

Figure 2. The iSBX™ 275 VGC Interfaces to a User-Supplied Video CRT and Light Pen

SPECIFICATIONS

Controller Characteristics

DISPLAY RESOLUTION

Black and White — nominal 512 x 512 x 1, interlaced

Color — nominal 256 x 256 x 3, non-interlaced

CRT OUTPUTS

Black and White — TTL level Video, HSYNC, VSYNC or CSYNC; maximum dot rate 13 MHz

Color — TTL level, 75 ohm line drivers for RGB and combined sync provide 8 different display colors with a 9.75 MHz maximum dot rate

FRAME RATE

50 Hz or 60 Hz via programmable option (non-interlaced)

VIDEO CONTROL

Pan and user selectable display and background color

DRAWING CONTROL

Lines, arcs, circles, rectangles, characters and area fill

CHARACTERS

Any user defined 8 x 8 font

MONITOR

Black and White — Most video display monitors with a TTL interface and a minimum bandwidth of 12 MHz

Color — Most video display monitors with a TTL interface and a minimum bandwidth of 6 MHz

LIGHT PEN INPUT

TTL level pulse, maximum 50 ns rise time, minimum 1.4 μS hold time

Compatibility

CPU

Any iSBC single board computer or I/O board compatible with the MULTIBUS system bus and implementing the iSBX bus and connector

Physical Characteristics

Width — 3.08 inches (7.82 cm)

Height — 0.8 inches (2.05 cm)

Length — 7.5 inches (19.05 cm)

Shipping Weight — 0.5 pounds (0.175 Kg)

Mounting — Occupies one double-wide iSBX MULTIMODULE position on boards; increases board height (host plus iSBX board) to 1.14 inches (2.90 cm)

Electrical Characteristics

Power Requirements — + 5 Vdc @ 1.5A

Environmental Characteristics

Temperature — 0° to 55°C (operating); – 55°C to + 85°C (non-operating)

Humidity — Up to 90% relative humidity without condensation (operating); all conditions without condensation or frost (non-operating)

Equipment Supplied

iSBX 275 VGC Controller

Reference Schematic — Cabling and connectors from the VGC controller to the CRT and light pen are not supplied with the controller. Cables can be fabricated with commercially available cable and connectors as described in the iSBX 275 Hardware Reference Manual.

Reference Manual

144829-001 — iSBX 275 Video Graphics Display Controller Hardware Reference Manual (NOT SUPPLIED)

Reference manuals may be ordered from any Intel sales representative, distributor office or from Intel Literature Department, 3065 Bowers Avenue, Santa Clara, CA 95051.

ORDERING INFORMATION

Part Number	Description
SBX 275	Video Graphics Display Controller MULTIMODULE Board