



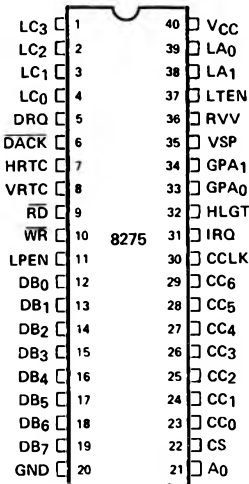
PRELIMINARY
 Notice: This is not a final specification. Some parametric limits are subject to change.

8275 PROGRAMMABLE CRT CONTROLLER

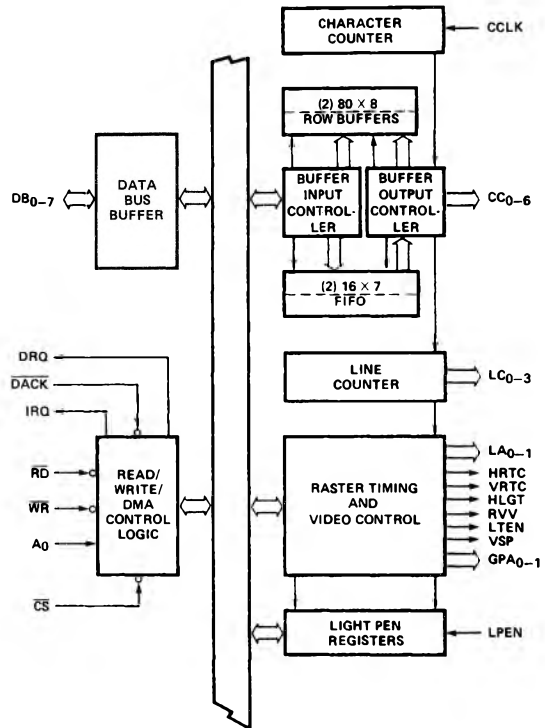
- Programmable Screen and Character Formats
- Six Independent Visual Field Attributes
- Eleven Visual Character Attributes (Graphic Capability)
- Cursor Control (4 Types)
- Light Pen Detection and Registers
- Dual Row Buffers
- Programmable DMA Burst Mode
- Single +5 Volt Supply
- 40 Pin Package

The 8275 Programmable CRT Controller is a single chip device to interface CRT Raster Scan Displays with Intel® Micro-computer Systems. Its primary function is to refresh the display by buffering the information from main memory and keeping track of the display position of the screen. The flexibility designed into the 8275 will allow simple interface to almost any Raster Scan CRT Display with a minimum of external hardware and software overhead.

PIN CONFIGURATION



BLOCK DIAGRAM



General

The CRT Controller (8275) is a single chip, programmable, NMOS-LSI device which is designed to provide an interface for microcomputers to a large class of CRT character displays. The chip provides the display row buffering, raster timing, cursor timing, light pen detection and visual attribute decoding. It is programmable to a large number of different display formats. The controller can be interfaced to standard character generator ROMs for dot matrix decoding.

The controller can generate a screen format size of from 1 to 80 characters per row, 1 to 64 rows per screen and from 1 to 16 horizontal lines per character row.

The device has 7 character code address bits allowing 6 or 7 bit ASCII capability or can be used with other 7 bit codes to generate up to 128 characters.

Hardware Description

The 8275 is Packaged in a 40 pin DIP. The following is a functional description of each pin.

Pin Name	I/O	Description
V _{CC}	—	+5V power supply
GND	—	Ground
CCCLK	I	Character Clock (from dot/timing logic)
DB ₇ -DB ₀	I/O	Bi-directional three-state data bus lines. The outputs are enabled during a read of the C or P ports.
$\overline{\text{CS}}$	I	Chip select. The read and write are enabled by $\overline{\text{CS}}$.
$\overline{\text{RD}}$	I	Read input. A control signal to read registers.
$\overline{\text{WR}}$	I	Write input. A control signal to write commands into the control registers or write data into the row buffers during a DMA cycle.
A ₀	I	Port Address. A high input on A ₀ selects the "C" port or command registers and a low input selects the "P" port or parameter registers.
INT	O	Interrupt request.
DRQ	O	DMA request. Output signal to the 8257 DMA controller requesting a DMA cycle.
$\overline{\text{DACK}}$	I	DMA acknowledge. Input signal from the 8257 DMA controller acknowledging that the requested DMA cycle has been granted.
LPEN	I	Light pen. Input Signal from the CRT system signifying that a light pen signal has been detected.
HRTC	O	Horizontal retrace. Output signal which is active during the programmed horizontal retrace interval. During this period the VSP output is high and the LTEN output is low.

Pin Name	I/O	Description
VRTC	O	Vertical retrace. Output signal which is active during the programmed vertical retrace interval. During this period the VSP output is high and the LTEN output is low.
LC0-LC3	O	Line count. Output from the line counter which is used to address the character generator for the line positions on the screen.
CC0-CC6	O	Character codes. Output from the row buffers used for character selection in the character generator.
GPA0, GPA1	O	General purpose attribute codes. Outputs which are enabled by the general purpose field attribute codes.
LA0, LA1	O	Line attribute codes. These attribute codes have to be decoded externally by the dot/timing logic to generate the horizontal and vertical line combinations for the graphic displays specified by the character attribute codes.
HLGT	O	Highlight. Output signal used to intensify the display at particular positions on the screen as specified by the character attribute codes or field attribute codes.
RVV	O	Reverse video. Output signal used to indicate the CRT circuitry to reverse the video signal. This output is active at the cursor position if a reverse video block cursor is programmed or at the positions specified by the field attribute codes.
LTEN	O	Light enable. Output signal used to enable the video signal to the CRT. This output is active at the programmed underline cursor position, and at positions specified by the character attribute codes during generation of graphics display.
VSP	O	Video suppression. Output signal used to blank the video signal to the CRT. This output is active: <ul style="list-style-type: none"> — during the horizontal and vertical retrace intervals. — at the top and bottom lines of rows if the number of lines/row are greater than or equal to 9. — when an end of row or end of screen code is detected. — when a DMA underrun occurs. — at regular intervals (1/16 frame frequency for cursor, 1/32 frame frequency for character and field attributes)—to create blinking displays as specified by cursor, character attribute, or field attribute programming.

Principles of Operation

The basic elements of the CRT controller are the two row buffers (80X8), cursor position, light pen position, and visual attribute decode and control logic. The CRT controller is used with the DMA chip (8257) to provide the high speed controlling function of a CRT.

Two row buffers are utilized to provide display row refresh. Each buffer is alternately loaded from main memory and then used to provide characters to the external character generator and internal visual attribute decode logic during row display. Each buffer is loaded from main memory by DMA cycles which are requested by the CRT controller at programmable intervals. The controller can also be programmed to request a single DMA at a time or bursts of 2, 4, or 8 bytes.

Raster Control and Timing

The raster logic provides the proper video scan timing for the CRT. The various parameters of the raster timing are programmable at controller reset. Raster timing is derived from the basic character interval clock which is provided to the controller from the external dot timing logic. The following count functions are performed by the raster logic:

- Character Count
- Horizontal Retrace Interval Count
- Line Count
- Row Count
- Vertical Retrace Interval Count
- Blink Timing

Cursor

The cursor location is determined by the cursor line and character position registers which are loaded by command to the controller. The cursor can be programmed to appear on the display as 1) a blinking underline, 2) a blinking reverse video block, 3) a non-blinking underline, or 4) a non-blinking reverse video block.

Light Pen

When the controller detects a light pen signal, the row and character position coordinates of the raster are stored in a pair of registers. On command to the controller, these registers can be read by the microprocessor. The registers are loaded on the 0-1 transition of the light pen input which is internally synchronized with the character clock. The horizontal address will be off three character positions (more if external delays are present) and has to be corrected in the software. In addition, the controller has a status flag to indicate that the light pen signal was detected.

Visual Attributes

Visual attributes are generated and timed by the CRT controller without the intervention of the external character generator. They are actuated and controlled by special code combinations. These attribute codes can affect the display for just the character position in which they appear (character type) or they may affect a field of characters (field type).

Field Attributes

The field attributes are control codes which will affect the visual characteristics for a field of characters starting at the character following the field attribute code up to the character which precedes the next field attribute code. A field attribute code does not have to occupy a display position. Any of the following field display can be independently selected for a field:

- Blink
- Highlight
- Reverse Video
- Underline

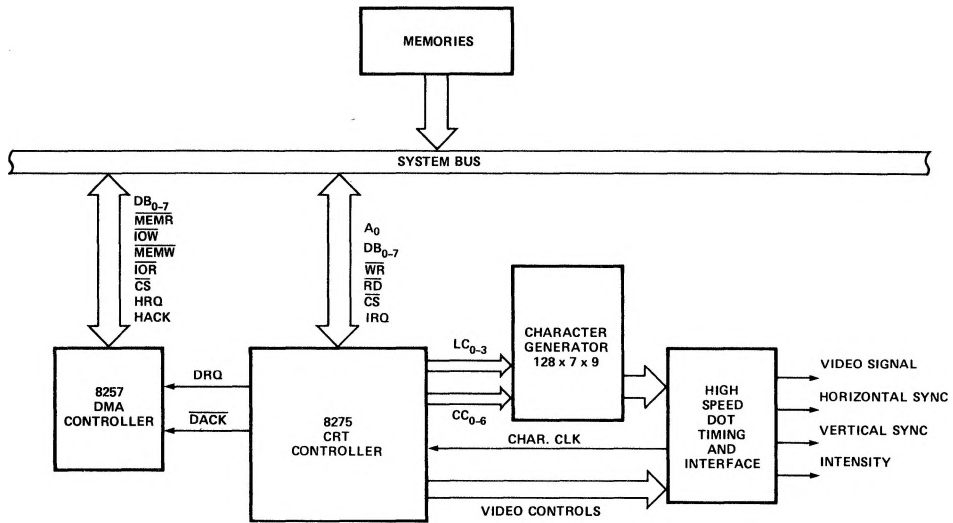
Character Attributes

A character attribute generates a graphics symbol in the character position without the use of an external character generator. A character attribute is generated through the Line Attribute outputs together with the Video Suppress and Light Enable outputs. The external logic then can generate the proper symbol. Character attributes can be programmed to blink or be highlighted.

Software Operation

The 8275 can accept commands from the CPU at any time to perform the CRT controlling functions. A command ($A_0=1$) from the CPU to the 8275 chip may be followed by up to 4 bytes of parameters ($A_0=0$). The list of commands and their associated parameters are summarized below:

C/ \bar{P}	DB	
1	0 0 0 X X X X X	RESET & STOP DISPLAY
0	S H H H H H H H	SCREEN COMPOSITION #1
0	V V R R R R R R	SCREEN COMPOSITION #2
0	U U U U L L L L	SCREEN COMPOSITION #3
0	D F C C Z Z Z Z	SCREEN COMPOSITION #4
1	0 0 1 S S S B B	START DISPLAY
1	0 1 0 X X X X X	STOP DISPLAY
1	0 1 1 X X X X X	READ LIGHT PEN (*2 \bar{RD})
1	1 0 0 X X X X X	LOAD CURSOR POSITION
0	X C C C C C C C	CURSOR X-POSITION
0	X X C C C C C C	CURSOR Y-POSITION
1	1 0 1 X X X X X	ENABLE INTERRUPT
1	1 1 0 X X X X X	DISABLE INTERRUPT



8275 SYSTEM DIAGRAM