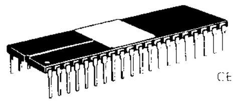
MOTOROLA

MC2675

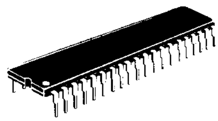
Advance Information

HMOS
(HIGH-DENSITY N-CHANNEL, SILICON-GATE)

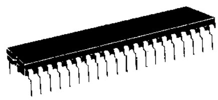
COLOR/MONOCHROME ATTRIBUTES CONTROLLER (CMAC)



L SUFFIX
CERAMIC PACKAGE
CASE 715



P SUFFIX
PLASTIC PACKAGE
CASE 711



S SUFFIX
CERDIP PACKAGE
CASE 734

COLOR/MONOCHROME ATTRIBUTES CONTROLLER (CMAC)

The MC2675 color/monochrome attributes controller (CMAC) is a bipolar LSI device designed for CRT terminals and display systems that employ raster scan techniques. It contains a programmable dot clock divider to generate a character clock, a high speed shift register to serialize input dot data into a video stream, latches, logic to apply visual attributes to the resulting display, and logic to display a cursor on the display.

The CMAC provides control of visual attributes on a character-by-character basis for two operating modes: monochrome and color. The monochrome mode provides reverse video, blank, highlight, and two general purpose user definable attributes. In this mode, the display characters can be specified to appear on either a light or dark screen background. Retrace video supression can be automatically or externally controlled. The color mode provides eight colors for foreground (character) video and eight colors for background video together with a luminance output for external color set selection or to simultaneously drive a monochrome monitor. Additionally, both modes provide double width, underline, blink, dot stretching, and dot width attributes. In monochrome mode, the MC2675 emulates the attributes characteristics of Digital Equipment Corporation VT100 terminal.

The horizontal dot frequency is the basic timing input to the CMAC. This clock is divided internally to provide a character clock output for system synchronization. Up to ten bits of dot data are parallel loaded into the video shift register on each character boundary. The two TTL video data outputs in monochrome mode are encoded to provide four video intensities (black, gray, white, and highlight). The video data in color mode is encoded to provide eight foreground colors and shifted out on three TTL outputs, together with the luminance output.

Applications include CRT terminals, word processing systems, small business computers.

- 25 MHz and 18 MHz Video Dot Rate Versions*
- Four Video Intensities Encoded on Two TTL Outputs (Monochrome Mode)
- Eight Foreground and Background Colors Encoded on Three TTL Outputs (Color Mode)
- Internally Latched Character Attributes:

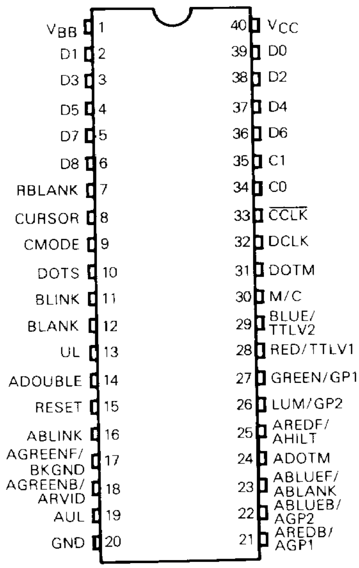
Reverse Video	Two General Purpose
Blank	Eight Foreground Colors
Blink	Eight Background Colors
Underline	Dot Width Control
Highlight	Double Width Characters

- VT100 Compatible Attributes
- Reverse Video Cursor with Optional White Cursor in Color Mode
- Up to Ten Dots Per Character
- Light or Dark Background in Monochrome Mode — Automatic Retrace Blanking
- Programmable Dot Stretching
- TTL Compatible
- 40-Pin Dual-in-Line Package

*For faster versions consult factory.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

PIN ASSIGNMENT



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ORDERING INFORMATION (V_{CC} = 5 V ±5%, 0°C to 70°C)

Package Type	Dots Per Character	Frequency (MHz)	Order Number
Ceramic L Suffix	7, 8, 9, 10	18	MC2675B8L
	7, 8, 9, 10	25	MC2675B5L
	6, 8, 9, 10	18	MC2675C8L
	6, 8, 9, 10	25	MC2675C5L
Plastic P Suffix	7, 8, 9, 10	18	MC2675B8P
	7, 8, 9, 10	25	MC2675B5P
	6, 8, 9, 10	18	MC2675C8P
	6, 8, 9, 10	25	MC2675C5P
Cerdip S Suffix	7, 8, 9, 10	18	MC2675B8S
	7, 8, 9, 10	25	MC2675B5S
	6, 8, 9, 10	18	MC2675C8S
	6, 8, 9, 10	25	MC2675C5S

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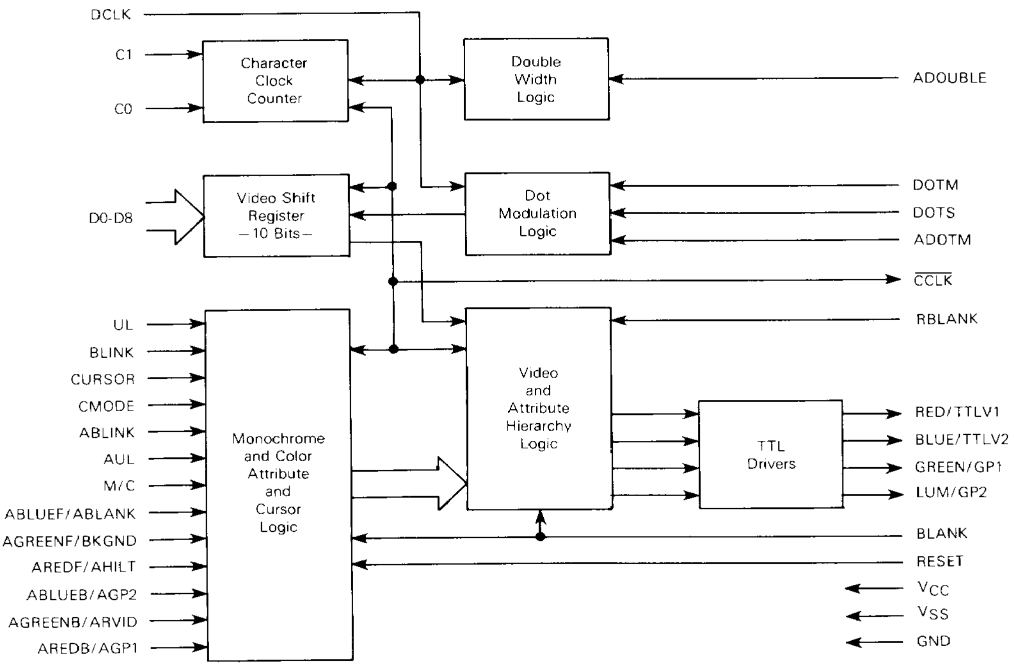
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	−0.3 to +7.0	V
Input Voltage	V_{in}	−0.3 to +7.0	V
Operating Temperature Range	T_A	0 to 70	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum-rated voltages to this high-impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{CC}$. Reliability of operation is enhanced if unused inputs are tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{CC}).

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Rating
Thermal Resistance Plastic Package Ceramic Package	θ_{JA}	50 50	°C/W

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POWER CONSIDERATIONS

The average chip-junction temperature, T_J, in °C can be obtained from:

$$T_J = T_A + (P_D \bullet \theta_{JA}) \quad (1)$$

Where:

$T_A \equiv$ Ambient Temperature, °C

$\theta_{JA} \equiv$ Package Thermal Resistance, Junction-to-Ambient, °C/W

$P_D \equiv P_{INT} + P_{PORT}$

$P_{INT} \equiv I_{CC} \times V_{CC}$, Watts − Chip Internal Power

$P_{PORT} \equiv$ Port Power Dissipation, Watts − User Determined

For most applications $P_{PORT} \ll P_{INT}$ and can be neglected. P_{PORT} may become significant if the device is configured to drive Darlington bases or sink LED loads.

An approximate relationship between P_D and T_J (if P_{PORT} is neglected) is:

$$P_D = K \div (T_J + 273°C) \quad (2)$$

Solving equations 1 and 2 for K gives:

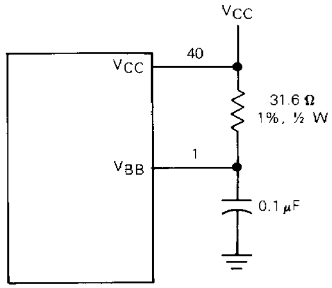
$$K = P_D \bullet (T_A + 273°C) + \theta_{JA} \bullet P_D^2 \quad (3)$$

Where K is a constant pertaining to the particular part. K can be determined from equation 3 by measuring P_D (at equilibrium) for a known T_A. Using this value of K the values of P_D and T_J can be obtained by solving equations (1) and (2) iteratively for any value of T_A.

DC ELECTRICAL CHARACTERISTICS (T_A = 0°C to 70°C, V_{CC} = 5.0 V ±5%)

Parameter		Symbol	Min	Max	Unit
Input Low Voltage		V_{IL}	−0.3	0.8	V
Input High Voltage		V_{IH}	2.0	V_{CC}	V
Output Low Voltage (I_{OL} = 4 mA)		V_{OL}	–	0.4	V
Output High Voltage (I_{OH} = −400 μA)		V_{OH}	2.4	–	V
Input Low Current (V_{in} = 0.4 V)	DCLK All Other Inputs	I_{IL}	– –	−800 −400	μA
Input High Current (V_{in} = 2.4 V)	DCLK All Other Inputs	I_{in}	– –	40 20	μA
V_{CC} Supply Current (V_{in} = 0 V, V_{CC} = Max)		I_{CC}	–	80	mA
V_{BB} Supply Current (See Figure 1)		I_{BB}	–	120	mA

FIGURE 1 — RECOMMENDED V_{BB} TEST CIRCUIT



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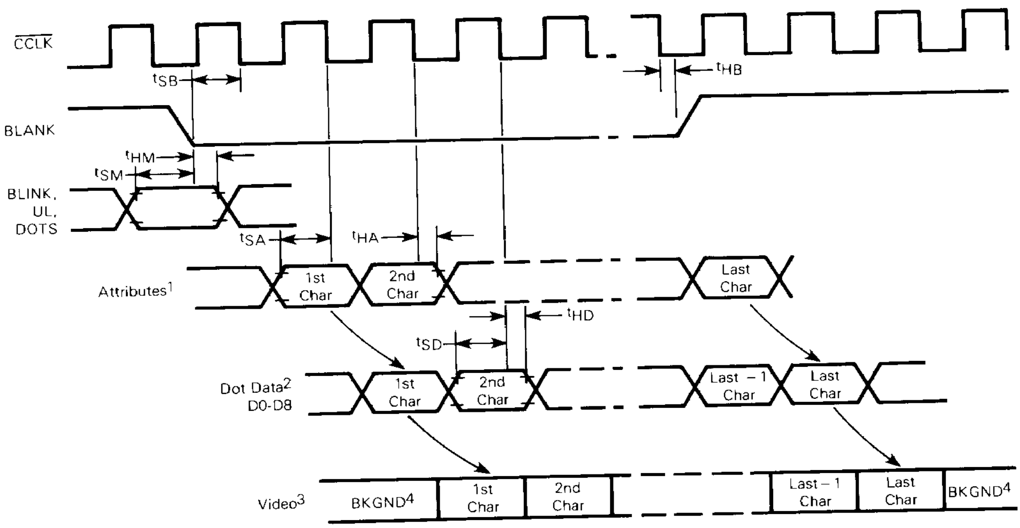
AC ELECTRICAL CHARACTERISTICS — DOT CLOCK TIMING (T_A = 0°C to 70°C, V_{CC} = 5.0 V ±5%)

Parameter	Symbol	25 MHz		18 MHz		Unit
		Min	Max	Min	Max	
Dot Clock High Time	t_{DH}	15	–	22	–	ns
Dot Clock Low Time	t_{DL}	15	–	22	–	ns
BLANK to $\overline{CCLK}$ Setup Time	t_{SB}	40	–	50	–	ns
Attributes to $\overline{CCLK}$ Setup Time	t_{SA}	40	–	50	–	ns
D0-D9 to $\overline{CCLK}$ Setup Time	t_{SD}	60	–	70	–	ns
CURSOR to $\overline{CCLK}$ Setup Time	t_{SK}	40	–	50	–	ns
C0 and C1 to DCLK Setup Time	t_{SC}	20	–	20	–	ns
RBLANK to DCLK Setup Time	t_{SR}	20	–	20	–	ns
BLINK, UL, DOTS, to BLANK Setup Time	t_{SM}	20	–	20	–	ns
BLANK from $\overline{CCLK}$ Hold Time	t_{HB}	20	–	20	–	ns
Attributes from $\overline{CCLK}$ Hold Time	t_{HA}	20	–	20	–	ns
D0-D8 from $\overline{CCLK}$ Hold Time	t_{HD}	30	–	30	–	ns
CURSOR from $\overline{CCLK}$ Hold Time	t_{HK}	20	–	20	–	ns
C0 and C1 from DCLK Hold Time	t_{HC}	20	–	20	–	ns
RBLANK from DCLK Hold Time	t_{HR}	20	–	20	–	ns
BLINK, UL, DOTS, from BLANK Hold Time	t_{HM}	20	–	20	–	ns
$\overline{CCLK}$ from DCLK Delay Time (C_L = 50 pF)	t_{DC}	–	55	–	70	ns
Other Outputs from DCLK Delay Time (C_L = 50 pF)	t_{DV}	30	60	35	70	ns

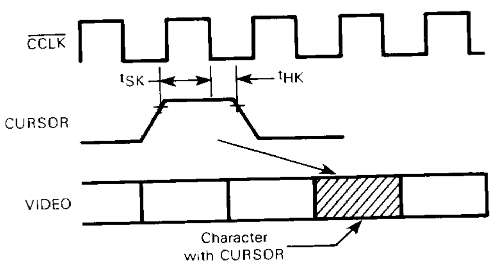
NOTE: All voltage measurements are referenced to ground. For testing, all input signals swing between 0.4 volts and 2.4 volts with a transition time of 3 nanoseconds maximum. All time measurements are referenced at input voltages of 0.8 volts and 2.0 volts and at output voltages of 0.8 volts and 2.0 volts as appropriate.

CMAC PIPELINE TIMING DIAGRAM

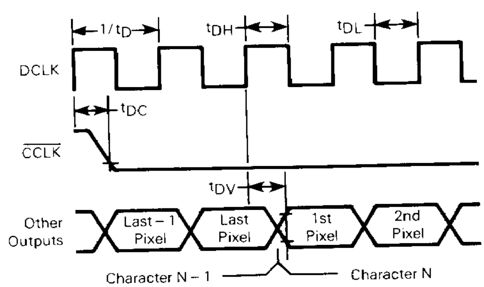


NOTES:
1. Attributes include: ABLINK, ABLANK, ARVID, AUL, AHILT, ADOUBLE, ADOTM, two general purpose, and foreground/background colors.
2. One $\overline{CCLK}$ delay for dot data (obtained from delay through character generator).
3. For detail timing of video outputs, see Output Pipeline Timing Diagram.
4. Non-active scan time. Video reverts to polarity selected by the BKGND input in monochrome mode.

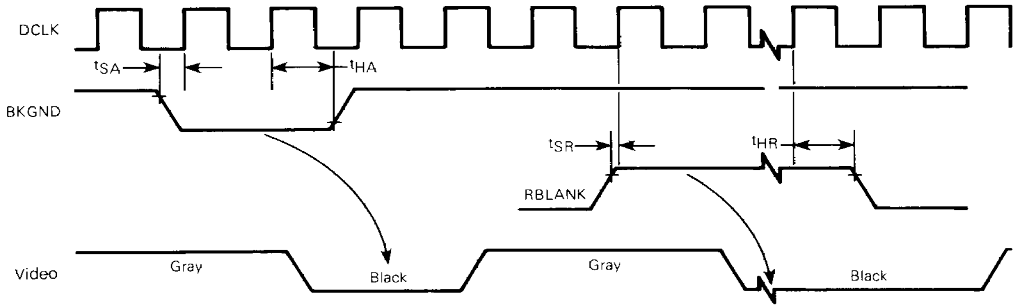
CURSOR PIPELINE TIMING DIAGRAM



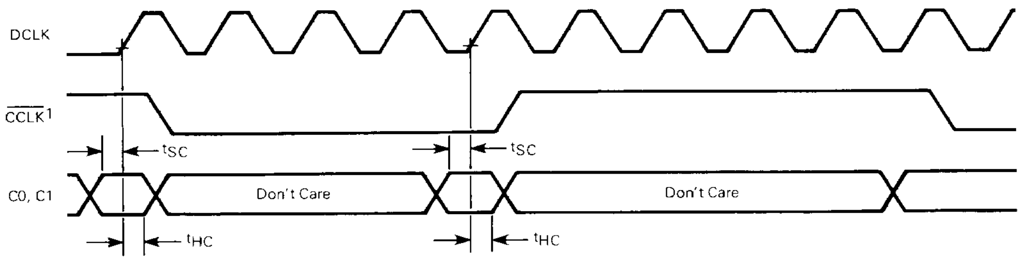
OUTPUT PIPELINE TIMING DIAGRAM



BKGND AND RBLANK TIMING DIAGRAM DURING INACTIVE SCAN TIME (BLANK = 1) — MONOCHROME MODE



CLOCK DIVIDER TIMING DIAGRAM



NOTE:
1. The high and low times of $\overline{CCLK}$ may be controlled independently.

SIGNAL DESCRIPTION

The input and output signals for the CMAC are described in the following paragraphs.

V_{CC}, V_{BB}, AND GND

Power is supplied to the CMAC using these three pins. V_{CC} is the +5 volts ±5% power input, V_{BB} is the bias supply current (refer to Figure 1), and GND is the ground connection.

DOT CLOCK (DCLK)

This dot frequency input controls the video output shift rate.

CHARACTER CLOCK ($\overline{CCLK}$)

This output is a submultiple of DCLK. The period ranges from seven to ten DCLK periods per cycle and is determined by the state of the character clock control (C0-C1) inputs.

RED/TTL VIDEO 1 (RED/TTLV1)

In color mode, this output provides the red gun serial video. In monochrome mode, it should be used with the blue/TTL video 2 output to decode four video intensities.

BLUE/TTL VIDEO 2 (BLUE/TTLV2)

In color mode, this output provides the blue gun serial video. In monochrome mode, it should be used with the read/TTL video 1 output to decode four video intensities.

GENERAL/GENERAL PURPOSE 1 (GREEN/GP1)

In color mode, this output provides the green gun serial video. In monochrome mode, it is a general purpose TTL output which is asserted if the AREDB/AGP1 input is asserted when the corresponding character dot data is loaded into the video shift register.

LUMINANCE/GENERAL PURPOSE 2 (LUM/GP2)

In color mode, this output is the logical OR of the RGB foreground video. It is low during a blanking interval and during the foreground portion of the cursor display. In monochrome mode, it is a general purpose TTL output which is asserted if the ABLUEB/AGP2 input is asserted when the corresponding character dot data is loaded into the video shift register.

UNDERLINE TIMING (UL)

Indicates the scan line(s) for the underline attribute. Latched on the falling edge of BLANK.

BLINK TIMING (BLINK)

This input is sampled on the falling edge of BLANK to provide the blink rate for the blink attribute. Should be a submultiple of the frame rate.

SCREEN BLANK (BLANK)

When high, this input forces the video outputs to the specified background color in color mode and to the level specified by the BKGND input (either black or gray) in monochrome mode.

RETRACE BLANK (RBLANK)

This input is used to force the video outputs to a low during retrace periods. If pulled high, it will automatically suppress video during the retrace periods when BLANK is high. The user may also pulse this input while BLANK is high to selectively suppress raster video.

GREEN FOREGROUND/BACKGROUND INTENSITY (AGREENF/BKGND)

In color mode, this input activates the GREEN/GP1 output during the foreground (character video) portion of the associated character block. In monochrome mode, this input specifies gray or black screen background.

BLUE FOREGROUND/BLANK ATTRIBUTE (ABLUEF/ABLANK)

In color mode, this input activates the BLUE/TTLV2 output during the foreground (character video) portion of the associated character block. In monochrome mode, this input generates a blank space for the associated character. The blank space intensity is controlled by the AGREENF/BKGND input, the reverse video attribute and cursor input.

RED FOREGROUND/HIGHLIGHT ATTRIBUTE (AREDF/AHILT)

In color mode, this input activates the RED/TTLV1 output during the foreground (character video) portion of the associated character block. In monochrome mode, this input highlights the associated character (including underline).

CURSOR TIMING (CURSOR)

This input provides the timing for the cursor video. In color mode, with CURSOR and CMODE high, the RGB outputs are driven high (white cursor). If CMODE is low, or in monochrome mode, this input reverses the intensities of the video and attributes. Cursor position, shape, and blink rate are controlled by this input.

CURSOR MODE (CMODE)

Used in color mode only. When CURSOR and CMODE are high, the RGB outputs are driven high (white cursor). When CURSOR is high and CMODE is low, the RGB outputs are logically inverted (reverse video cursor).

UNDERLINE ATTRIBUTE (AUL)

Specifies a line to be displayed in the character block. The specific line(s) are specified by the UL input. All other attributes apply to the underline video.

BLINK ATTRIBUTE (ABLINK)

In color mode, this active high input will drive the foreground RGB combination to the background RGB combination. In monochrome mode, the associated character or background is driven to the intensity determined by BKGND, reverse video attribute, and the cursor input.

DOUBLE WIDTH ATTRIBUTE (ADOUBLE)

This active high input causes the associated character video to be shifted out of the serial shift register at one-half the dot frequency (DCLK). The $\overline{CCLK}$ output is not affected.

RED BACKGROUND/GENERAL PURPOSE ATTRIBUTE 1 (AREDB/AGP1)

In color mode, this input activates the RED/TTLV1 output during the background portion of the associated character block. In monochrome mode, it activates the GREEN/GP1 output for the associated character block.

BLUE BACKGROUND/GENERAL PURPOSE ATTRIBUTE 2 (ABLUEB/AGP2)

In color mode, this input activates the BLUE/TTLV2 output during the background portion of the associated character block. In monochrome mode, it activates the LUM/GP2 output for the associated character block.

GREEN BACKGROUND/REVERSE VIDEO ATTRIBUTE (AGREENB/ARVID)

In color mode, this input activates the GREEN/GP1 output during the background portion of the associated character block. In monochrome mode, it causes the associated character block video intensities to be reversed.

DOT DATA INPUT (D0-D8)

These are parallel inputs corresponding to the character/graphic symbol dot data for a given scan line. These inputs are strobed into the video shift register on the trailing (falling) edge of each character clock ($\overline{CCLK}$).

CHARACTER CLOCK CONTROL (C0-C1)

The states of these two static inputs determine the internal divide factor for the $\overline{CCLK}$ output rate.

RESET (RESET)

This active high input initializes the internal logic and resets the attribute latches.

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MONOCHROME/COLOR MODE (M/C)

This input selects whether the CMAC operates in monochrome or color mode. A low selects color mode and a high selects monochrome mode.

DOT MODULATION ATTRIBUTE (ADOTM)

When DOTM and this input are high, the active dot width of the associated character video is one DCLK. When DOTM is high and this input is low, the active dot width of the associated character video is two DCLKs.

DOT WIDTH MODULATION (DOTM)

When this input is high, two DCLKs are used for each dot shifted through the shift register. When this input is low, one DCLK is used.

DOT STRETCHING (DOTS)

This input is sampled at the falling edge of BLANK. When this input is high, one extra dot is appended to individual dots or groups of dots of the input parallel data and then transferred through the shift register. When this input is low, normal transfer of input parallel data results.

FUNCTIONAL DESCRIPTION

The CMAC consists of seven major sections (refer to the block diagram). The high speed dot clock input is applied to a programmable divider to provide a character clock output for system timing. Parallel dot data is loaded into the video shift register on character boundaries and shifted into the video logic block at the dot rate specified by the dot modulation section. The appropriate attribute control inputs are selected by the mode select logic, latched internally on character boundaries, and combined with the serial dot data to provide monochrome or color video outputs. System block diagrams of the MC2675 in color mode and monochrome mode are provided in Figures 2 and 3.

The BLANK input defines the active screen area. In color mode, the video outputs are forced to the specified background color when this signal is asserted; in monochrome mode the video outputs are forced to the states defined by the BKGND input, i.e., black if dark background is selected and gray if light background is selected. A separate RBLANK input allows the user to select the amount of border around the active area when operating in color mode or in monochrome mode with light background. This input can be

FIGURE 2 — SYSTEM BLOCK DIAGRAM OF MC2675 IN COLOR MODE

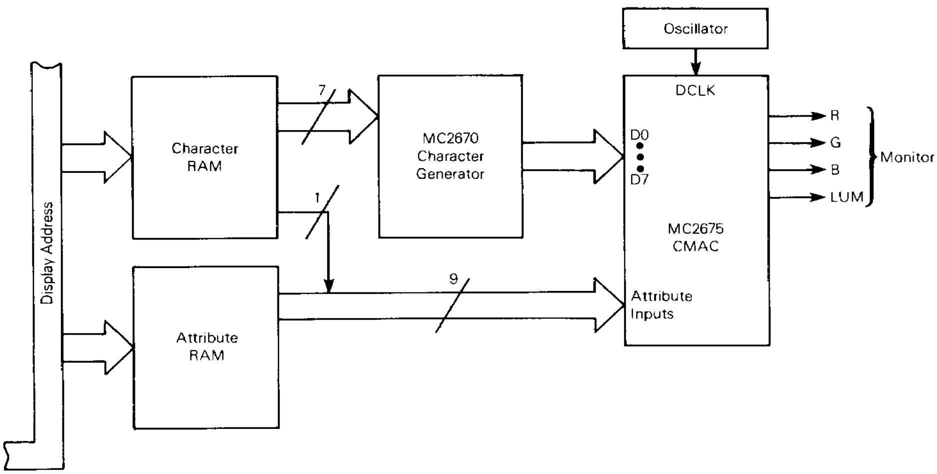
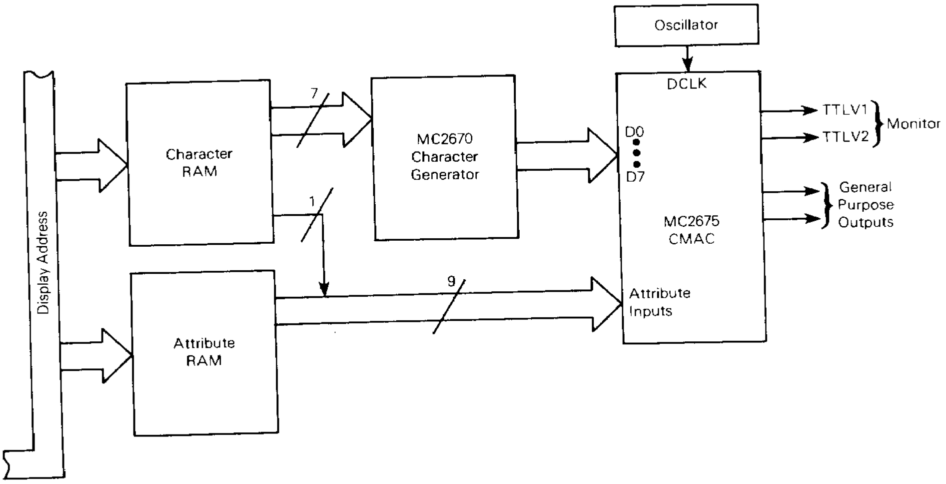


FIGURE 3 — SYSTEM BLOCK DIAGRAM OF MC2675 IN MONOCHROME MODE



tied high, in which case the area outside the active area will be dark, or it may be pulsed during BLANK periods to externally control the border widths.

In color mode, eight colors for the character (foreground) and eight colors for the background (area other than character) can be selected by the attribute inputs. In monochrome mode, the intensities of foreground and background are a function of the attribute and BKGND inputs, i.e., characters may be black, gray, white, or highlight (very white) while background may be black, gray, or white (see Table 1).

CHARACTER CLOCK COUNTER

The character clock counter divides the DCLK input to generate the character clock ($\overline{CCLK}$). The divide factor is specified by the clock control inputs (C1-C0) as follows:

		MC2675B		MC2675C	
C1	C0	Dots/ Character	$\overline{CCLK}$ Duty Cycle*	Dots/ Character	$\overline{CCLK}$ Duty Cycle*
0	0	10	5/5	10	5/5
0	1	7	4/3	6	3/3
1	0	8	4/4	8	4/4
1	1	9	5/4	9	5/4

*High/Low

TABLE 1 — MONOCHROME MODE ATTRIBUTE CHARACTERISTICS

REV*	AHILT	ABLINK**	Foreground Video	Background Video
0	0	0	W	B
0	0	1	W/G	B
0	1	0	H	B
0	1	1	H/W	B
1	0	0	B	G
1	0	1	B/W	G/B
1	1	0	B	W
1	1	1	B/H	W/B

*REV = (BKGND) XOR (AVRID):

BKGND	ARVID	REV
0	0	0
0	1	1
1	0	1
1	1	0

**For blinking, the video outputs are shown as zero/one, where zero and one are the blink timing input states.

NOTES:
1. Foreground includes underline when underlining is specified by AUL = 1.
2. When ABLANK = 1, foreground component becomes same as background component.
3. Codes for video outputs are as follows:

Code	TTLV2	TTLV1	Beam Intensity
B	0	0	Black
G	0	1	Gray
W	1	0	White
H	1	1	Highlight

The number of dot clocks/character is normally the number of dots/character as listed above. However, when dot width control is specified, the DCLK input is divided by two before it is applied to the character clock counter resulting in the number of dot clocks/character being double those listed above, although the number of displayed dots/character remains the same. See **DOT MODULATION LOGIC.**

VIDEO SHIFT REGISTER

On each character boundary, the parallel input dot data (D0-D8) is loaded into the video shift register. The data is shifted out least significant bit first (D0) at the DCLK rate. If ten dots/character are specified (C1-C0=00), the tenth dot will be the same as D8. The serial dot data from the video shift register is routed to the video logic where it is combined with the cursor and attribute control bits to produce the video data outputs.

MODE SELECT, ATTRIBUTE, AND CURSOR CONTROL

The mode select logic multiplexes the monochrome and color attribute inputs and outputs as specified by the M/C input. The monochrome mode provides blank, reverse video, highlight, and two general purpose attributes. The latter may be used, with external logic, to combine other attributes (e.g., overscore) into the video stream. The color mode provides RGB foreground and background color attributes. Both modes provide double width characters, blink, underline, dot width control, and dot stretching.

The cursor and attribute inputs are pipelined internally to allow for system pipeline propagations. The cursor input signal is delayed internally by two $\overline{CCLK}$s (one for RAM and one for the character generator), while the attribute inputs are delayed for one $\overline{CCLK}$ to account for the delay of the character data through the character generator latches. The attribute timing inputs (BLINK, UL, and DOTS) are clocked into the MC2675 at the beginning of each scan line time by the falling edge of BLANK. Thus, these inputs must be their proper state at the falling edge of BLANK preceding the scan line where they are required to be active. The BLANK signal itself is also delayed internally to provide for the RAM and character generator delays. Internal delays cause the video outputs to be delayed relative to $\overline{CCLK}$.

VIDEO LOGIC

Each character block consists of the three components shown in Figure 4. Symbol video is generated from the dot data inputs D0-D8. Underline video is enabled by the AUL attribute and is generated during the scan lines for which the UL input is active. Underline and symbol video are always the same intensity or color, and other attributes (e.g., ABLINK) apply to them equally. The combination of underline and symbol video is also referred to as foreground video. Background video is the area of the character block corresponding to the absence of foreground video. The assertion of the non-display attribute (ABLANK) causes the entire character block to be displayed as background.

In monochrome mode, the serial dot data and pipelined cursor and attributes are combined to generate four video intensities (black, gray, white, and highlight) which are encoded on the TTLV1 and TTLV2 outputs as follows:

TTLV2	TTLV1	Video Intensity
0	0	Black
0	1	Gray
1	0	White
1	1	Highlight

FIGURE 4 — CHARACTER BLOCK DEFINITION

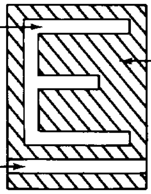


Table 1 describes the relationship between attributes and video intensity of the foreground and background components of the character block in monochrome mode.

In color mode, the colors of the foreground and background components are specified by the corresponding attribute inputs; AREDF, AGREENF, and ABLUEF dictate the color of the foreground components while AREDB, AGREENB, and ABLUEB do the same for the background component. In this mode, the serial dot data and pipelined cursor and attributes are combined to generate four video outputs. The RED, GREEN, and BLUE outputs separately contain the corresponding foreground and background components. The LUM output is the logical OR of the foreground colors and can be used to drive a separate monochrome monitor or to select a different set of colors for the foreground.

DOT MODULATION LOGIC

The dot modulation logic controls the video shift register to supply dot stretching and dot width control.

Dot stretching is controlled by the DOTS input which is sampled each scan line at the trailing (falling) edge of BLANK. If DOTS is asserted at that time, all characters on the following scan line will have dot stretching applied. Dot stretching causes an extra dot to be added to individual dots or groups of dots as shown in Figures 5 and 6. Dot stretching can be used to:

1. Compensate for low video backwidth monitors (since the minimum active displayed segment with dot stretching is two DCLKs).
2. Assure crisp black characters when operating in white background mode.
3. Provide thick characters as a means of distinguishing areas of the display.

FIGURE 5 — DOT MODULATION TIMING

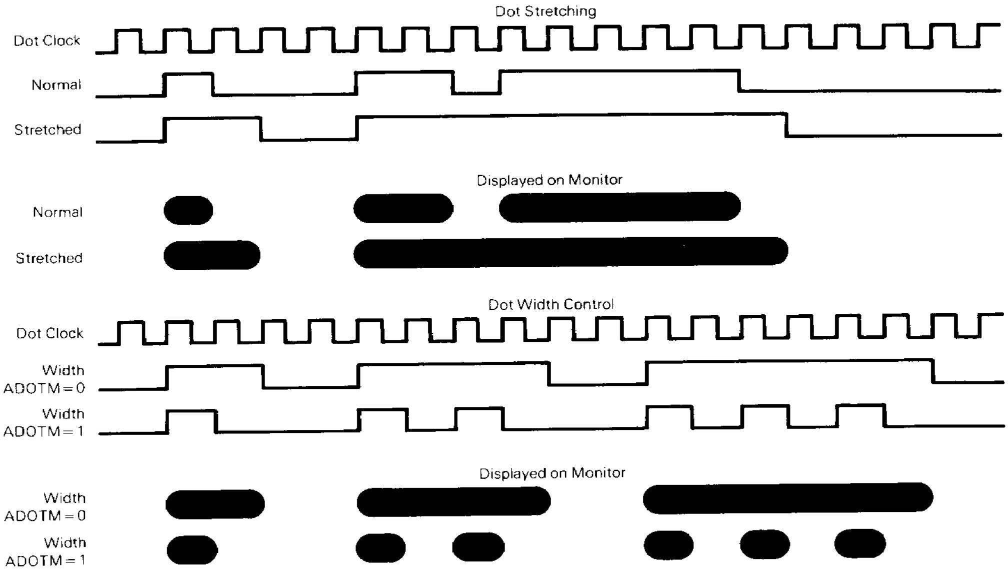
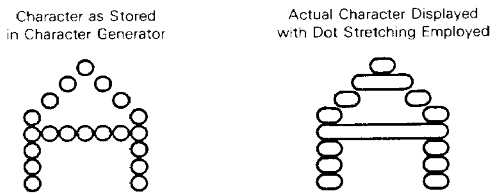


FIGURE 6 — DOT STRETCHING



Dot width is controlled by the DOTM and ADOTM inputs. DOTM is tied either high, which enables the features on the entire display, or low, which disables the feature. With ADOTM high, the dot width of characters can be selectively controlled by assertion of the ADOTM attribute input. When operating in this mode, the dot clock input is divided by two before being applied to other circuits in the CMAC. This affects the $\overline{CCLK}$ output.

When dot width control is enabled as above, two DCLKs are used for each video dot period. Asserting ADOTM for a particular character will cause each active video dot of the displayed character to be turned on for one DCLK and off for the other DCLK, while if ADOTM is negated for that character, the active video dot for that character will be turned on (black background) or off (white background) for both DCLK times (see Figures 5 and 7). Only the character video components of the character block are modulated. Underline video and background are not affected by on-time modulation. Width control can be used to:

1. Make horizontal lines and vertical lines appear the same brightness on the display.
2. Provide two different brightness levels for characters without requiring a monitor with analog brightness inputs.

However, note that the effects produced by this feature are highly dependent on the video amplifier characteristics of the monitor used.

FIGURE 7 — DOT WIDTH CONTROL

DOUBLE WIDTH LOGIC

The double width logic controls the rate at which dots are shifted through the video shift register. When the ADOUBLE input is asserted, the associated character video will be shifted at one half the DCLK rate, and the dot information for the next character will be loaded into the shift register two $\overline{CCLK}$s later. The $\overline{CCLK}$ output is not affected. If a double width character is specified at the last location of a character row, the second half of the double width character (one $\overline{CCLK}$) will extent into the horizontal front porch.

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