TV & CASSETTE INTERFACE CARD/64 CHARACTER

the digital group inc
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298-040-A-51+3

DIGITAL GROUP 1024 CHARACTER TV READOUT/CASSETTE INTERFACE CARD

General Design

This PC Board combines two functions needed by microprocessors, the ability to output data and messages on a low-cost TV set, and the ability to reliably store, retrieve, and exchange programs or data at low cost. The TV Readout will display 1024 characters, 16 lines of 64 characters per line, with upper and lower case alpha characters, Greek alphabet, math symbols, and special characters. The characters are formed from a 7 x 13 matrix of dots, producing easy to read characters with a normal height to width aspect ratio.

The cassette section provided circuits for recording data as well as receiving data previously recorded. Frequency Shift Keying is utilized, 2125 Hz being the Mark of "1" frequency, and 2975 Hz used as the Space or "0" frequency. The frequency shift keying system gives a better signal/noise ratio and the wide spacing of the harmonically unrelated frequencies permit the use of low cost home cassette recorders in spite of their generally poor "wow" and "flutter".

Software parallel to serial conversion systems are used for record, and software serial to parallel conversion systems for data playback. These software conversion systems permit complete flexibility in Data rate (from near Ø to 1000 bits per second), Codes utilized (ASCII, Baudot, etc.), and Error checking (Parity, CRC, etc.) inclusion.

TV Readout Description

The TV Readout consists of five interacting sections. They are Memory, Character Generation, Composite Video Output, Read Clock, and Write Clock. The memory section consists of seven 2102A or faster 1K memories, giving a possible storage of 1024 seven bit ASCII characters. The microprocessor, keyboard, or some attached circuit writes the characters one by one into the 2102's, and then the TV Readout continuously displays these characters until either more characters are entered, or the circuit is turned off.

The character generation circuit consists of two IC's, the MCM6571L character generator, and 74165 parallel to serial converting shift register. the 6571 takes the seven bit ASCII character coming from the memories and outputs 7 dots making up a character row for each of 13 potential rows making up each character. The 74165 loads these 7 dots coming out at a time into its internal memory, and then outputs these one at a time for serial transmission to a TV set. For more information on TV character generators, I would suggest reading an excellent article by Don Lancaster in June, 1974 Radio-Electronics (p. 48-52).

The video output section uses a 74151 data selector, a 7401 open collector NAND gate and a driver transistor to produce a low impedence composite video signal. The 74151 permits selecting either white characters on a black background, or black characters on a white background. In addition extermal binary level video (such as TV graphics) may be selected/inverted. The TV output is around 2 volts peak to peak with about a ½volt horizontal and vertical sync and blanking pedestal.

The Read Clock is the master control of the various sections. Starting from an initial frequency of 11.980 MHz, a countdown chain of three 74193's (IC's 26, 25, and 37) produce and 8µs horizontal sync when gated by 1/6 IC2, 1/2 IC27, 2/3 IC29, and 1/4 IC28. A 20 µs horizontal blanking circuit prevents loss of characters at the edges of the screen and is produced by the gating action of 3/4 IC17, 1/6 IC2, and 1/3 IC29. The resultant horizontal frequency is 15,598 Hz, somewhat lower than the standard 15,750 Hz, but usually only requires trimming horizontal hold slightly if at all.

The vertical countdown chain uses three more 74193's (IC's 1,15, and 5) to obtain a final vertical frequency of 60 Hz, syncronous with the AC line to avoid hum roll and wobble problems on low cost TV's. 3/6 IC7 and IC8 produce an 820µs Vertical sync pulse, 2/3 IC6 gives a ÷ 22 gating to IC's 15 and 5, and the 1/6 IC7 produces a 3.5ms Vertical blanking pulse. Modified to put serrations in V-sync pulse immediately preceding when H-sync pulse would normally be — to help maintain H sync during V retrace. See schematic.
A special feature of this TV Readout board is its ability to be externally syncronized to an external video timed base. This permits syncronizing the microprocessor's video countdown chain to an external video source such as a TV camera or a commercial TV program for titling, "Frame Grab", etc. operations. The horizontal countdown chain is syncronized by a short negative going pulse applied to connector pin U which will reset the horizontal counters and the horizontal sync pulse. The Vertical chain is reset by applying a short negative pulse to connector pin V.

The various Read Clock timings are brought out to the connector so that external video based systems (such as graphics) may be easily coupled with this TV system. As if these operations weren't enough, various timings from the Read Clock also tell which of the 13 rows, which make up each character, is being currently accessed, and loads the 74165 when the row of 7 dots is available from the 6571. The 11.980 MHz signal then shifts out 8 dot peroids (the 8th one is a horizontal space between characters) before the next dot load command occurs. All of these timings are very critical during the design phase, but the builder should have no problems, since no adjustments are needed. The Read Clock also controls which of 1024 characters is currently being inputed to the 6571 for dot encoding, except during Write Clock times.

I thought you'd never ask about the Write Clock. Well, it controls the entry of the characters from whatever external source into the 2102 memory bank. Several alternatives in character entry are possible. However, this design tries to be as simple as possible, yet give the user a very capable unit, particularly when using a microprocessor, or even mini, midi, or maxi processors.

A sequential entry system is utilized. A Home Reset control signal is developed by IC22 when it detects the 7 character defining input lines high ("1"). IC's 23, 13, and 3 are then preset so that the next character to be entered will result in its being displayed as the top leftmost character on the screen. The 2nd character will be viewed to the right of the first,....until on the 65th character a new line appears, displaying the 65th character. Up to 1024 characters are thus sequentially entered and displayed. If a 1025th and following characters are entered, an overwrite condition results, with the new page load displayed from the top

leftmost, the former character overwritten "gone forever". The display may be reset at any time. Screen erase consists of either 1024 or more ASCII "spaces" (Octal 240) and an ASCII ∎ (all bits on (either a 177 or a 377)), or an ASCII ∎ and exactly 512 ASCII spaces, the latter being preferable.

Memory writing occurs when the MSB goes high. The 74157's then allow the 74193's IC23, 13 and 3 in the Write Clock to control the memory address lines on a priority interrupt basis. 600 ns later, a 600 ns strobe pulse writes the new character into memory. There is a parallel logic path to step the Write Clock address forward or backward without writing a character. This produces a "Pseudo Cursor" effect without the usual expense of a number of comparators, etc. A software "blink" may be easily implemented with a final result indistinguishable from a hardware cursor. The "Pseudo Cursor" logic consists of 1/4 IC16 and IC38 which detect the presence of an LSB, toggling the Write Clock 74193's up in count without firing the 74L123 (IC20) Write Strobe if ~~not~~ the MSB is not simultaneously brought high (indicating character entry then, of course). LSB + 1 high without the MSB toggles the Write Clock 74193's down in count, which backs up the cursor.

A 74122 (IC39) produces a short pulse each time the MSB is brought high, thereby blanking the screen while the memory updating process is taking place. This reduces the glitches appearing on the screen when high rate updating occurs. The only way to completely eliminate the glitches would be to only update during the Vertical blanking pulse, but this would seriously downgrade performance in some critical operations.

Cassette Interface Circuit Description

The previous 512 character Digital Group TVC used a tunable oscillator which required careful alignment. This requirement has been eliminated by using a digital frequency synthesizer countdown chain. The TV master oscillator is divided by either 5650 or 4030 to get the 2125 or 2975 cassette frequencies. The actual frequencies are a few Hertz low, but well within tolerances. The main cassette countdown chain consists of IC's 45, 46, and 43. IC49 is used to gate an early reset to achieve the 2125 tone, and IC48 gates an early reset for 2975. The actual output of this chain is 10 times too high, and the 7490 (IC42) provides a ÷ 10 smoothing and squaring function. A logic level input at pin 18 on the connector controls the resultant audio frequency at output pin 10. A high input ("1") produces a 2125 Hz output, and a low output ("Ø") results in 2975 Hz. The output wave shape is a symetrical square wave. The 47K (R13) resistor in series with the output is a typical value to be used when coupling to the low level, low impedence external microphone inputs of most cassette recorders.

The cassette receive circuitry detects the prerecorded frequency shift keying and produces a "1" or a "Ø" output as a result of a detected 2125 Hz or 2975 Hz tone at the input. IC40 is a clamped limiter which prevents variations in amplitude from affecting the resultant detection process. The output of IC40 should be about 1.2 volts p-p, roughly a square wave of the incoming frequency, constant in amplitude regardless of tape volume setting or minor tape "dropout" problems.

Two bandpass active filters then amplify a tone 5 times when actually tuned to their respective frequencies of 2975 Hz for the top filter and 2125 Hz for the lower filter. The further off the tuned frequency the tone is, the less amplification the filter will produce. The actual resonance points of the filters may be easily adjusted by merely trimming the multiturn potentiometers in each filter.

Full wave active detectors produce rectified full wave pulses at the summing junction, pin 5 of IC47. The 2975 Hz tones are rectified +, and the 2125 Hz tones are rectified -. As tones depart from either exact frequency, a value less + or - is produced until approximately midway a summed voltage of Ø results.

A 3-pole lowpass active filter then removes the remaining traces of pulsating DC from the summed signal with almost no effect on the data pulses up to a speed of 1000 bits per second. If lower data rates were to be utilized, an improved signal to noise ration could be obtained by multiplying the values of C35, C37, and C38 by the reciprocal of the data rate difference. I doubt you would notice any operational difference, however.

The final section is a slicer connected 741 (IC51). This op amp detects whether the voltage at its pin 2 is + or - with respect to the constant voltage at its pin 3. The output voltage will then swing either to nearly +5 or to nearly -12. A forward biased germanium diode prevents the actual output voltage from going less than ≃ -.2 volts, so that valid TTL levels are not exceeded. An offset adjusting pot allows the output to be placed in a "Mark Hold" condition when no tone input is being detected. 2/4 7400 (IC50) provides output TTL level buffering, and allows data inversion by tapping the output to the pin 11 section if a customized circuit required this modification.

Construction

Tools: Fine tipped, low wattage soldering iron, "wire solder" (around 20 gauge resin solder), small diagonal cutters.

Test Equipment: Ohmeter
Audio Generator helpful
10 MHz or better triggered sweep oscilloscope
Frequency Counter
Microprocessor, Mini, etc.

Estimated Construction Time: 3-6 hours

1. Insert the 24-pin socket, 5 8-pin sockets, 28 16-pin sockets, and 17 14-pin sockets into the PC board. If the sockets have a keyway indication, orient this away from the connector. Note: the top side of the board is indicated by The Digital Group label.

2. Invert the board and carefully solder in the sockets. A special plating process is used by The Digital Group to minimize solder joint troubles. We would suggest a "warmup area" by starting with the cassette interface sections of the card.

3. Insert and solder the 17 resistors in the TV Readout section enclosed by the +12 bus line. Insert and solder the 22 resistors in the cassette section.

4. Insert and solder the zener diode, the germanium diode, and the 8 silicon diodes. Note: all of the diodes are oriented with their cathode or "bar" end oriented towards the right.

5. Insert and solder the output transistor in the TV Readout section.

6. Insert and solder the two 220 pfd and the 330 pfd and the 100 pfd condensers in the TV Readout section.

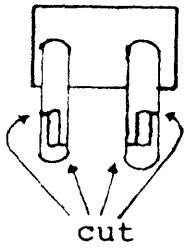
7. Insert and solder the fourteen condensers in the Cassette Interface section.

8. Insert and solder the three potentiometers in the Cassette section. Note that the potentiometer is a 50K, the other two are long multi-turn 500 ohm units.

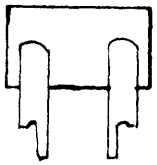
9. Insert and solder the various bypass condensers in the TV Readout section. Note: the positive (+) end of the dipped tantalum condensers is indicated by the vertical marking (paint strip) along one side. Additional holes have been provided between IC's 9 and 30 for additional input bypassing with 50-200 pfd condensers if your installation so requires.

10. Trim the crystal socket's pins as shown to fit into the crystal holes.

Pin view:



Result:



Press the rear tab into the board hole provided for it. Solder the pins and the rear tab.

The socket provides a space-saving flat mount as well as avoids soldering to the heat-sensitive crystal.

11. At this point, measure the resistance between ground (pin 20) and the other voltage supply pins (19, 21, & 22). A very low resistance indicates a bad bypass or a solder bridge short somewhere.

12. Insert the IC's in the TV Readout section except for the memories (2102's) and the MCM6571L character generator. The notch or pin 1 end of each IC should be oriented away from the connector end of the board. Measure the resistance between pins 19 & 20, noting the value. Reverse the ohmeter leads and remeasure. A shorted reading indicates a bad IC, and near equal readings indicates a reversed IC.

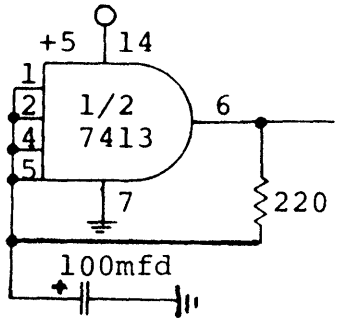
13. Temporarily groung pin 1 of the TV readout and connect a TV set modified for direct video, or a commercial TV monitor, between pins 16 (video) and 20 (ground).

14. Putting a +5 voltage between pins 19 (+) and 20 (Ground) should result in 64 vertical white columns on the screen. Refer to "Troubles" section if this does not happen.

15. Connect the other ±12 supplies, and turn on power again. Measure the voltages on pins 1, 2, and 3 of the MCM6571L socket. They should measure -5, +5, and +12 respectively.

16. Plug in the 2102's and the 6571. The temporary grounding jumper to pin 1 should still be connected as well as the TV monitor. Turning on power this time should result in a random display of 1024 characters on the screen. The actual character at each location is determined by the chance bit structure at the memory locations. Remove the temporary grounding jumper from pin 1 when done with this test.

17. Complete testing of the TV Readout is best performed under microprocessor control, and sample diagnostic programs are included with The Digital Group Systems. "Breadboard diagnostic testing" may be accomplished by temporarily tieing each of pins 2 - 8 to +5 through a 1K resistor. Tie pin 1 to the output of a simple oscillator such as shown below:



Grounding pins 2 - 8 to ground should produce:

pin to ground	Character
8	∿
7	}
6	{
5	w
4	o
3	
2	?

18. Plug in the twelve IC's in the Cassette section.

19. Connect a calibrated frequency counter between pin 10 and ground.

20. Apply +5 and ±12 voltages to the board. With the Cassette Write input pin 18 open or tied to +5, the frequency counter should read approximately 2120 Hz.

21. With voltages still applied, ground input pin 18. The frequency counter should now read approximately 2970 Hz. This completes cassette write turn up. Easy, isn't it.

22. Jumper pins 10 and 9 together. This permits using the Write Cassette section as a master oscillator to align the Read Cassette section.

23. Measure the output at pin 6 of the 741 limiter (IC40) with an oscilloscope. The waveshape should be an approximate square wave of about .6 volts p-p.

24. Keeping the jumper from ground to connector pin 18, (the frequency counter should read about 2970 yet) measure the output at pin 7 of the 5558 active bandpass filter (IC41). Turn the 2975 trimmer pot (R30-the pot in the right corner) until the signal exactly peaks, and leave at this point.

25. Move the jumper on connector pin 18 from gorund over to +5. The frequency counter should now read about 2120. Measure the output at pin 1 of IC41. Turn the 2125 pot (R29-the middle pot) until the signal exactly peaks, and leave at this point.

26. Measure the detected voltages at pin 5 of IC47. When the input frequency approaches 2125, the output should go -. When approaching 2975, the output should go +. Trouble in this area would most likely be caused by reversed or defective diodes, or adjacent line shorts.

27. Measure the voltage at the cathode (bar) end of the output clamping germanium diode (G1). If desired, remove the jumpers and attach an audio oscillator. Sweeping the frequency between 2125 and 2975 Hz should result in a clean voltage jump somewhere between 2125 and 2975. Be sure that the negativemost voltage at this point is about -.2 volts.

28. Remove the jumper between pins 9 and 10 and short input pin 9 temporarily to ground. Measure the output at pin 6 of IC40 again. A stable condition (no oscillation) should be seen. Connect the oscilloscope to the cathode of G1 again. Adjust the balance potentiometer (R18 - the small leftmost pot) clockwise so that the voltage is at a - level. Slowly turn the potentiometer counterclockwise until the voltage jumps + and leave setting at this point.

29. Disconnect the temporary jumper from conncector pin 9 and reconnect the audio oscillator. Perform step 24 again. If all proceeds well at this point, the cassette interface is ready to receive data.

Troubles - General

1. One of the more difficult troubles to find is an IC pin which was bent under the IC when it was inserted. Any unusual pressure when inserting an IC should be investigated.

2. Every pin should be soldered. The most frequent cause of trouble is an unsoldered pin, generally an end IC pin. Carefully sighting down parallel rows of pins usually finds any that are not soldered.

3. When troubleshooting with a 'scope probe, measure from the top side of the IC, not the bottom, to eliminate a bent under pin problem or defective socket from misleading.

4. Before ever plugging in any IC's, always measure the voltages at the PC board and at the pins of the more expensive IC's, like the 6571.

5. When handling IC's, avoid static charges. Run your house humidity high, and ground yourself ty touching a grounded chassis before touching IC's.

6. Beware of solder splashes and drilling errors. Please inform The Digital Group of board manufacturing errors that you detect. A flashover or splash on the topside would be very difficult to find after soldering the sockets. The black socket body of the sockets used in The Digital Group kits may be pried off after removing the IC should a hidden splash be suspected.

7. Beware of shorts in the cassette area between component leads and underlying circuitry.

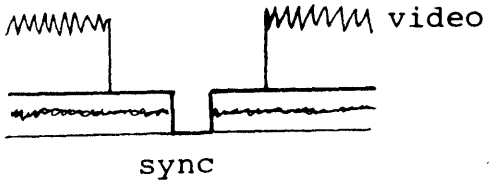
Specific Troubles

No white colums on the screen at step 14.

1. Bad connection between connector pin 16 and TV.
2. Temporary jumper from connector pin 1 to ground not connected.
3. Crystal not oscillating. Check for pulses at pin 1 of IC16.
4. Horizontal Countdown chain defective. Successively measure output at pin 3 of IC's 26, 25, and 37. Each should be progressively lower in frequency.
5. Vertical Countdown chain defective. As above #4, but measure IC's 1, 15, and 5.
6. Defective video mixer. Look for pulses at pins 1 and 13 of IC19.

Poor or lacking syncronization at step 14.

1. TV is overloaded by the ≃ 3 volts of video. Swamp the video with a 10 ohm resistor to see of sync & video stabilizes.
2. Check for Horizontal and Vertical sync and blanking pulses at connector pin 16. A 75 ohm load should be attached. The pattern should look like:



   a. If Horizontal Sync is defective, check IC's 2, 27, 28, and 29.
   b. If Vertical Sync is defective, check IC's 7 and 8.
   c. If Horizontal Blank, check IC's 2, 17, and 29.
   d. If Vertical Blank, IC7.

No characters at Step 16.

1. Missing voltages at the MCM6571 (IC11).
2. Defective Character generator.
3. Defective 74165 (IC10) or 74157 (IC18).
4. Defective logic signals to and from IC11 and IC10. All inputs and outputs should be pulsing at valid TTL levels (Ø to .8 volts = low/ 2 to 5 volts = high).
5. Pins 11 and 10 of 74151 (IC18) not at +5.

Wrong character(s) in display

1. Miswired or misjumpered input.
2. Defective Memory IC. Note: the bit difference between the intended character. IC30 is the memory for the Least Significant **Bit (LSB)** of the character... and IC36 is the Most Significant Bit's **(MSB)** memory.
3. Defective 74157(s) - IC's 24, 14, and 4.
4. Shorted lines in the memory and write clock area.

"Twinkling" character on TV

1. Slow memories. 500 nanoseconds or faster 2102's must be used.
2. Overheated memories. Access times increase with heat.
3. Slow 6571L - none seen so far, but possible.

Uneven lighting of leading and trailing edges of characters, esp. "H".

1. Monitor bandwidth too low produces a dim left side of H, bright on the horizontal bar part.
2. Incorrectly high peaked monitors give an excessively bright left edge to characters such as "H".
3. Dim right side of "H" and other characters may be monitor or may require increasing the clock lag condenser (IC43) in value. Too high of a value will reduce the left side of characters such as "H".

Won't write characters

1. Missing Storbe pulse, or continuous level on MSB input (connector pin 1).
2. No Write pulse from 74L123 (IC20). Measure at pin 12 of IC20, looking for an ≃ 600 ns negative going pulse. Connecting the MSB (connector pin 1) to a ≃50KHz TTL clock will permit viewing on lower cost oscilloscopes.
3. Write Clock not toggling. With above temporary oscillator inputting to MSB, look for pulses at pin 3 of IC's 23, 13, and 3.
4. Defective Read/Write Multiplexers (IC's 24, 14, and 4.

Extraneous Characters

1. Noise on the input lines to the memory, particularly on the MSB (connector pin 1). Pads for C1, C2, and C3 - small pfd condensers used on the input line to suppress most noise sources. This trouble generally shows up as an α appearing on the screen when another port is addressed.
2. Data sent to the TV character generator faster than it can handle. Data must be valid for 1.5 microseconds following the rise of MSB strobe. Faster data rates can be handled by reducing the value of the condensers in the 74L123 (IC20) Write strobe singleshot. Alternatively, a data hold loop consisting of NOP's can slow the data output to the readout.
3. Defective or slow memories. Look at the bit pattern of the extraneous character to determine if a single memory is bad.
4. More bypassing required. A number of unused voltage bypassing pads at the top of the TV Readout section have been included should your particular system require them.

Defective level output from Cassette Input Limiter

1. None at all: Check for ±12 to IC40.
2. Too high output level. Diodes (S3 and S4) open or one is reversed.

Bandpass Active Filter Problems

1. Check by sweeping with audio oscillator for proper range.
2. Swap 5558 (IC41) with IC's 44 and 47.
3. Check for shorts or out of tolerance (5%) condensers C30, C31, C32, or C33. Disc ceramics are a no-no in tuned circuits!

Full Wave Detector

1. Diodes open, reversed or shorted.
2. Defective 5558 (IC44).

Low Pass Active Filter

1. Shorted or out of tolerance condensers.
2. Defective IC47.

Output Slicer (IC38)

1. Reversed, open, or not Germanium diode at G1.
2. Defective or missoldered resistors in pin 3 circuitry of 741 (IC51).
3. Defective 741 (IC51).

1024 CHARACTER READOUT & CASSETTE INTERFACE - PARTS LIST

IC's	
IC30,36	7 - 2102-1 or better
IC11	1 - MCM6571L
IC9, 17, 28, 50	4 - 7400
IC19	1 - 7401
IC16	1 - 7402
IC2, 7	2 - 7404
IC6, 29	2 - 7410
IC27	1 - 7420
IC8, 22, 48, 49	4 - 7430
IC42	1 - 7490

IC's	
IC39	1 - 74122
IC20, 38	2 - 74L123
IC18	1 - 74151
IC4, 14, 24	3 - 74157
IC10	1 - 74165
IC1, 3, 5, 12, 13, 15, 21, 23, 25, 26, 37, 43, 45 46	14 - 74193
IC40, 51	2 - 741
IC41, 44, 47	3 - 5558 or LM1458

Capacitors	
C2	1 - 100 pfd mica
C4, 5	2 - 100 pfd mica
C43	1 - 330 pfd mica
C24	1 - 1000 pfd mica
C35	1 - .0047 mylar
C30 - C33	4 - .01 polystyrene (may be marked 10000)
C37	1 - .01 mylar
C38	1 - .015 mylar

Diodes	
S1 - S8	8 - 1N914 or 1N4148
G1	1 - 1N48 or eq. Germanium
Z1	1 - 5V 1 watt zener (1N4733 or eq.)
T1	1 - 2N5129/2N2369

Bypass Capacitors
24 - .01 mfd disc
4 - 1 mfd tantalums

Crystal
1 - 11.980 MHz

Misc
5 - 8 pin sockets
17 - 14 pin sockets
28 - 16 pin sockets
1 - 24 pin sockets
1 - crystal holder
1 - documentation

Resistors - all ¼ watt 5% unless noted	
R11	1 - 22 ohm
R12	1 - 220 ohm
R31	1 - 390 ohm
R1, 2, 10	3 - 470 ohm
R28	1 - 470 ohm ½ watt
R32	1 - 620 ohm
R5, 42	2 - 1K
R6, 7, 8, 9, 14	5 - 2.2K
R22	1 - 4.7K
R3, 4	2 - 15k

Resistors	
R16, 17, 19, 20, 21, 26, 27, 35, 36, 37, 38	11 - 10K
R15	1 - 33K
R13, 24, 25, 33	4 - 47K
R34	1 - 68K
R39, 40, 41	3 - 100K
R29, 30	2 - 500Ω trimpot
R18	1 - 50K pot

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1024 Character TVC

Front of Board

Pin	Function	
1	MSB	Strobe
2	MSB	
3	MSB	
4	MSB	Data to TV
5	MSB	
6	MSB	
7	MSB	
8	LSB	
9	Data from Cassette	
10	Data to Cassette	
11	Clock	
12	H sync	
13	V sync	
14	H Blank	
15	V Blank	
16	Video	
17	Data to CPU	
18	Data from CPU	
19	+5	
20	Ground	
21	+12	
22	-12	

Pin Side of Board

Pin	Function	
A	P	
B	A	
C	B	
D	C	Horz
E	D	
F	E	
H	N	
J	F	
K	G	
L	H	
M	I	Vert
N	J	
P	K	
R	L	
S	M	
T	Data Inv	
U	H Preset	
V	V Preset	
W	Graphic Input	
X	Graphic Select	
Y	not used	
Z		

512 TO 1024 UPGRADE SPECIAL DIRECTIONS

This 512 to 1024 character upgrade kit permits using most of the 512 character IC's in addition to a new board, sockets, resistors, condensers and miscellaneous parts to achieve a 1024 character TV readout.

Steps:

1. Remove all IC's from your 512 board except IC27 (74L00), IC23 (74123), and IC33 (566).

2. Add the 34 IC's just removed to the IC's supplied with the 1024 character upgrade kit.

3. Continue with regular 1024 character readout directions.

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1024 CHARACTER READOUT & CASSETTE INTERFACE UPGRADE - PARTS LIST

IC's	
(IC30, 36)	7 - 2102-1 or better
(IC11)	1 - MCM6571L
IC9, 17 (28, 50)	4 - 7400
(IC19)	1 - 7401
IC16	1 - 7402
(IC2, 7)	2 - 7404
IC6, (29)	2 - 7410
(IC27)	1 - 7420
IC8, 22, (48, 49)	4 - 7430
IC42	1 - 7490

IC's	
IC39	1 - 74122
IC20, 38	2 - 74L123
IC18	1 - 74151
(IC4, 14, 24)	3 - 74157
(IC10)	1 - 74165
IC1, 3, 5, 12, 13, 15, 21, 23, 25 (26, 37, 43, 45, 46)	14 - 74193
(IC40, 51)	2 - 741
(IC41, 44, 47)	3 - 5558 or LM1458

Capacitors	
C2	1 - 100 pfd mica
C4, 5	2 - 220 pfd mica
C43	1 - 330 pfd mica
C24	1 - 1000 pfd mica
C35	1 - .0047 mylar
C30 - C33	4 - .01 polystyrene (may be marked 10000)
C37	1 - .01 mylar
C38	1 - .015 mylar

Diodes	
S1 - S8	8 - 1N914 or 1N4148
G1	1 - 1N48 or eq. Germanium
Z1	1 - 5V 1 watt zener (1N4733 or eq.)
T1	1 - 2N5129/2N2369

Bypass Capacitors	Misc
24 - .01 mfd disc	5 - 8 pin sockets
4 - 1 mfd tantalums	17 - 14 pin sockets
	28 - 16 pin sockets
Crystal	1 - 24 pin sockets
1 - 11.980 MHz	1 - crystal holder
	1 - documentation

Resistors - all ¼ watt 5% unless noted

R11	1 - 22 ohm
R12	1 - 220 ohm
R31	1 - 390 ohm
R1, 2, 10	3 - 470 ohm
R28	1 - 470 ohm ½ watt
R32	1 - 620 ohm
R5, 42	2 - 1K
R6, 7, 8, 9, 14	5 - 2.2K
R22	1 - 4.7K
R3, 4, 22	3 - 6.8K

Resistors	
R16, 17, 19, 20, 21, 26, 27, 35, 36, 37, 38	11 - 10K
R15	1 - 33K
R13, 24, 25, 33	4 - 47K
R34	1 - 68K
R39, 40, 41	3 - 100K
R29, 30	2 - 500Ω trimpot
R18	1 - 50K pot

( ) indicates IC's removed from 512 Character Readout and Cassette Interface

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NOTE TO OWNERS OF THE PREVIOUS 512 CHARACTER TVC-F.

The 1024 character TV readout board produces 64 characters on each horizontal line now, instead of the previous 32 per line. This will generally result in a need for reprogramming the screen formatting somewhat. Most D.G.S.S. Z-80 tapes using 512 character TV output have been modified to reflect this additional character count requirement. However, user designed programs may have to be modified to support the additional characters. A "quick and dirty" implementation can be performed by outputting an additional space "after each character or space."

The screen erase subroutine must output 1024 spaces. This subroutine is part of the EROM op system of the various Digital Group CPU boards. The Z-80 has had several versions of EROM supplied, marked ZA, ZB, ZC, ZD, and ZE. ZE is the latest and most common. All but the ZA version already perform a correct "Erase" for both the 1024 and the 512 character TVC's.

The 8080, 6800 or 6502, (or 6501) must have 80B, 68B or 6502, respectively, EROM's to satisfactorily perform a 1024 character Erase.

Should you have an older 512 character erasing EROM (a very small number of customers are in this category) please return your EROM and the Digital Group will reprogram/exchange it with the latest version for $5.00 postpaid.

the digital group
po box 6528 denver, colorado 80206 (303) 777-7133

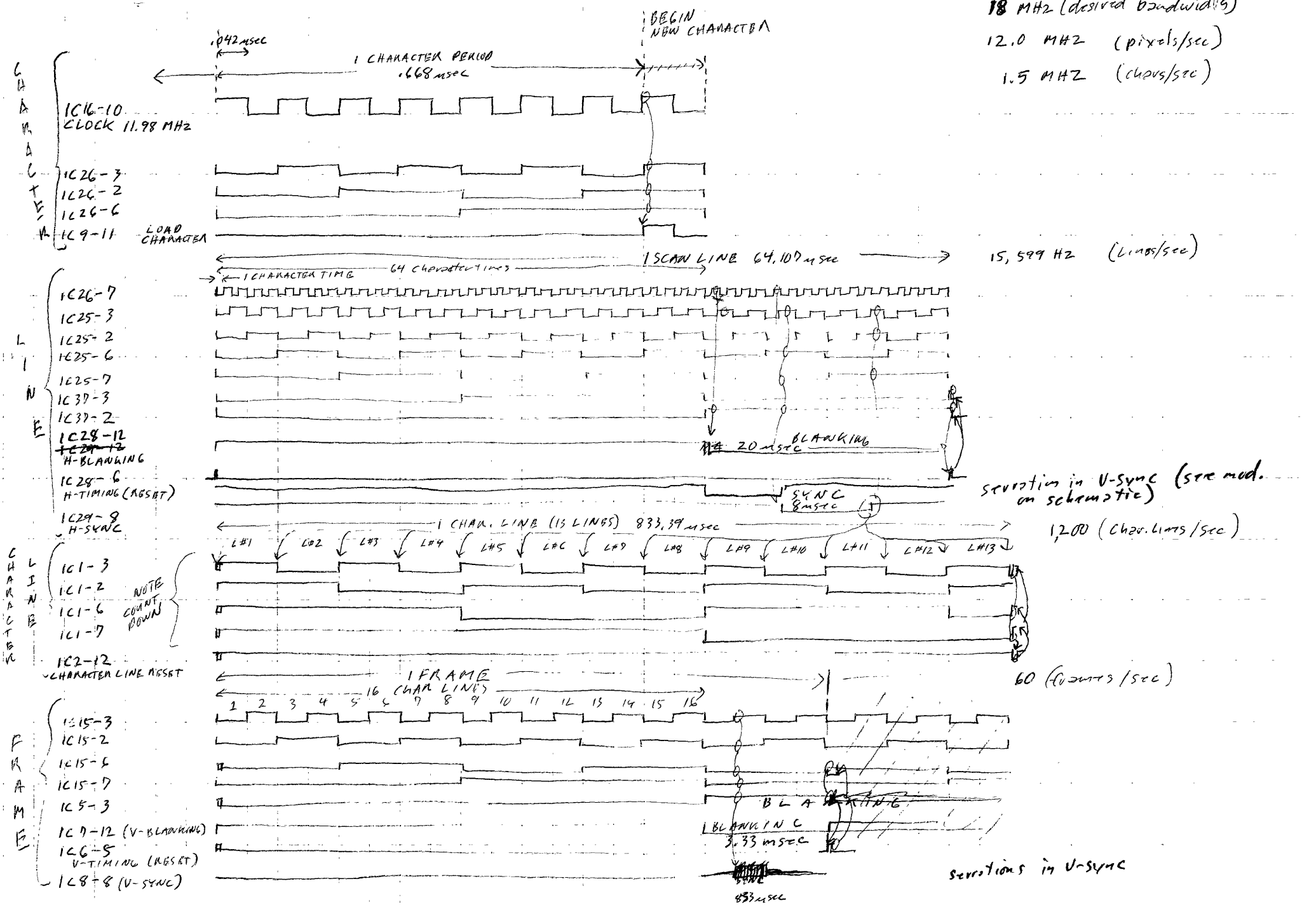

18 MHz (desired bandwidth)
12.0 MHz (pixels/sec)
1.5 MHz (chars/sec)
.042 msec
1 CHARACTER PERIOD
.668 msec
BEGIN NEW CHARACTER
CHARACTER
IC16-10
CLOCK 11.98 MHz
IC26-3
IC26-2
IC26-6
IC9-11
LOAD CHARACTER
1 SCAN LINE 64.107 msec
15,599 Hz (lines/sec)
1 CHARACTER TIME
64 character times
LINE
IC26-7
IC25-3
IC25-2
IC25-6
IC25-7
IC39-3
IC39-2
IC28-12
H-BLANKING
20 msec BLANKING
IC28-6
H-TIMING (RESET)
IC29-8
H-SYNC
SYNC 8 msec
serration in V-sync (see mod. on schematic)
1 CHAR. LINE (13 LINES) 833.39 msec
1,200 (char. lines/sec)
LN1 LN2 LN3 LN4 LN5 LN6 LN7 LN8 LN9 LN10 LN11 CH12 LN13
CHARACTER LINE
IC1-3
IC1-2
IC1-6
IC1-7
NOTE COUNT DOWN
IC2-12
CHARACTER LINE RESET
1 FRAME
16 CHAR LINES
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
60 (frames/sec)
FRAME
IC15-3
IC15-2
IC15-6
IC15-7
IC5-3
IC7-12 (V-BLANKING)
IC6-5
V-TIMING (RESET)
IC8-8 (V-SYNC)
BLANKING
BLANKING
3.33 msec
SYNC
833 msec
serrations in V-sync

FIGURE 22 – MCM6578 PATTERN

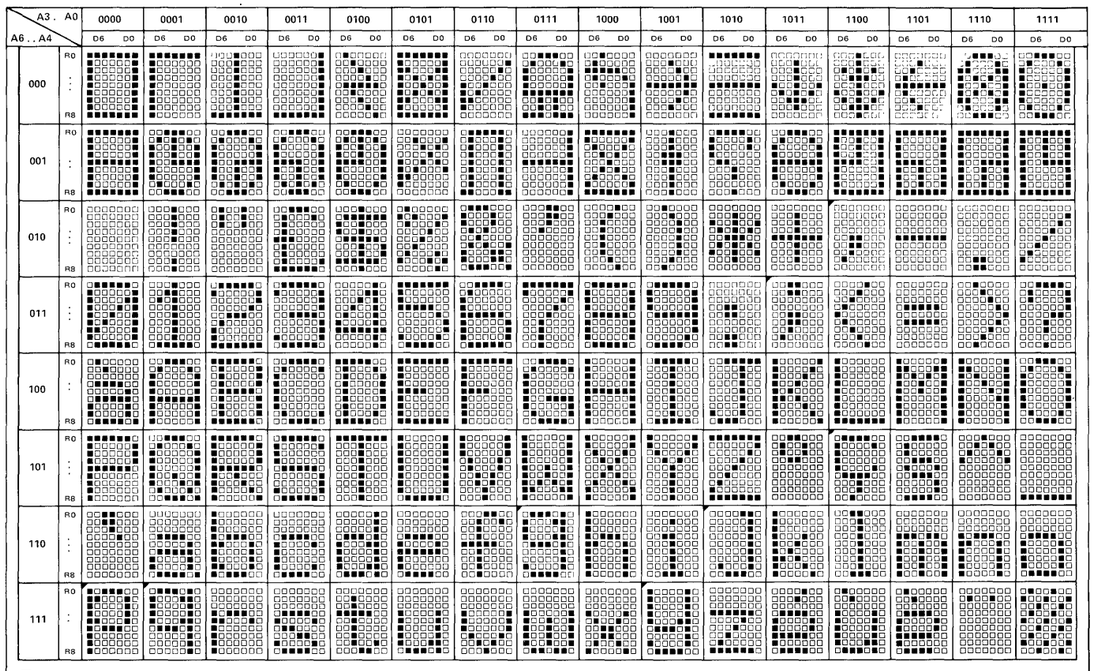
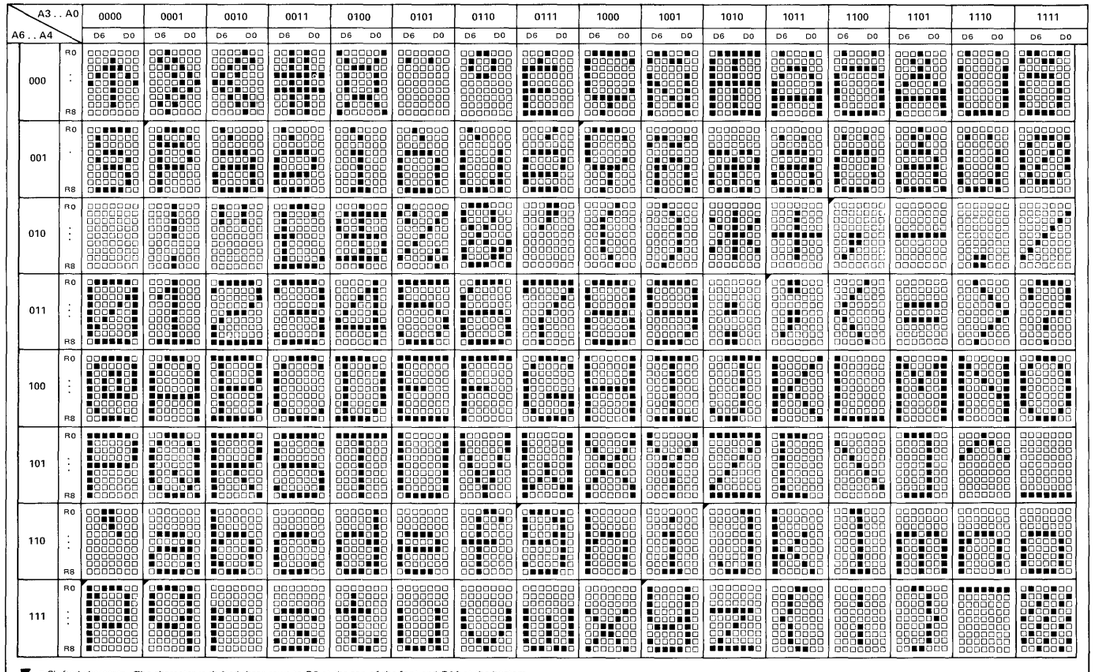


FIGURE 23 – MCM6579 PATTERN



APPLICATIONS INFORMATION

One important application for the MCM6570-79 is in CRT display systems (Figure 24). A set of buffer shift registers or random access memories applies a 7-bit character code to the input of the character generator, which then supplies one row of the character according to the count at the four row select inputs. As each row is available, it is put into the TTL MC7495 shift registers. The parallel information in these shift registers is clocked serially out to the Z-axis where it modulates the raster to form the character.

The MCM6570-79 require three power supplies: -3.0 volts, +5.0 volts, and +12 volts. The character generator requires only small currents from the -3.0 volt and +12 volt supplies, such that charge pump techniques using +5.0 volts can be used.

Figure 25 shows a supply circuit that will generate the required -3.0 volts for V_{BB}. The +12-volt supply of Figure 26 will supply the 6.0 mA that is typically required. Increased current capability is possible by modifying the circuits. Use of these small, low-cost supplies makes a single +5.0-volt system possible.

When powering this device from laboratory or system power supplies, it is important that the Absolute Maximum Ratings not be exceeded or device failure can result. Some power supplies exhibit spikes or "glitches" on their outputs when the ac power is switched on and off. For example, the bench power supply programmed to deliver +12 volts may have large transients below ground when the ac power is switched on and off. If this possibility exists, it is suggested that the user switch the dc side of the power supply or protect the device power pins (+12, +5.0, and -3.0 volt) against reverse biasing with clamp diodes. A hot carrier diode such as the MBD501 is suggested for this purpose.

FIGURE 24 – CRT DISPLAY APPLICATION USING MCM6571

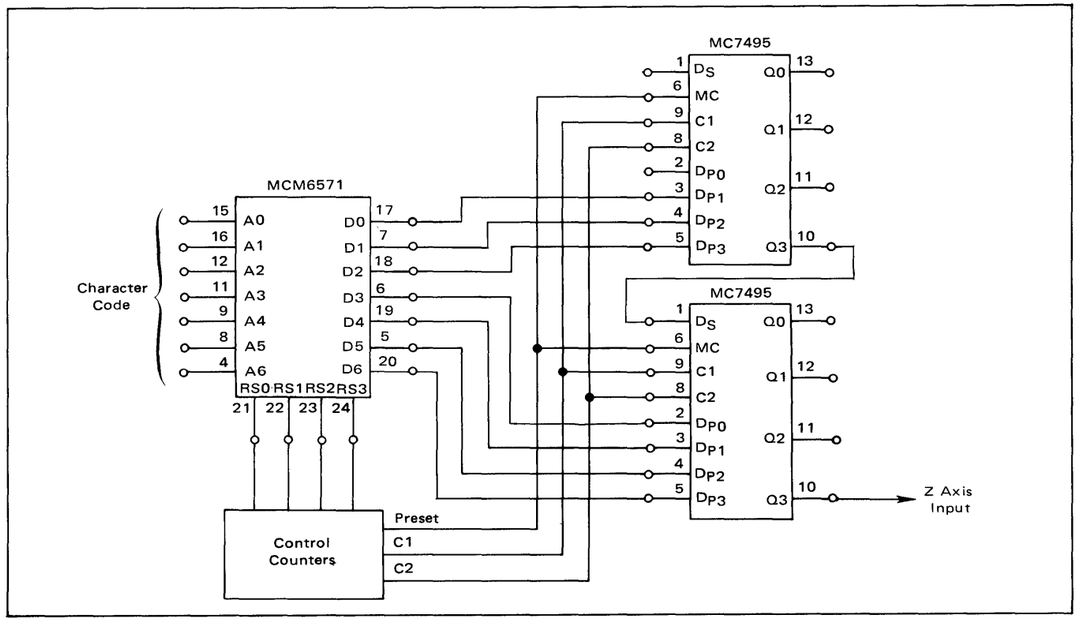


FIGURE 25 – SUBSTRATE BIAS CHARGE PUMP SUPPLY

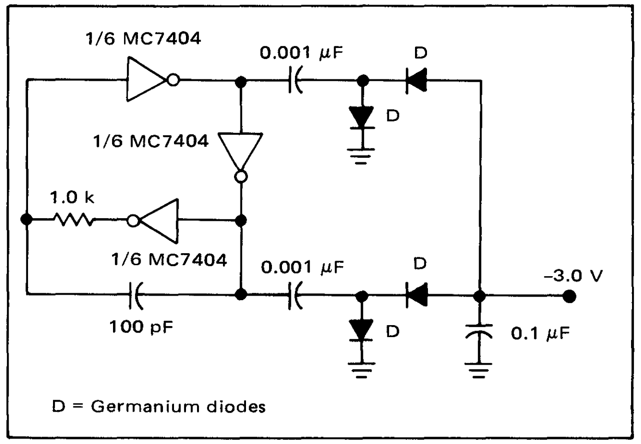
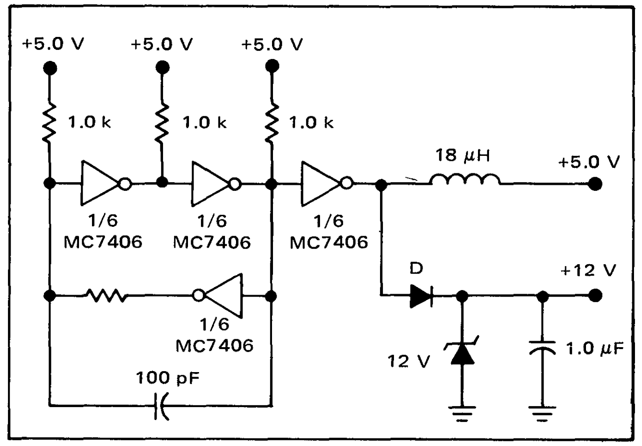
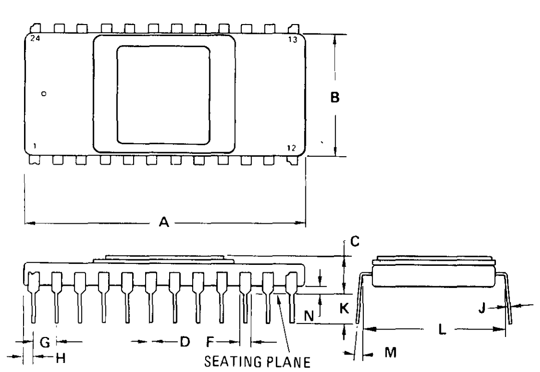


FIGURE 26 – GATE VOLTAGE CHARGE PUMP SUPPLY



PACKAGE DIMENSIONS

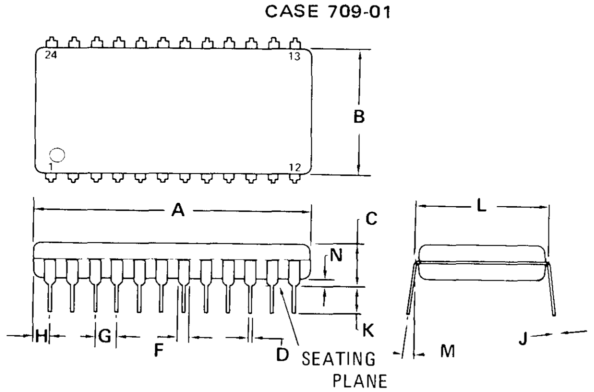
CASE 684-04



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	29.34	30.86	1.155	1.215
B	12.70	14.22	0.500	0.560
C	3.05	3.94	0.120	0.155
D	0.38	0.51	0.015	0.020
F	0.89	1.40	0.035	0.055
G	2.54 BSC		0.100 BSC	
H	0.89	1.40	0.035	0.055
J	0.20	0.30	0.008	0.012
K	2.92	3.68	0.115	0.145
L	14.86	15.87	0.585	0.625
M	–	15^0	–	15^0
N	0.51	1.14	0.020	0.045

NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE WITH MAXIMUM MATERIAL CONDITION.
2. LEAD NO. 1 CUT FOR IDENTIFICATION, OR BUMP ON TOP.
3. DIM "L" TO INSIDE OF LEADS. (MEASURED 0.51 mm (0.020) BELOW PKG BASE)

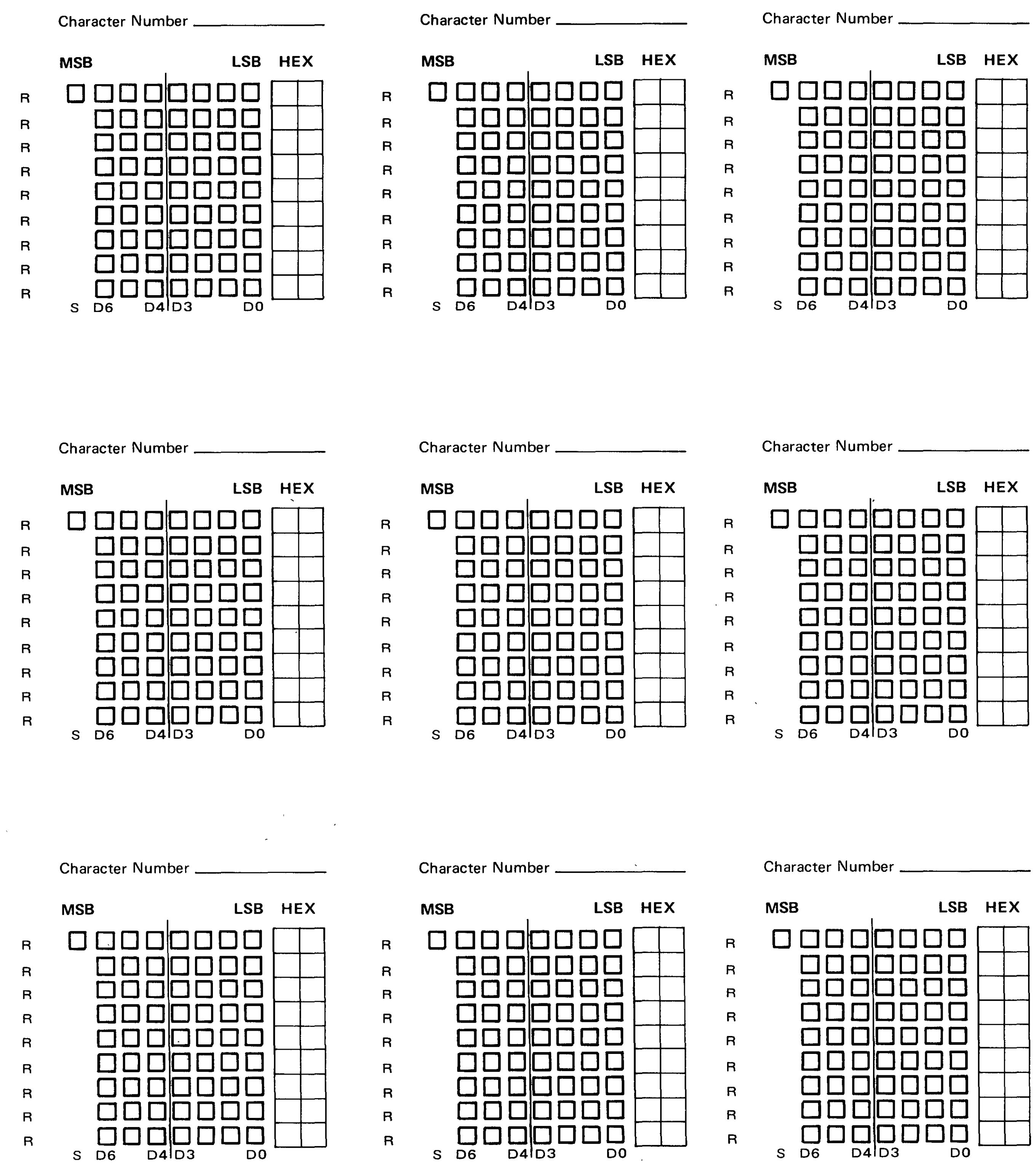
CASE 709-01



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	31.37	32.13	1.235	1.265
B	13.72	14.22	0.540	0.560
C	4.57	5.08	0.180	0.200
D	0.36	0.51	0.014	0.020
F	1.02	1.52	0.040	0.060
G	2.41	2.67	0.095	0.105
H	1.78	2.03	0.070	0.080
J	0.20	0.30	0.008	0.012
K	3.05	3.56	0.120	0.140
L	14.73	15.24	0.580	0.600
M	0^0	10^0	0^0	10^0
N	0.51	1.02	0.020	0.040

NOTES:
1. LEADS, TRUE POSITIONED WITHIN 0.25 mm (0.010) DIA AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION. (DIM. "D")
2. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.

The formats below are given for your convenience in preparing character information for MCM6570 programming. THESE FORMATS ARE NOT TO BE USED TO TRANSMIT THE INFORMATION TO MOTOROLA. Refer to the Custom Programming instructions for detailed procedures.



8346-4 PRINTED IN USA 6-75 IMPERIAL LITHO B51336 12M
DS-9330-R1

MOTOROLA Semiconductors
BOX 20912 • PHOENIX, ARIZONA 85036

MCM6570
MCM6571
MCM6571A
MCM6572
thru
MCM6579

MOS
(N-CHANNEL, LOW THRESHOLD)

8 K
READ ONLY MEMORIES

HORIZONTAL-SCAN CHARACTER GENERATORS WITH SHIFTED CHARACTERS

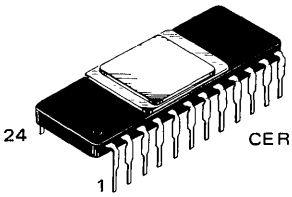
8192-BIT READ ONLY MEMORIES
ROW SELECT CHARACTER GENERATORS

The MCM6570 is a mask-programmable 8192-bit horizontal-scan (row select) character generator. It contains 128 characters in a 7 x 9 matrix, and has the capability of shifting certain characters that normally extend below the baseline, such as j, y, g, p, and q. Circuitry is supplied internally to effectively lower the whole matrix for this type of character — a feature previously requiring external circuitry.

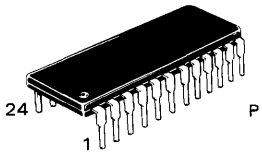
A seven-bit address code is used to select one of the 128 available characters. Each character is defined as a specific combination of logic "1"s and "0"s stored in a 7 x 9 matrix. When a specific four-bit binary row select code is applied, a word of seven parallel bits appears at the output. The rows can be sequentially selected, providing a nine-word sequence of seven parallel bits per word for each character selected by the address inputs. As the row select inputs are sequentially addressed, the devices will automatically place the 7 x 9 character in one of two pre-programmed positions on the 16-row matrix, with the positions defined by the four row select inputs. Rows that are not part of the character are automatically blanked.

The MCM6571, MCM6571A, and MCM6572 thru MCM6579 are pre-programmed versions of the MCM6570. They contain various sets of characters to meet the requirements of diverse applications. The complete patterns of these devices are contained in this data sheet.

- Static Operation
- TTL Compatibility
- CMOS Compatibility (5 V)
- Shifted Character Capability (Except MCM6572, MCM6573)
- Maximum Access Time = 500 ns

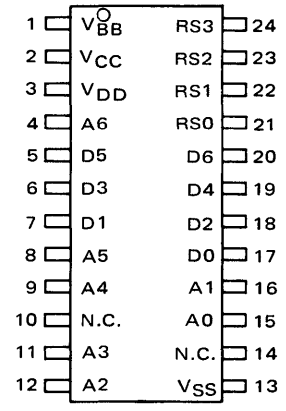


L SUFFIX
CERAMIC PACKAGE
CASE 684



P SUFFIX
PLASTIC PACKAGE
CASE 709

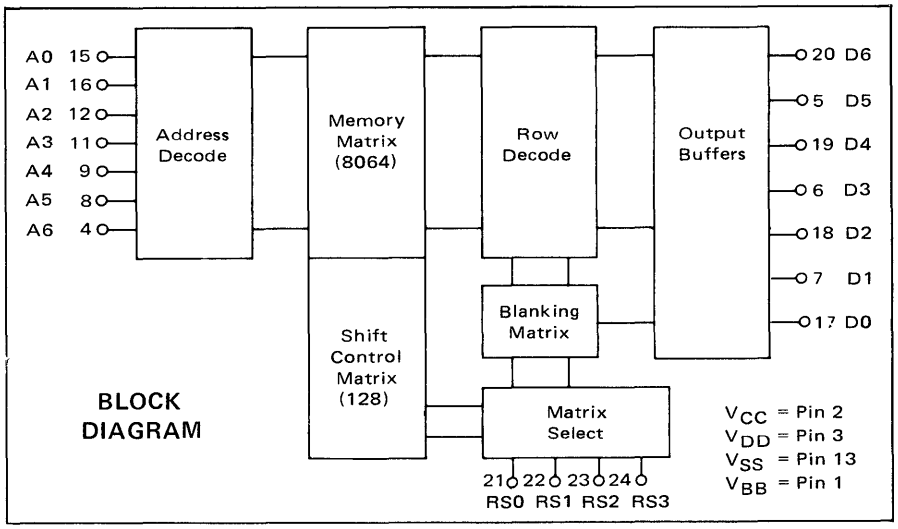
PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (See Note 1, Voltages referenced to V_{SS})

Rating	Symbol	Value	Unit
Supply Voltages	V_{CC} V_{DD} V_{BB}	-0.3 to +6.0 -0.3 to +15 -10 to +0.3	Vdc
Data Input Voltage	V_{in}	-0.3 to +15	Vdc
Operating Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	-55 to +125	°C

NOTE 1: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to RECOMMENDED OPERATING CONDITIONS. Exposure to higher than recommended voltages for extended periods of time could affect device reliability.



BLOCK DIAGRAM

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.

DC OPERATING CONDITIONS AND CHARACTERISTICS

(Full operating voltage and temperature range unless otherwise noted.)

RECOMMENDED DC OPERATING CONDITIONS (Referenced to V_{SS}).

Parameter	Symbol	Min	Nom	Max	Unit
Supply Voltage	V_{DD}	10.8	12	13.2	Vdc
	V_{CC}	4.75	5.0	5.25	Vdc
	V_{SS}	0	0	0	Vdc
	V_{BB}	-3.3	-3.0	-2.7	Vdc
Input Logic "1" Voltage (Driven by TTL)	V_{IH}*	3.0	–	V_{CC}	Vdc
(Driven by Other Than TTL)		4.0	–	V_{CC}	Vdc
Input Logic "0" Voltage	V_{IL}	0	–	0.8	Vdc

*A 4.0 V V_{IH} is required at the chip regardless of the type of driver used. However, internal MOS pullup devices on the chip can pull one TTL driver from 3.0 V to 4.0 V, without affecting access time. These pullup devices may not pull non-TTL drivers above 3.0 V.

DC CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Input Forward Current (V_{IL} = 0.4 Vdc)	I_{IL}	–	–	-1.6	mAdc
Input Leakage Current (V_{IH} = 5.25 Vdc, V_{CC} = 4.75 Vdc)	I_{IH}	–	–	100	μAdc
Output Low Voltage (Blank) (I_{OL} = 1.6 mAdc)	V_{OL}	0	–	0.4	Vdc
Output High Voltage (Dot) (I_{OH} = -40 μAdc)	V_{OH}	3.0	–	–	Vdc
Power Supply Current	I_{DD}	–	–	10	mAdc
	I_{CC}	–	–	125	mAdc
	I_{BB}	–	–	100	μAdc
Power Dissipation	P_D	–	600	800	mW

CAPACITANCE (Periodically sampled rather than 100% tested)

Characteristic	Symbol	Min	Typ	Max	Unit
Input Capacitance (f = 1.0 MHz)	C_{in}	–	4.0	7.0	pF
Output Capacitance (f = 1.0 MHz)	C_{out}	–	4.0	7.0	pF

AC CHARACTERISTICS

(Full operating voltage and temperature range unless otherwise noted.)

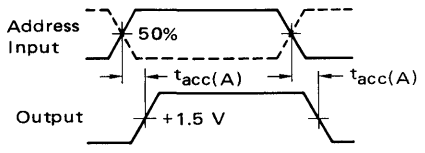
[All timing with t_r,t_f = 20 ns; Load = 1 TTL Gate (MC7400 Series), C_L = 30 pF]

TIMING (Typical values measured at 25°C and nominal supplies)

Characteristic	Symbol	Min	Typ	Max	Unit
Address Access Time (See Figure 1A)	$t_{acc(A)}$	–	350	500	ns
Row Select Access Time (See Figure 1B)	$t_{acc(RS)}$	–	300	500	ns

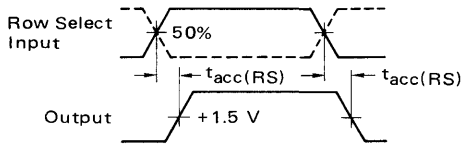
FIGURE 1 – TIMING DIAGRAMS

A. ADDRESS ACCESS TIMING DIAGRAM



Note: Row Select inputs are set in a dc state.

B. ROW SELECT ACCESS TIMING DIAGRAM



Note: Address inputs are set in a dc state.

FIGURE 2 – V_{CC} SUPPLY CURRENT versus TEMPERATURE

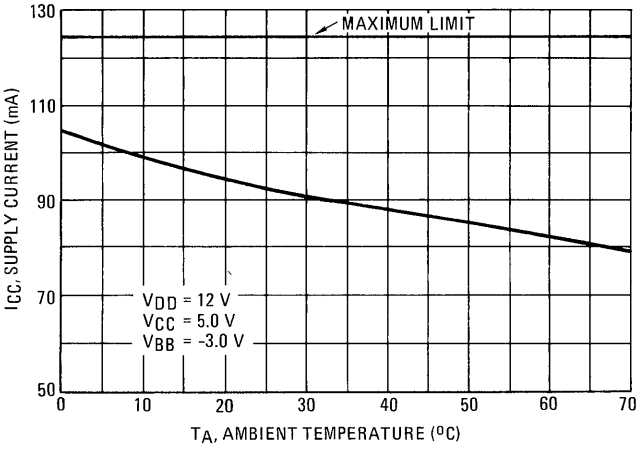


FIGURE 3 – V_{DD} SUPPLY CURRENT versus TEMPERATURE

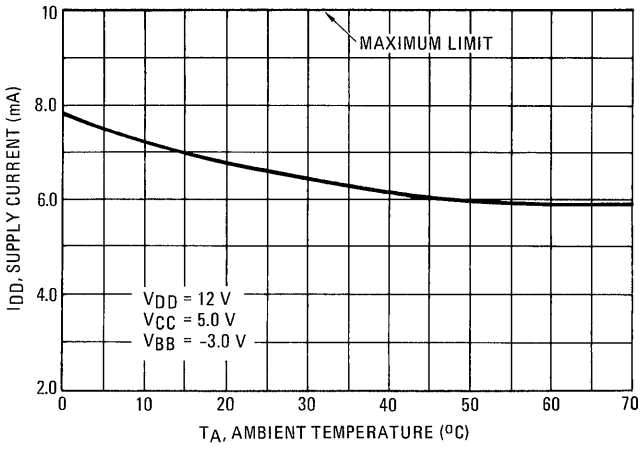


FIGURE 4 – OUTPUT SINK CURRENT versus OUTPUT VOLTAGE

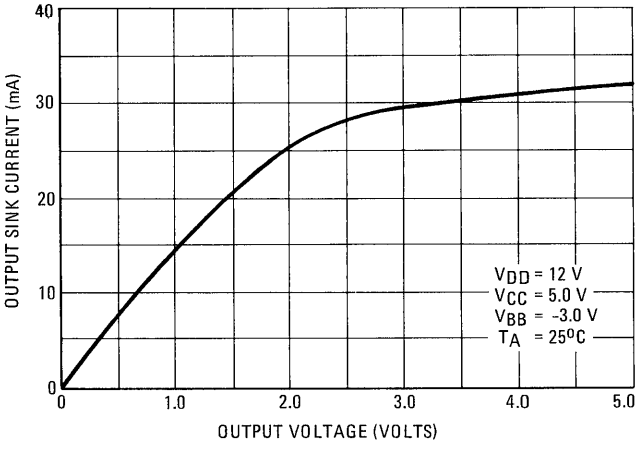


FIGURE 5 – POWER DISSIPATION versus V_{DD} SUPPLY VOLTAGE

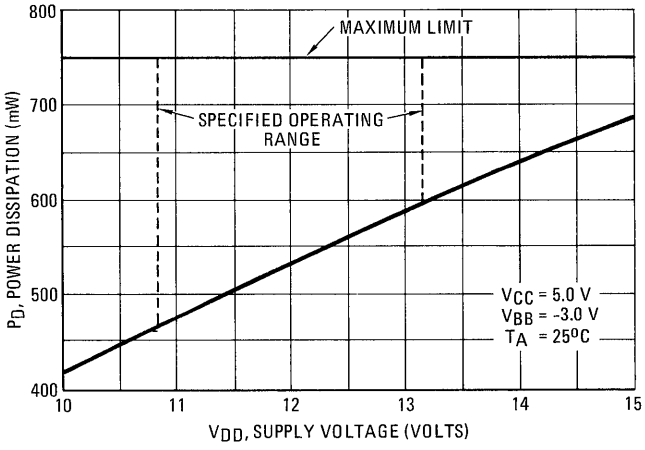


FIGURE 6 – ACCESS TIME versus V_{DD} SUPPLY VOLTAGE

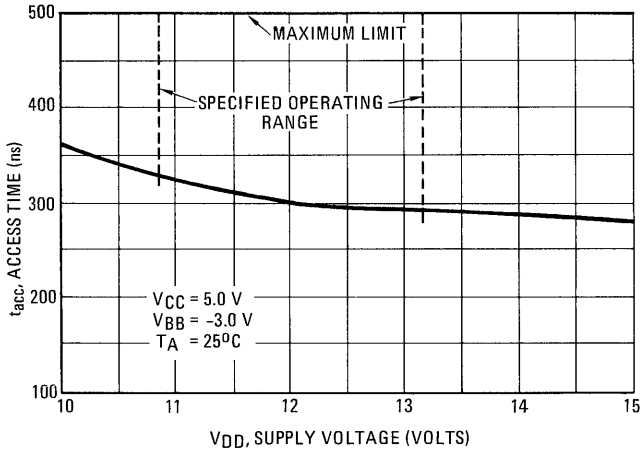
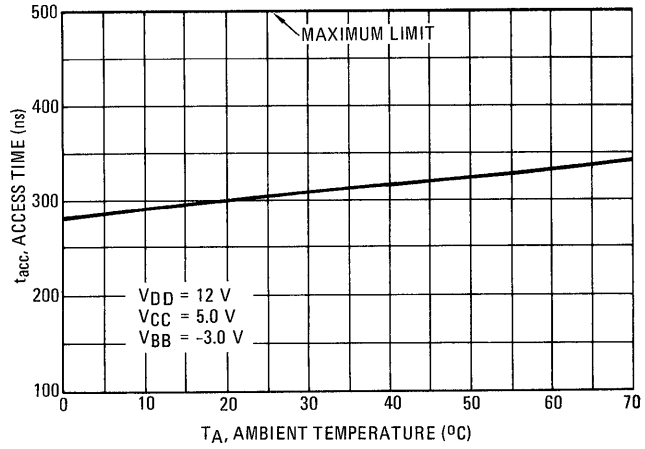


FIGURE 7 – ACCESS TIME versus TEMPERATURE



MEMORY OPERATION (Using Positive Logic)

Most positive level = 1, most negative level = 0

Address

To select one of the 128 characters, apply the appropriate binary code to the Address inputs (A0 thru A6).

Row Select

To select one of the rows of the addressed character to appear at the seven output lines, apply the appropriate binary code to the Row Select inputs (RS1 thru RS4).

Shifted Characters

These devices have the capability of displaying characters that descend below the bottom line (such as lower case letters j, y, g, p, and q). Internal circuitry effectively drops the whole matrix for this type of character. Any character can be programmed to occupy either of the two positions in a 7 x 16 matrix. (Shifted characters are not available on MCM6572 or MCM6573.)

Output

For these devices, an output dot is defined as a logic "1" level, and an output blank is defined as a logic "0" level.

DISPLAY FORMAT

Figure 8 shows the relationship between the logic levels at the row select inputs and the character row at the outputs. The MCM6570 allows the user to locate the basic 7 x 9 font anywhere in the 7 x 16 array. In addition, a shifted font can be placed anywhere in the same 7 x 16 array. For example, the basic MCM6571 font is established in rows R14 thru R6. All other rows are automatically blanked. The shifted font is established in rows R11 thru R3, with all other rows blanked. Thus, while any one character is contained in a 7 x 9 array, the MCM6571 requires a 7 x 12 array on the CRT screen to contain both normal and descending characters. Other uses of the shift option may require as much as the full 7 x 16 array, or as little as the basic 7 x 9 array (when no shifting occurs, as in the MCM6572).

The MCM6570 can be programmed to be scanned either from bottom to top or from top to bottom. This is achieved through the option of assigning row numbers in ascending or descending count, as long as both the basic font and the shifted font are the same. For example, an up counter will scan the MCM6571 from bottom to top, whereas an up counter will scan the MCM6571A from top to bottom (see Figures 14 and 15 for row designation).

FIGURE 8 – ROW SELECT INPUT CODE AND SAMPLE CHARACTERS FOR MCM6571 AND MCM6572

ROW SELECT TRUTH TABLE

RS3	RS2	RS1	RS0	OUTPUT
0	0	0	0	R0
0	0	0	1	R1
0	0	1	0	R2
0	0	1	1	R3
0	1	0	0	R4
0	1	0	1	R5
0	1	1	0	R6
0	1	1	1	R7
1	0	0	0	R8
1	0	0	1	R9
1	0	1	0	R10
1	0	1	1	R11
1	1	0	0	R12
1	1	0	1	R13
1	1	1	0	R14
1	1	1	1	R15

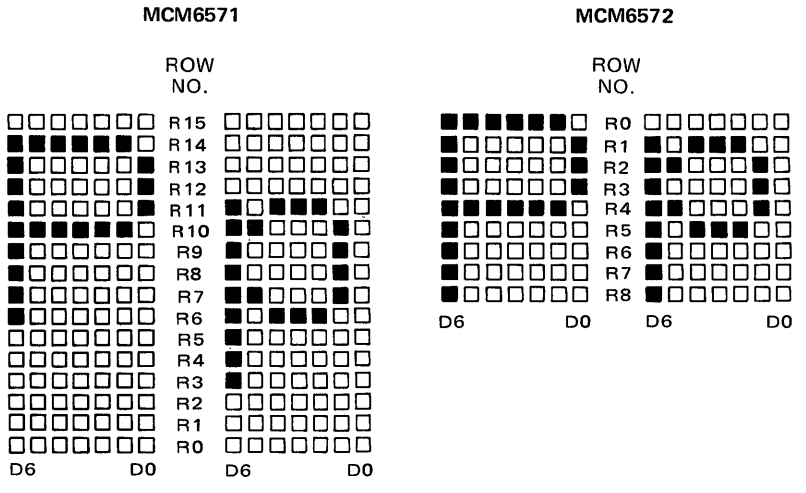


FIGURE 11 – EXAMPLE OF CARD PUNCH FORMAT
(First 9 Characters of MCM6571)

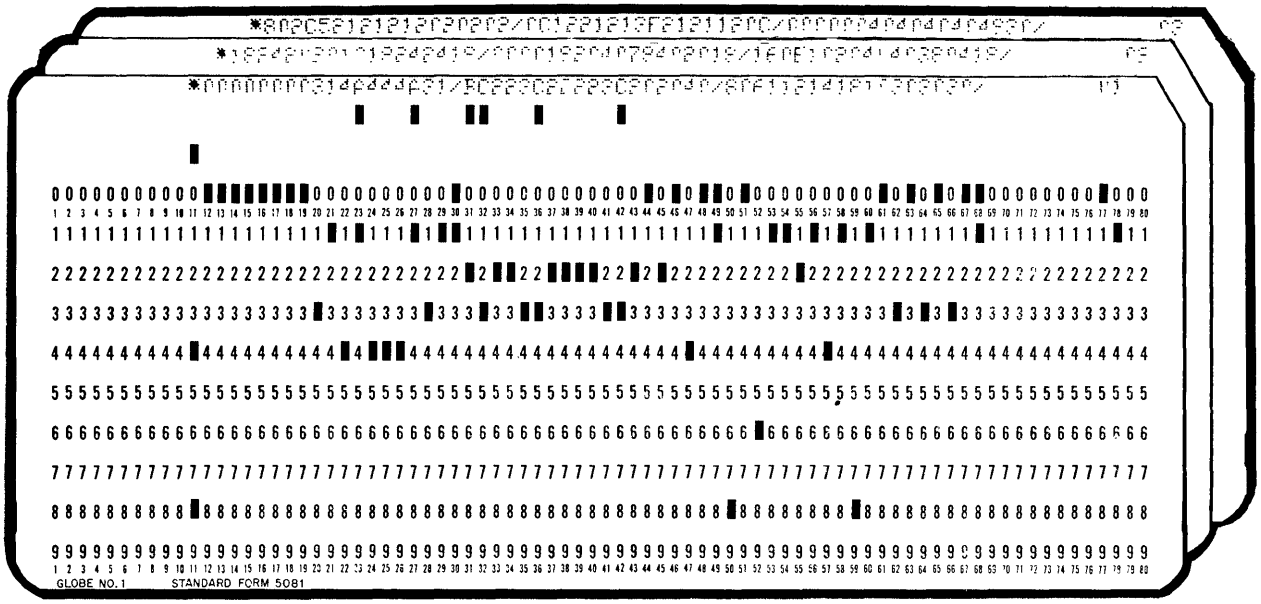


FIGURE 12 – PAPER TAPE FORMAT

Frames	
Leader	Blank Tape
1 to M	Allowed for customer use (M ⩽ 64)
M + 1, M + 2	CR; LF (Carriage Return; Line Feed)
M + 3 to M + 66	First line of pattern information (64 hex figures per line)
M + 67, M + 68	CR; LF
M + 69 to M + 2378	Remaining 35 lines of hex figures, each line followed by a Carriage Return and Line Feed

Blank Tape

Frames 1 to M are left to the customer for internal identification, where M ⩽ 64. Any combination of alphanumerics may be used. This information is terminated with a Carriage Return and Line Feed, delineating the start of data entry. (Note that the tape cannot begin with a CR and/or LF, or the customer identification will be assumed to be programming data.)

Frame M + 3 contains the hexadecimal equivalent of column S and D6 thru D4 for the top row of the first character. Frame M + 4 contains D3 thru D0. Frames M + 5 and M + 6 program the second row of the first character. Frames M + 3 to M + 66 comprise the first line of the printout. The line is terminated with a CR and LF.

The remaining 35 lines of data are punched in sequence using the same format, each line terminated with a CR and LF. The total 36 lines of data contain 36 x 64 or 2304 hex figures. Since 18 hex figures are required to program each 7 x 9 character, the full 128 (2304 ÷ 18) characters are programmed.

FIGURE 13 – FORMAT FOR ORGANIZATIONAL DATA

ORGANIZATIONAL DATA
MCM6570 MOS READ ONLY MEMORY

Customer _____

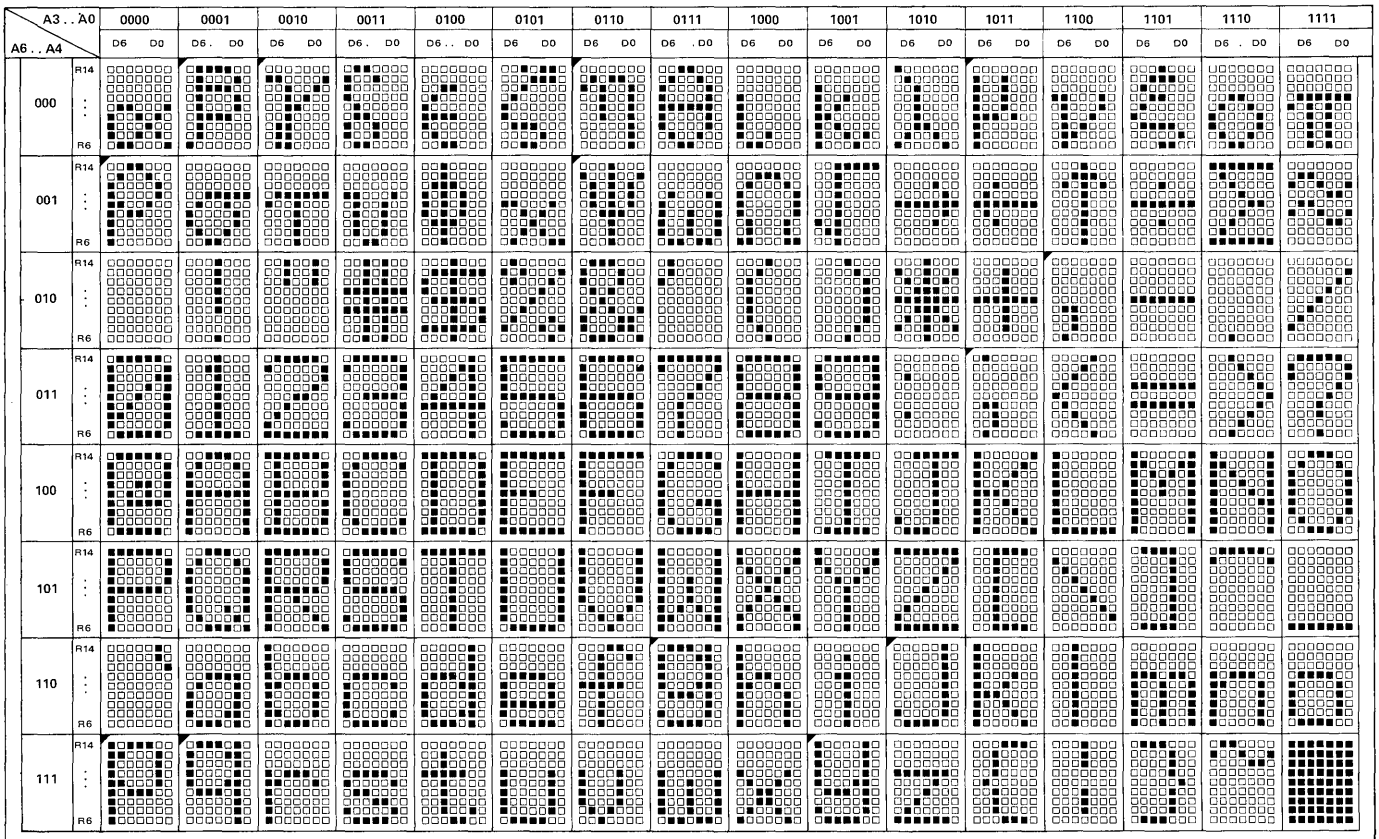
Customer Part No. _____ Rev. _____

Row Number for top row of non-shifted font _____

Row Number for bottom row of non-shifted font _____

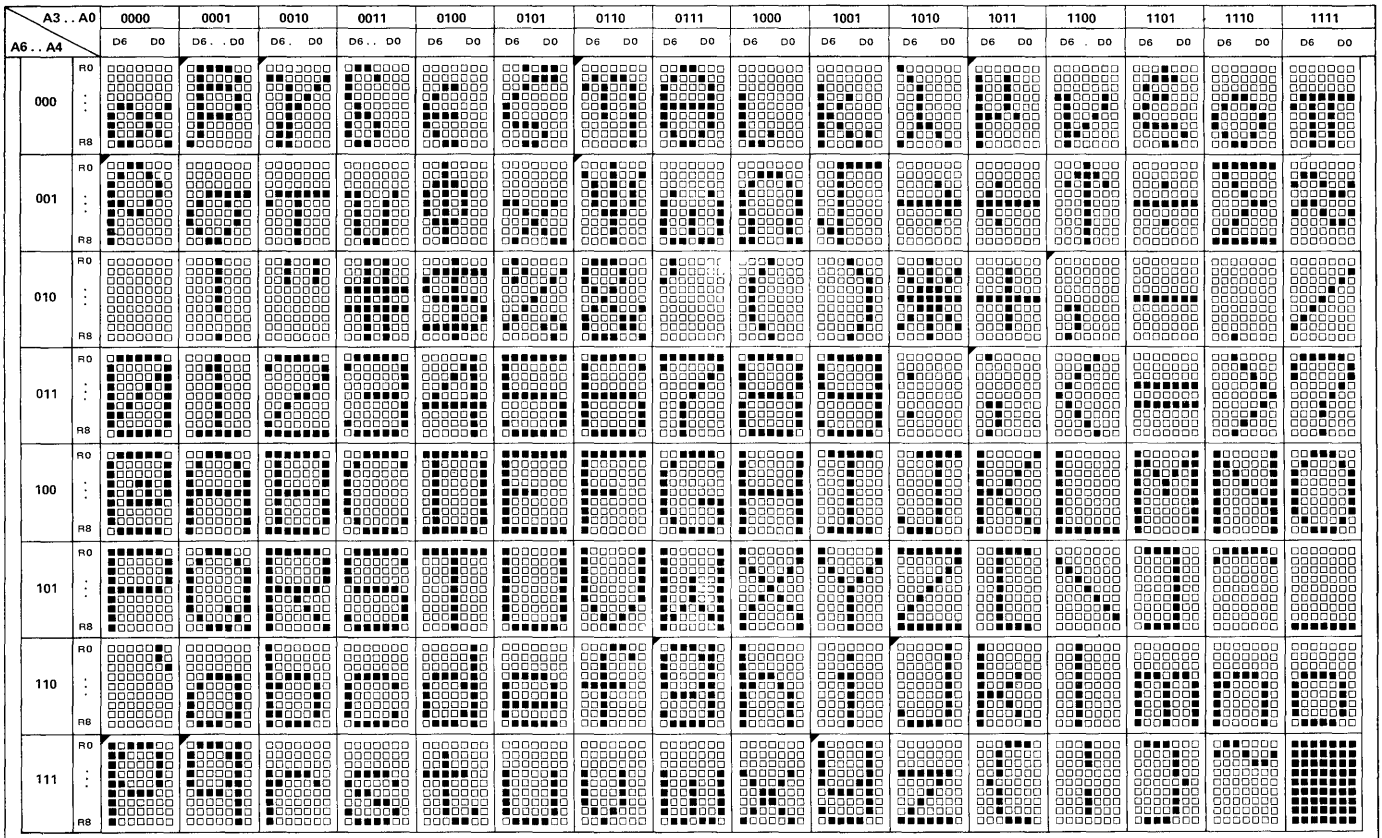
Row Number for top row of shifted font _____

FIGURE 14 – MCM6571 PATTERN



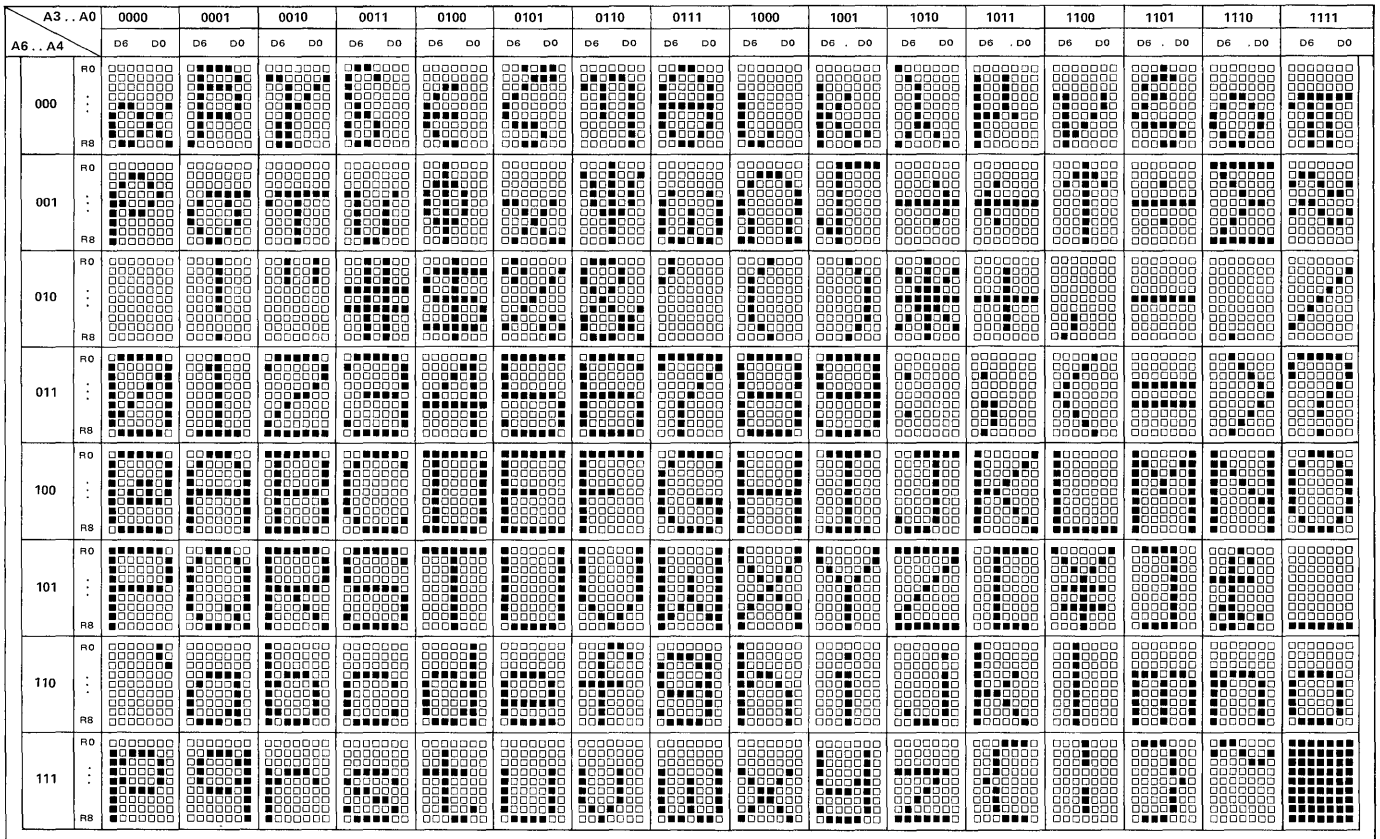
◤ = Shifted character The character is shifted three rows to R11 at the top of the font and R3 at the bottom.

FIGURE 15 – MCM6571A PATTERN



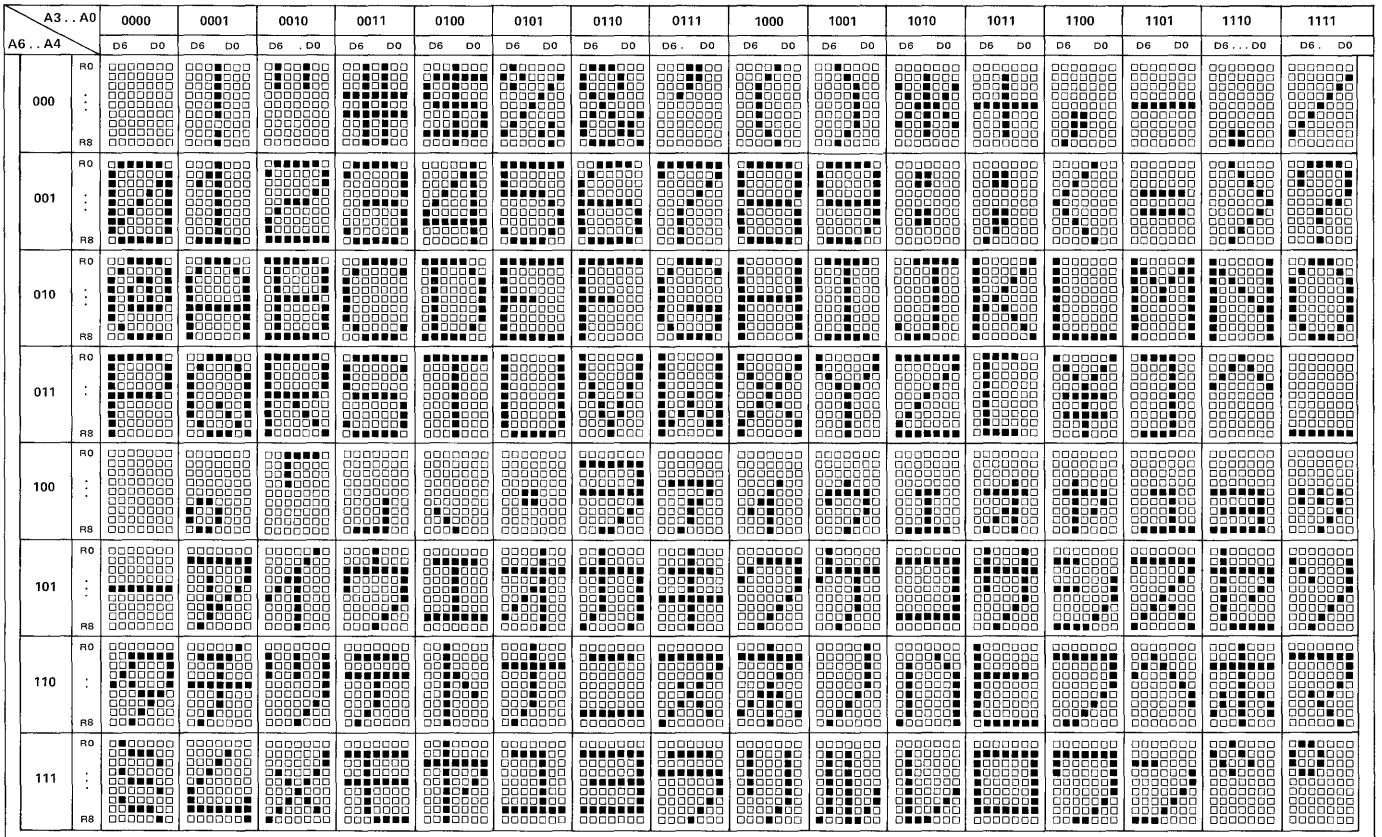
◤ = Shifted character. The character is shifted three rows to R3 at the top of the font and R11 at the bottom

FIGURE 16 – MCM6572 PATTERN**



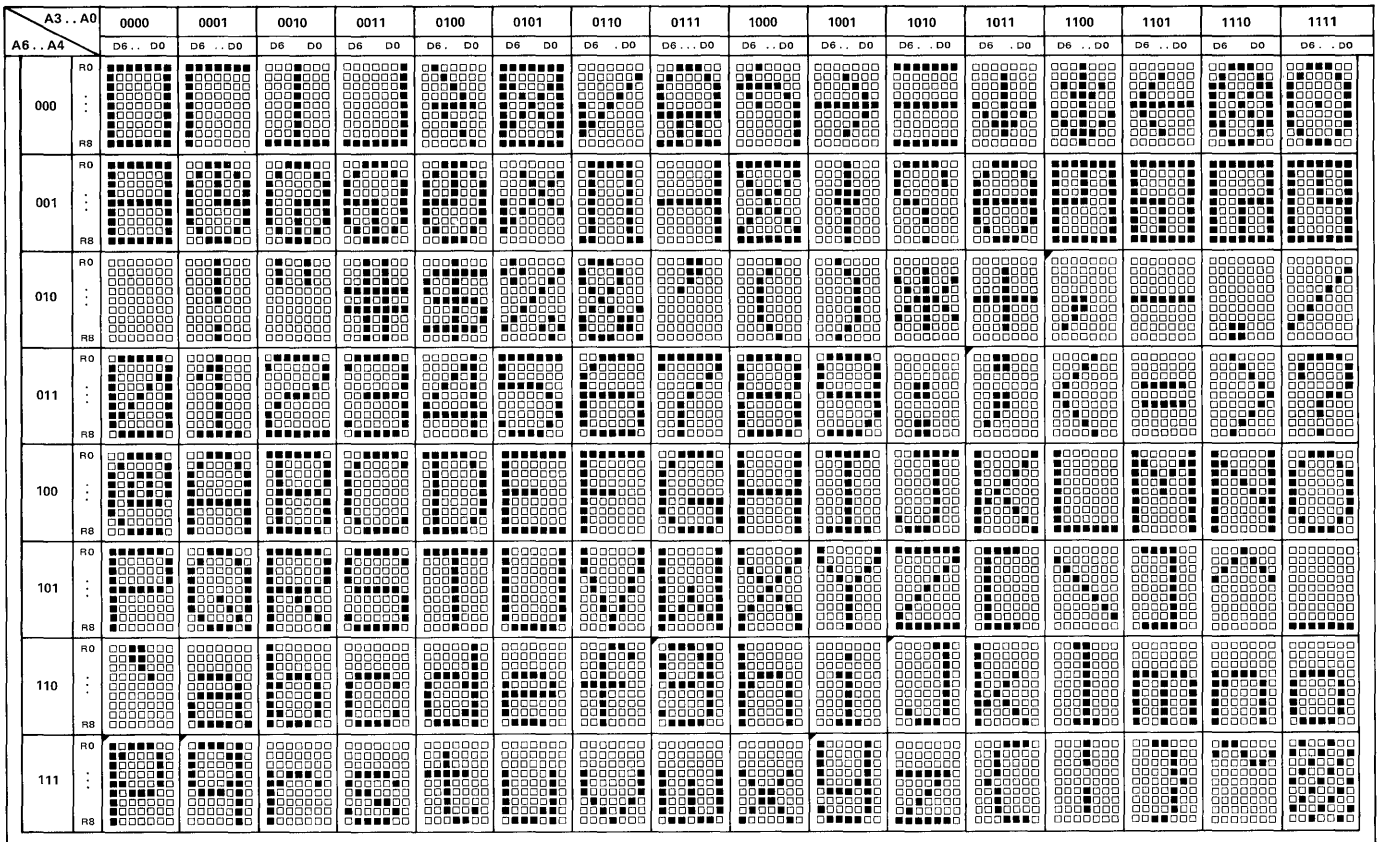
** Shifted characters are not used.

FIGURE 17 – MCM6573 PATTERN**



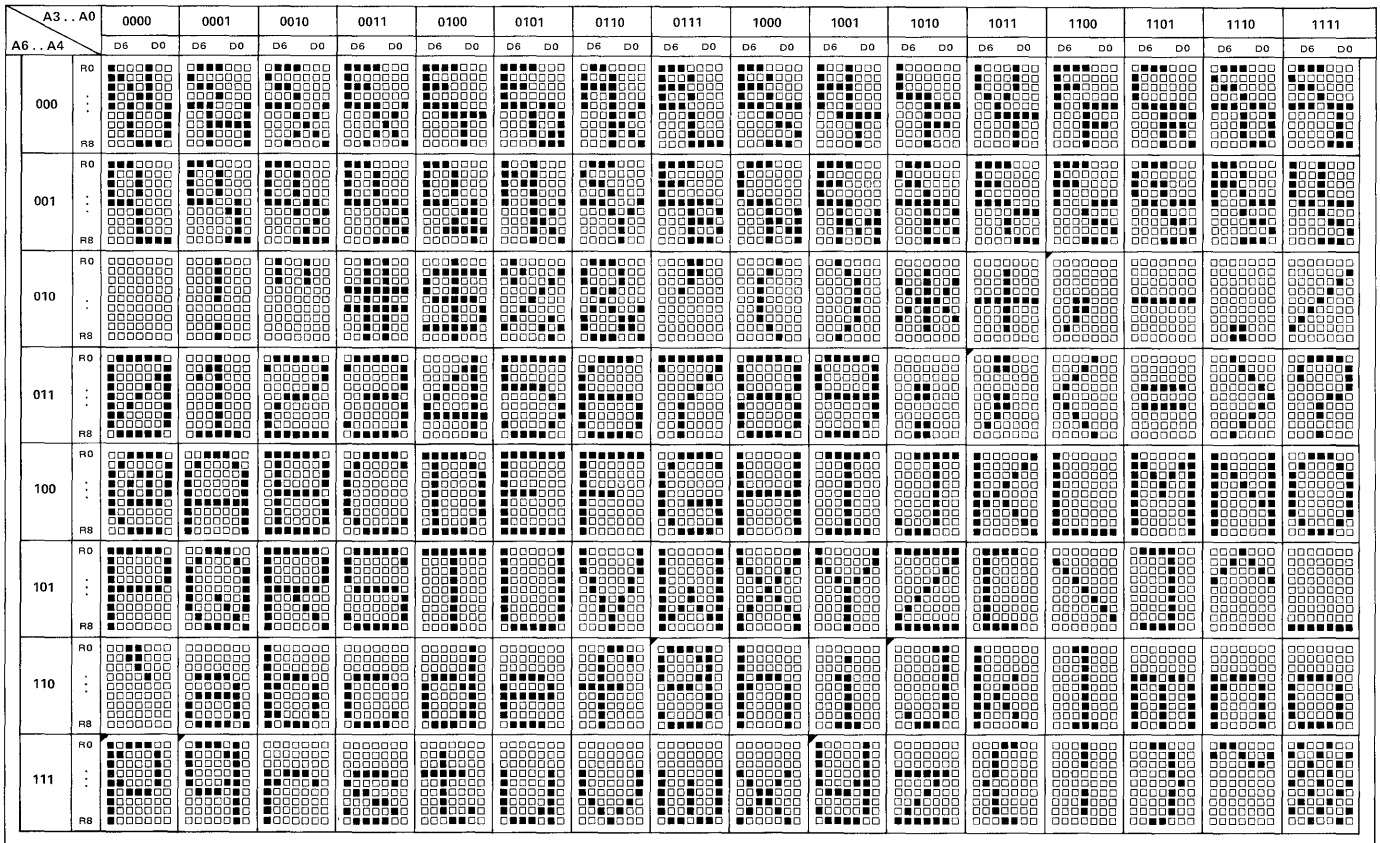
** Shifted characters are not used.

FIGURE 18 – MCM6574 PATTERN



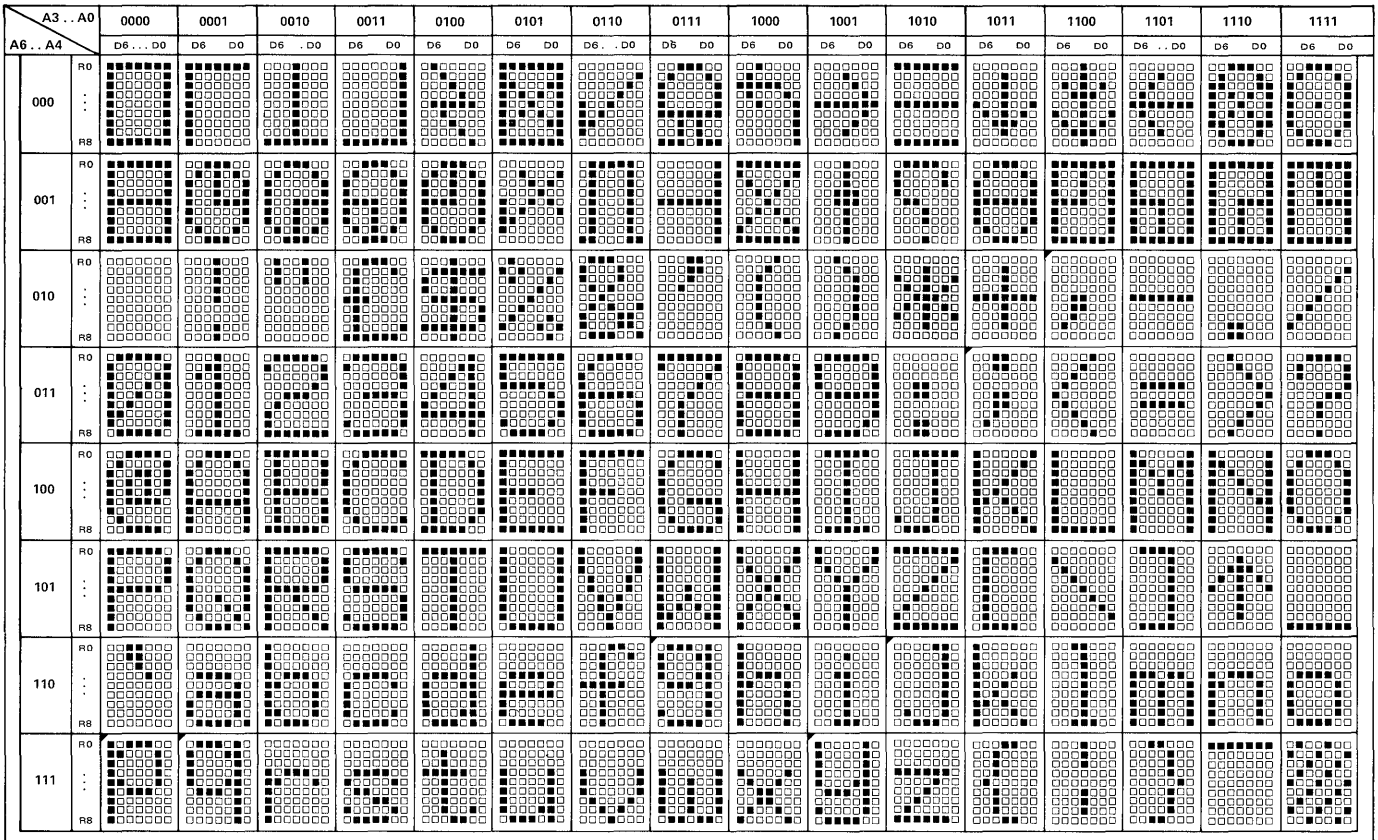
◤ = Shifted character. The character is shifted three rows to R3 at the top of the font and R11 at the bottom.

FIGURE 19 – MCM6575 PATTERN



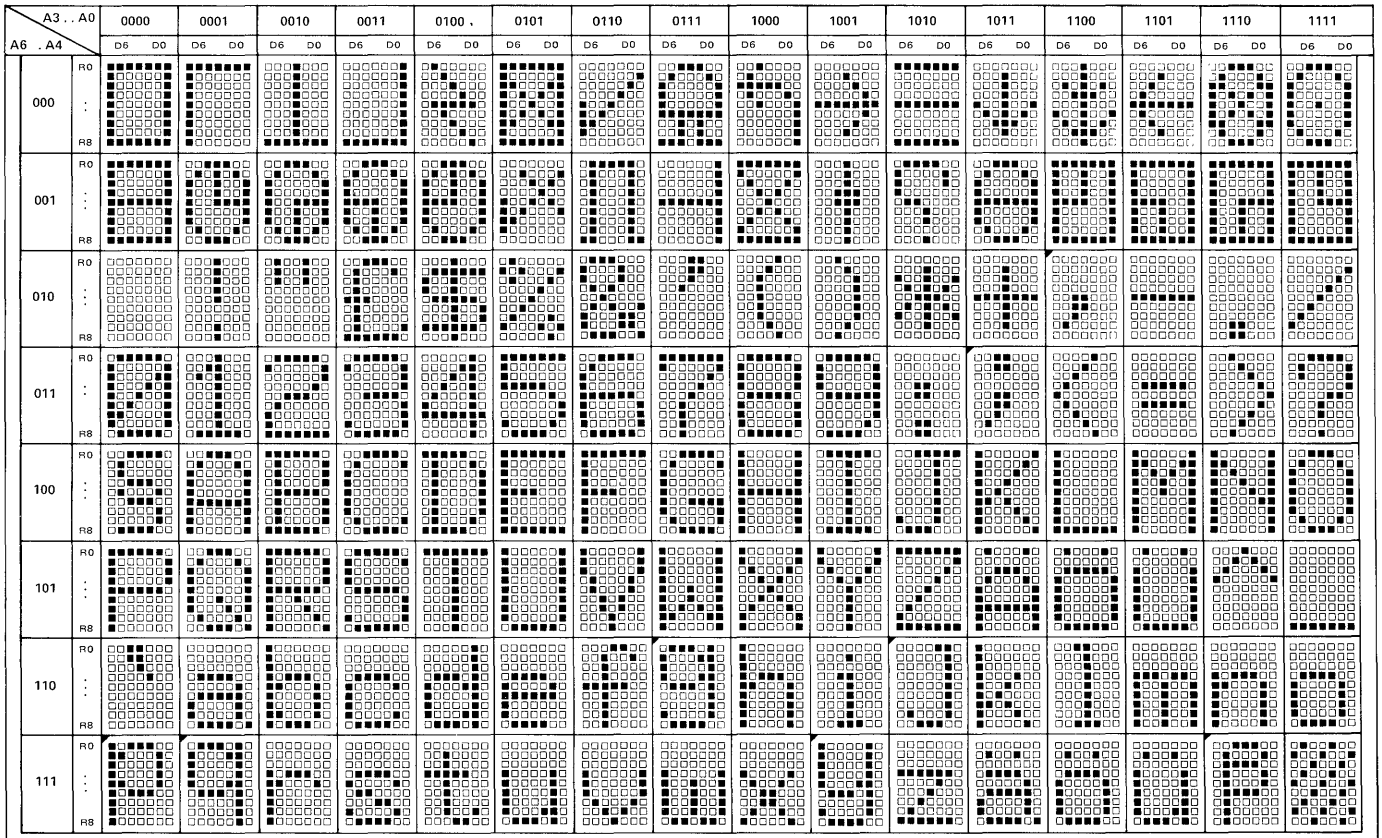
◤ = Shifted character. The character is shifted three rows to R3 at the top of the font and R11 at the bottom.

FIGURE 20 – MCM6576 PATTERN



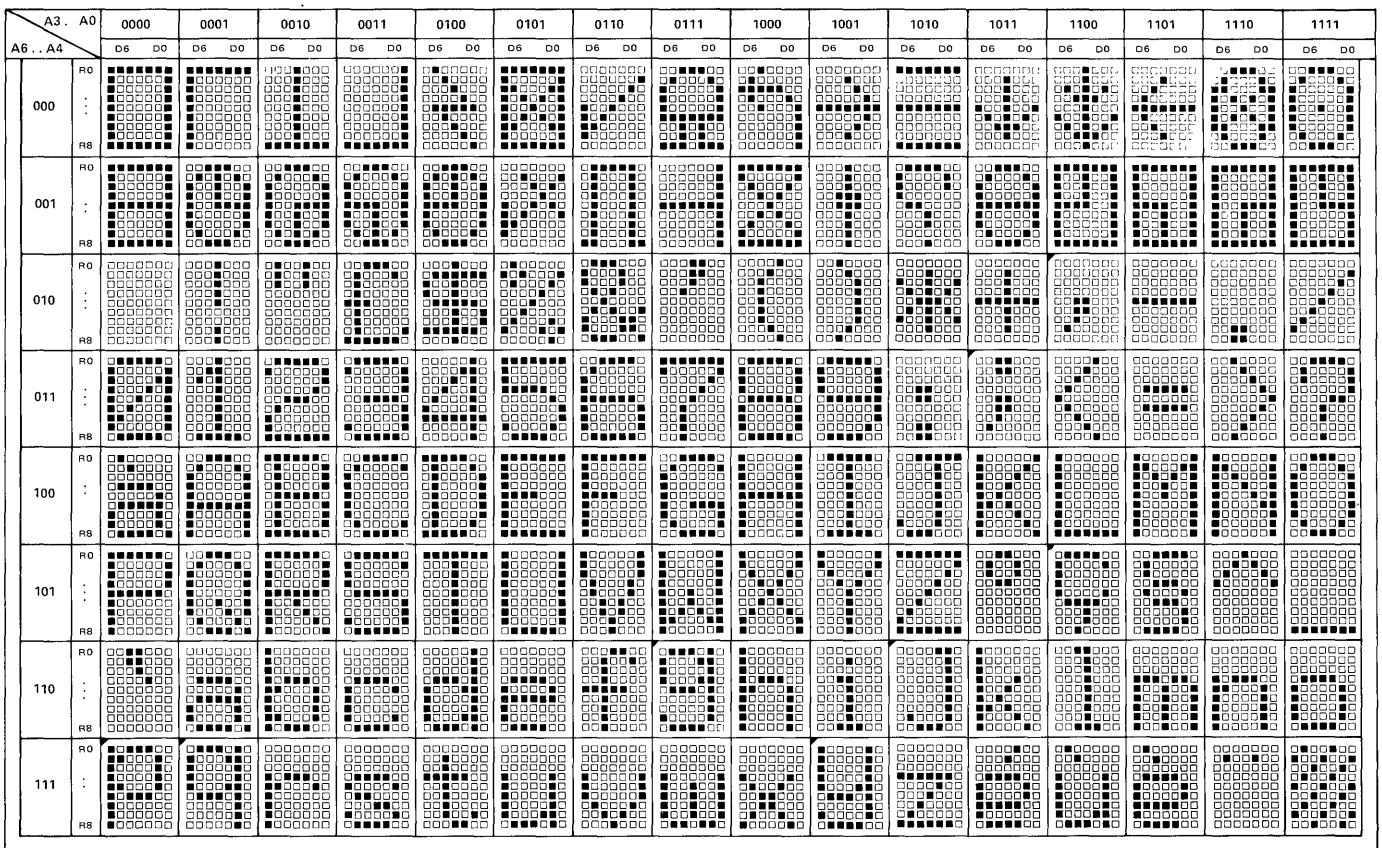
◤ = Shifted character. The character is shifted three rows to R3 at the top of the font and R11 at the bottom.

FIGURE 21 – MCM6577 PATTERN



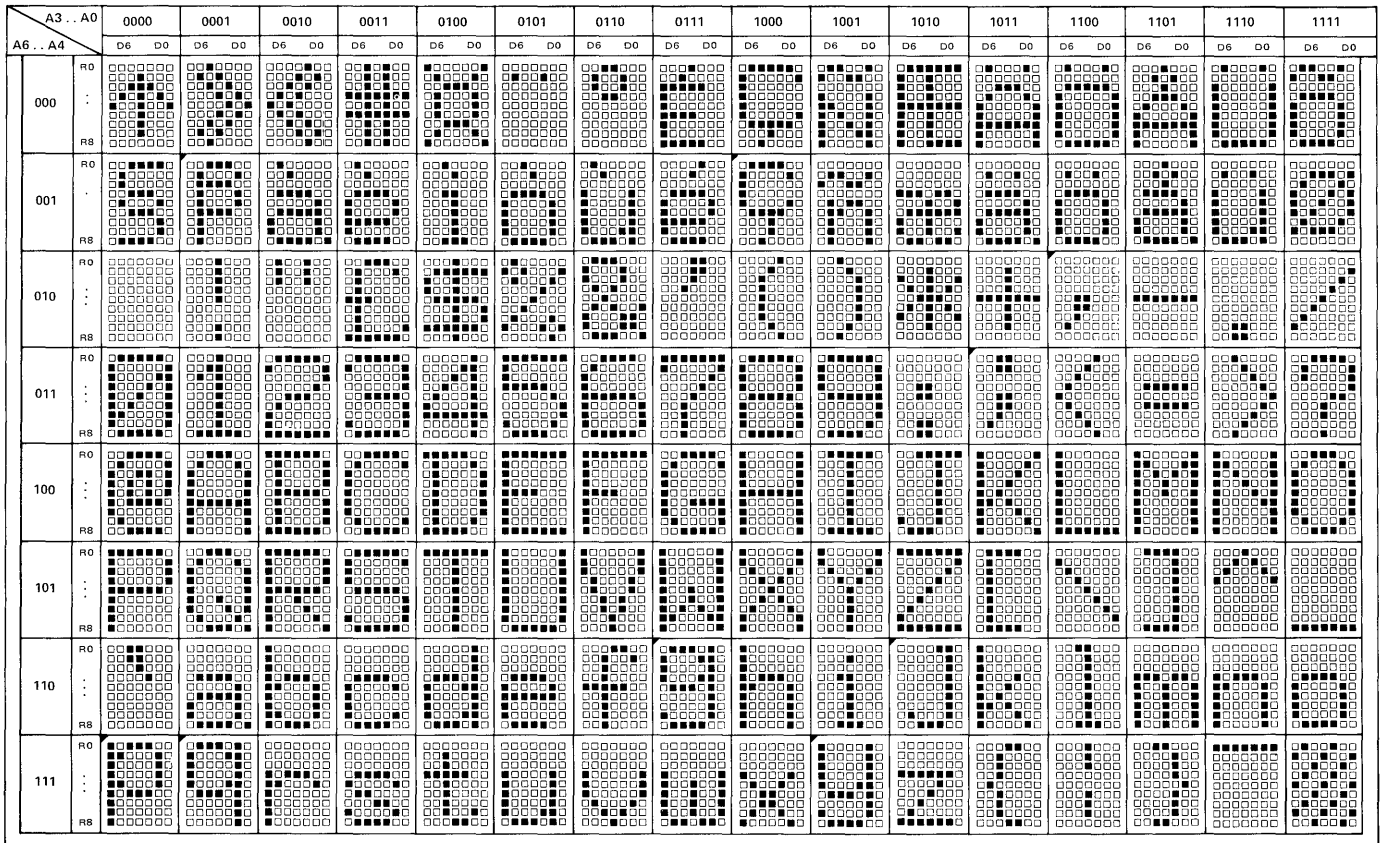
◤ = Shifted character The character is shifted three rows to R3 at the top of the font and R11 at the bottom

FIGURE 22 – MCM6578 PATTERN



◤ = Shifted character The character is shifted three rows to R3 at the top of the font and R11 at the bottom.

FIGURE 23 – MCM6579 PATTERN



◤ = Shifted character. The character is shifted three rows to R3 at the top of the font and R11 at the bottom.

APPLICATIONS INFORMATION

One important application for the MCM6570-79 is in CRT display systems (Figure 24). A set of buffer shift registers or random access memories applies a 7-bit character code to the input of the character generator, which then supplies one row of the character according to the count at the four row select inputs. As each row is available, it is put into the TTL MC7495 shift registers. The parallel information in these shift registers is clocked serially out to the Z-axis where it modulates the raster to form the character.

The MCM6570-79 require three power supplies: -3.0 volts, +5.0 volts, and +12 volts. The character generator requires only small currents from the -3.0 volt and +12 volt supplies, such that charge pump techniques using +5.0 volts can be used.

Figure 25 shows a supply circuit that will generate the required -3.0 volts for V_{BB}. The +12-volt supply of Figure 26 will supply the 6.0 mA that is typically required. Increased current capability is possible by modifying the circuits. Use of these small, low-cost supplies makes a single +5.0-volt system possible.

When powering this device from laboratory or system power supplies, it is important that the Absolute Maximum Ratings not be exceeded or device failure can result. Some power supplies exhibit spikes or "glitches" on their outputs when the ac power is switched on and off. For example, the bench power supply programmed to deliver +12 volts may have large transients below ground when the ac power is switched on and off. If this possibility exists, it is suggested that the user switch the dc side of the power supply or protect the device power pins (+12, +5.0, and -3.0 volt) against reverse biasing with clamp diodes. A hot carrier diode such as the MBD501 is suggested for this purpose.

FIGURE 24 – CRT DISPLAY APPLICATION USING MCM6571

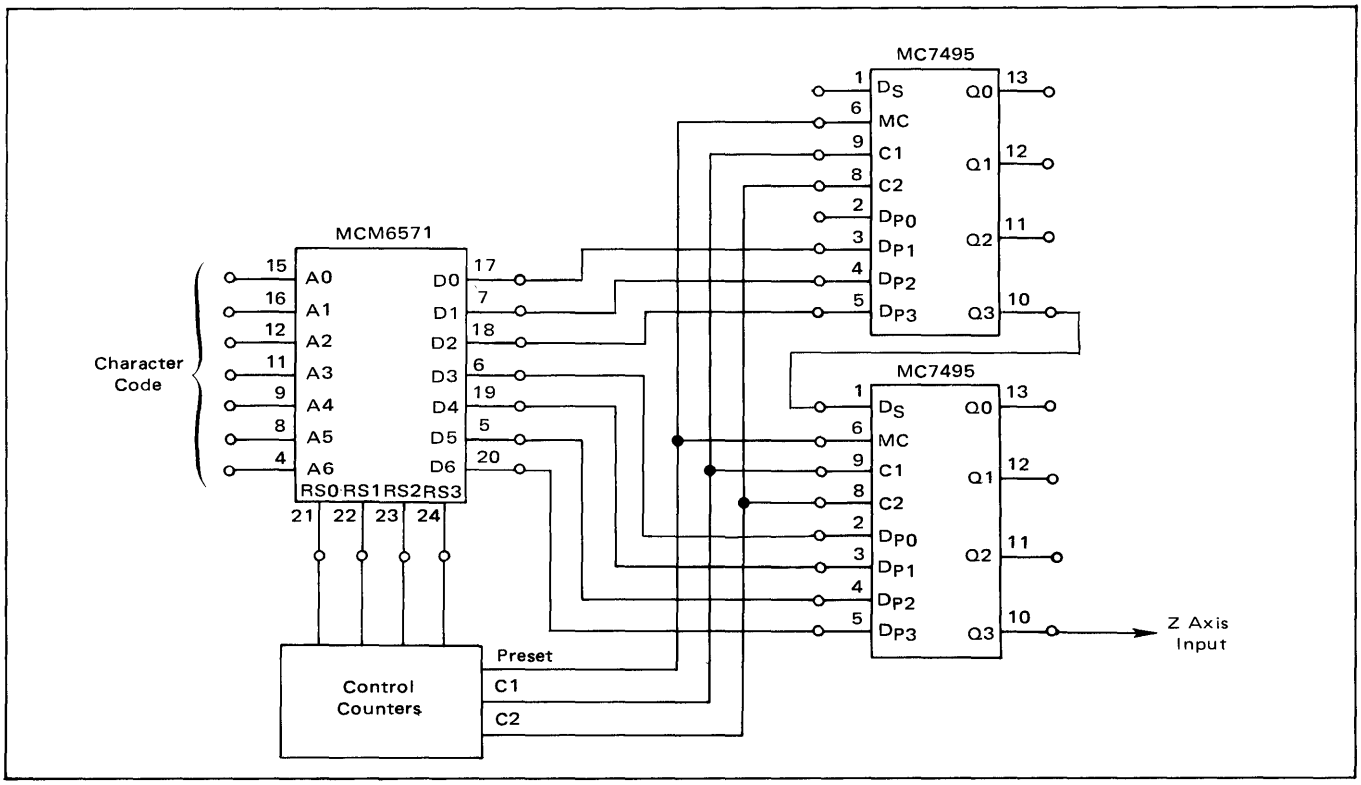


FIGURE 25 – SUBSTRATE BIAS CHARGE PUMP SUPPLY

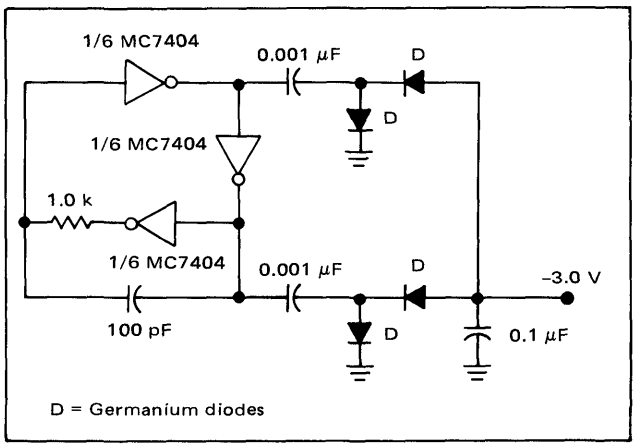
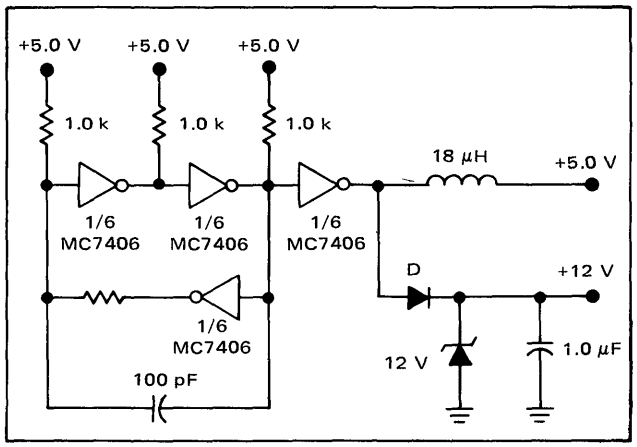
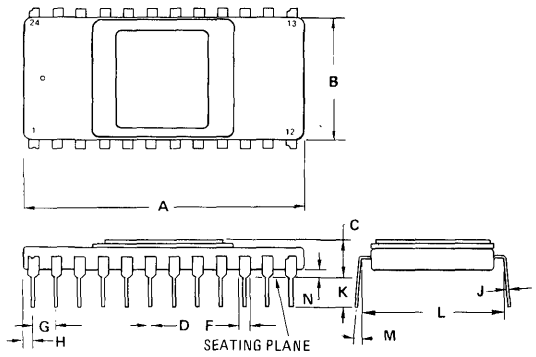


FIGURE 26 – GATE VOLTAGE CHARGE PUMP SUPPLY



PACKAGE DIMENSIONS

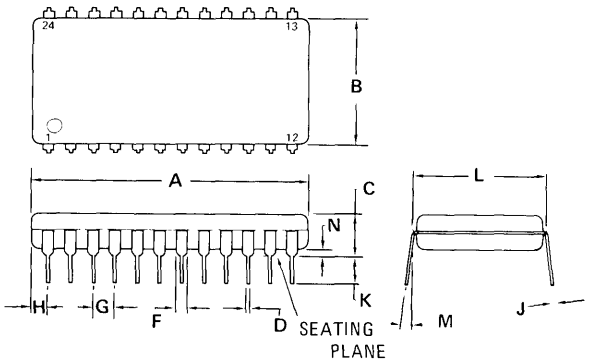
CASE 684-04



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	29.34	30.86	1.155	1.215
B	12.70	14.22	0.500	0.560
C	3.05	3.94	0.120	0.155
D	0.38	0.51	0.015	0.020
F	0.89	1.40	0.035	0.055
G	2.54 BSC		0.100 BSC	
H	0.89	1.40	0.035	0.055
J	0.20	0.30	0.008	0.012
K	2.92	3.68	0.115	0.145
L	14.86	15.87	0.585	0.625
M	–	15°	–	15°
N	0.51	1.14	0.020	0.045

NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE WITH MAXIMUM MATERIAL CONDITION.
2. LEAD NO. 1 CUT FOR IDENTIFICATION, OR BUMP ON TOP.
3. DIM "L" TO INSIDE OF LEADS. (MEASURED 0.51 mm (0.020) BELOW PKG BASE)

CASE 709-01



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	31.37	32.13	1.235	1.265
B	13.72	14.22	0.540	0.560
C	4.57	5.08	0.180	0.200
D	0.36	0.51	0.014	0.020
F	1.02	1.52	0.040	0.060
G	2.41	2.67	0.095	0.105
H	1.78	2.03	0.070	0.080
J	0.20	0.30	0.008	0.012
K	3.05	3.56	0.120	0.140
L	14.73	15.24	0.580	0.600
M	0°	10°	0°	10°
N	0.51	1.02	0.020	0.040

NOTES:
1. LEADS, TRUE POSITIONED WITHIN 0.25 mm (0.010) DIA AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION. (DIM. "D")
2. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.

CUSTOM PROGRAMMING FOR MCM6570

By the programming of a single photomask, the customer may specify the content of the MCM6570. Encoding of the photomask is done with the aid of a computer to provide quick, efficient implementation of the custom bit pattern while reducing the cost of implementation.

Information for the custom memory content may be sent to Motorola in the following forms, in order of preference:*

1. Hexadecimal coding using IBM Punch Cards (Figures 10 and 11).
2. Hexadecimal coding using ASCII Paper Tape Punch (Figure 12).

Programming of the MCM6570 can be achieved by using the following sequence:

1. Create the 128 characters in a 7 x 9 font using the format shown in Figure 9. Note that information at output D6 appears in column one, D5 in column two, thru D0 information in column seven. The dots filled in and programmed as a logic "1" will appear at the outputs as V_{OH}; the dots left blank will be at V_{OL}. (Blank formats appear at the end of this data sheet for your convenience; they are not to be submitted to Motorola, however.)

2. Indicate which characters are shifted by filling in the extra square (dot) in the top row, at the left (column S).

3. Convert the characters to hexadecimal coding treating dots as ones and blanks as zeros, and enter this information in the blocks to the right of the character font format. High order bits are at the left, in columns S and D3. For the bottom eight rows, the bit in column S must be zero, so these locations have been omitted. For the top row, the bit in column S will be zero for an unshifted character, and one for a shifted character.

4. Transfer the hexadecimal figures either to punched cards (Figure 10) or to paper tape (Figure 12).

5. Assign row numbers to the unshifted font. These must be nine sequential numbers (values 0 thru 15) assigned consecutively to the rows. The shifted font is similarly placed in any position in the 16 rows.

6. Provide, in writing, the information indicated in Figure 13 (a copy of Figure 13 may be used for this purpose). Submit this information to Motorola together with the punched cards or paper tape.

FIGURE 9 – CHARACTER FORMAT

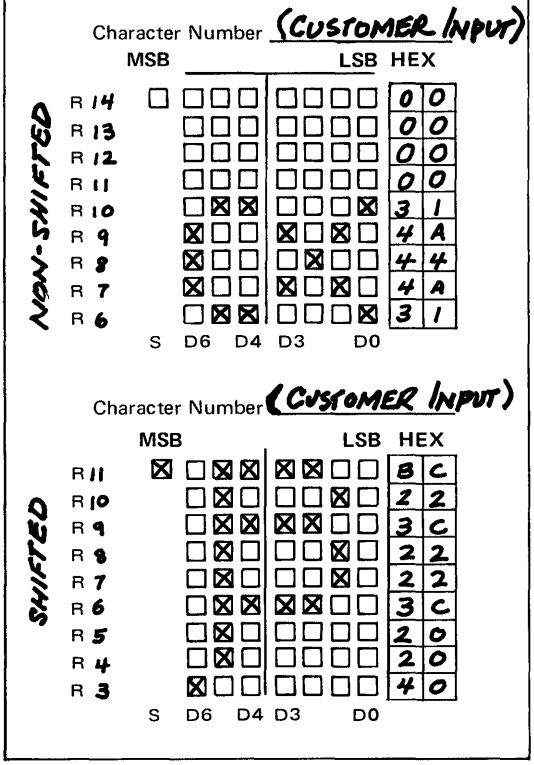


FIGURE 10 – CARD PUNCH FORMAT

Columns	
1 - 10	Blank
11	Asterisk (*)
12 - 29	Hex coding for first character
30	Slash (/)
31 - 48	Hex coding for second character
49	Slash (/)
50 - 67	Hex coding for third character
68	Slash (/)
69 - 76	Blank
77 - 78	Card number (starting 01; thru 43)
79 - 80	Blank

Column 12 on the first card contains the hexadecimal equivalent of column S and D6 thru D4 for the top row of the first character. Column 13 contains D3 thru D0. Columns 14 and 15 contain the information for the next row. The entire first character is coded in columns 12 thru 29. Each card contains the coding for three characters. 43 cards are required to program the entire 128 characters, the last card containing only two characters. The characters must be programmed in sequence from the first character to the last in order to establish proper addressing for the part. As an example, the first nine characters of the MCM6571 are correctly coded and punched in Figure 11.

*Note: Motorola can accept magnetic tape and truth table formats. For further information contact your local Motorola sales representative.

The formats below are given for your convenience in preparing character information for MCM6570 programming. THESE FORMATS ARE NOT TO BE USED TO TRANSMIT THE INFORMATION TO MOTOROLA. Refer to the Custom Programming instructions for detailed procedures.

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

Character Number ______________

	MSB							LSB	HEX	
R	☐	☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
R		☐	☐	☐	☐	☐	☐	☐		
	S	D6		D4	D3			D0		

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THE DIGITAL GROUP
1024 CHARACTER TV READOUT
&
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1024 CHARACTER TV READOUT & CASSETTE INTERFACE