516-15
DRW
8/23/68

A Suggested Graphic Display with Keyboard for Graphic Terminals

The "516 Honeywell Computer" (8000 words of 1 usec core memory) with a Data Disc forms a multicomputing system with a disc file management software to give an operating system of over 1/4 million 16-bit words and expandable to twice the size (fig. #1). A second part of the disc is used as a refresh buffer for the graphic "Glance" displays. A variable bit code is used to form incremental moves to make a series of dots to form a full graphic picture on the face of the C.R.T. Each display is connected to the disc through a coaxial cable. Other input-output pheripherals are connected to the "516" thru a coaxial ring which has a node modem for each peripheral.

It is possible for the software to handle a certain amount of keyboard traffic and display the character on the proper C.R.T. The traffic is limited by the disc access time. The disc revolves once every 33 milliseconds. The idea I would like to present is to use the display with their keyboards in a two-mode operation. There would be the normal Glance type operation called the "Display Mode" in which the computer would assemble a complete incremental picture in the form of bits on a disc track of the secondary store. These bits then would be transferred to the proper display track of the disc. In the "Display Mode" the normal 2-bit decoding takes place and a "Glance" incremental picture is displayed on the C.R.T.

The second mode would be a "Character Mode" in which the computer would transfer to the display track data causing the display to increment in a pseudo raster mode. At the display (fig. 2) a MOS read-only memory would form a character generator and a MOS static shift register would form a 1024 "Character Storage."

The "2-bit Decoder" of the "Glance Scope" has 10 bits that are brought out for external functions. The characters to be displayed are stored in the "Read Only Memory" (ROM). Control signals from the "2-bit Decoder" would be "Advance Next Character" (ANC), "Carriage Return" (CR) and TAB. The "ANC" would synchronize the character to be displayed to the position of the beam of the C.R.T. On a "ANC" command, the next output character is decoded to the R.O.M. whose output is the dot pattern to be displayed.

The serial shift register holds the dot pattern in form of bits until the beam is moved in a minor raster suitable for displaying the spot. When the unblank pulse occurs from the "2-bit Decoder"

the unblanking Mode Gate lets the unblanking pulse from the "2-bit Decoder" unblank the scope if the "Shift Register" output is a one. The Shift Register being a JK type, the unblanking pulse and clock from the "2-bit Decoder" can be used to shift the next bit in position for the next incremental move command from the "2-bit Decoder."

To type a message on the display, a "Message Out Key" is depressed, causing an "Interrupt" and a "Message Out" flag to occur. This causes the computer to read the Status and issue a command to put the display in the proper mode. The computer also writes the proper raster scan with control functions on the display buffer track. One of the proper commands will unlock the keyboard and permit the user to begin to assemble a message. Normal control characters may be used such as Carriage Return (CR). In this case, a "CR" is created from the keyboard and the polling logic waits until the "CR" is given by the "2-bit Decoder" to the polling logic. In other words, the "ANC" is ignored until the "CR" is given by the "2-bit Decoder." The "CR" code then is stored as a control character, along with the other alpha-numeric characters in the Character Register. The "TAB" works in the same fashion where the "ANC" is ignored until "TAB" is given by the "2-bit Decoder." In displaying the characters from the character register, all characters are displayed and advanced by "ANC" unless a control character is decoded to the ROM, a control character that acts as before, suppressing the "ANC" until the proper control character appears from the "2-bit Decoder." This is the method of synchronization of control characters with the alpha-numeric characters between the programmed raster and the characters in the "Character Store." A special bit, the 7th or 8th bit of the Character Store, is used to denote a Display Marker" (DM). This always is stored one character in advance of the last character in the "Char Store." This indicates the place for the next character to be written in the Character Memory and displays a marker on the scope. Back space will put the "DM" back one in the Character Memory. However, this does not apply to control characters that are in the Character Memory; they are skipped by the "DM."

Once a message has been assembled, a send key is pressed causing the interrupt flag to be set.

The computer then reads the Status and sets up the commands to the polling logic changing the mode to read the Display's Character Memory. The characters are sent via ring node modem to the computer until an EOM or end of a character memory address is sensed. This causes the Interrupt Flag to

be set. When the computer wants to send a message to the display, it has to set the display in the proper mode and send the message via the coaxial cable and node modem. It is also possible to send the message via the disc display track because of the extra not-used bits available for an external load operation by the "2-bit Decoder."

The above has shown that the Glance Display can be used in a character mode. It is not intended to show a detailed logic structure but suggests ways that the display tracks can be used to synchronize character streams for display purposes and for the control characters from the keyboard to be used as a typist uses them on a commercial typewriter.

The ROM price of a 5x7 dot matrix (figs. 3 and 4) is now priced around $60 for 16 characters. Static MOS memories now are about 10 cents (fig. 5) a bit. I suggest that 48 character MOS, ROM, and a 512 by 7 bit MOS Static Memory be used because they are available from the integrated circuit manufacturers.

One conclusion is that the raster is completely programmable including character size. It should also be possible to intermix the normal Glance Display and the character mode by using a command signal in the "ext" output of the "2-bit Decoder," causing the modes to switch between Display and Characters.

Attached
Figs. 1-5

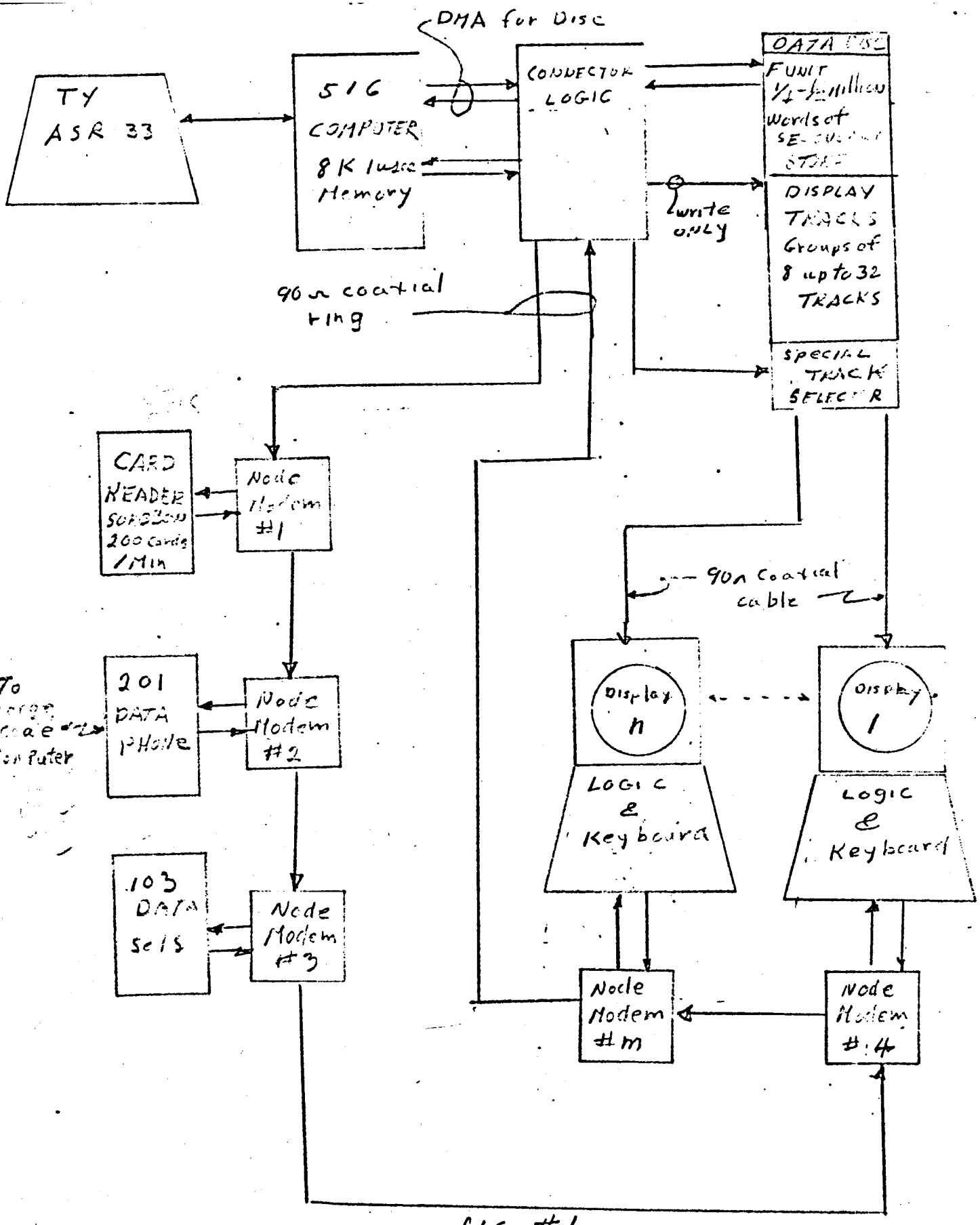


fig #1

Mini Time Sharing system

ISSUE	ENGR	TITLE	BELL TELEPHONE LABORATORIES INCORPORATED
	DRAWN	BLOCK DIAGRAM OF MITS	SHEET
		6-9-64, 1965	NO. OF SHEETS PER SET

PRINTED IN U.S.A.
E-1812-A-1 (9-65)

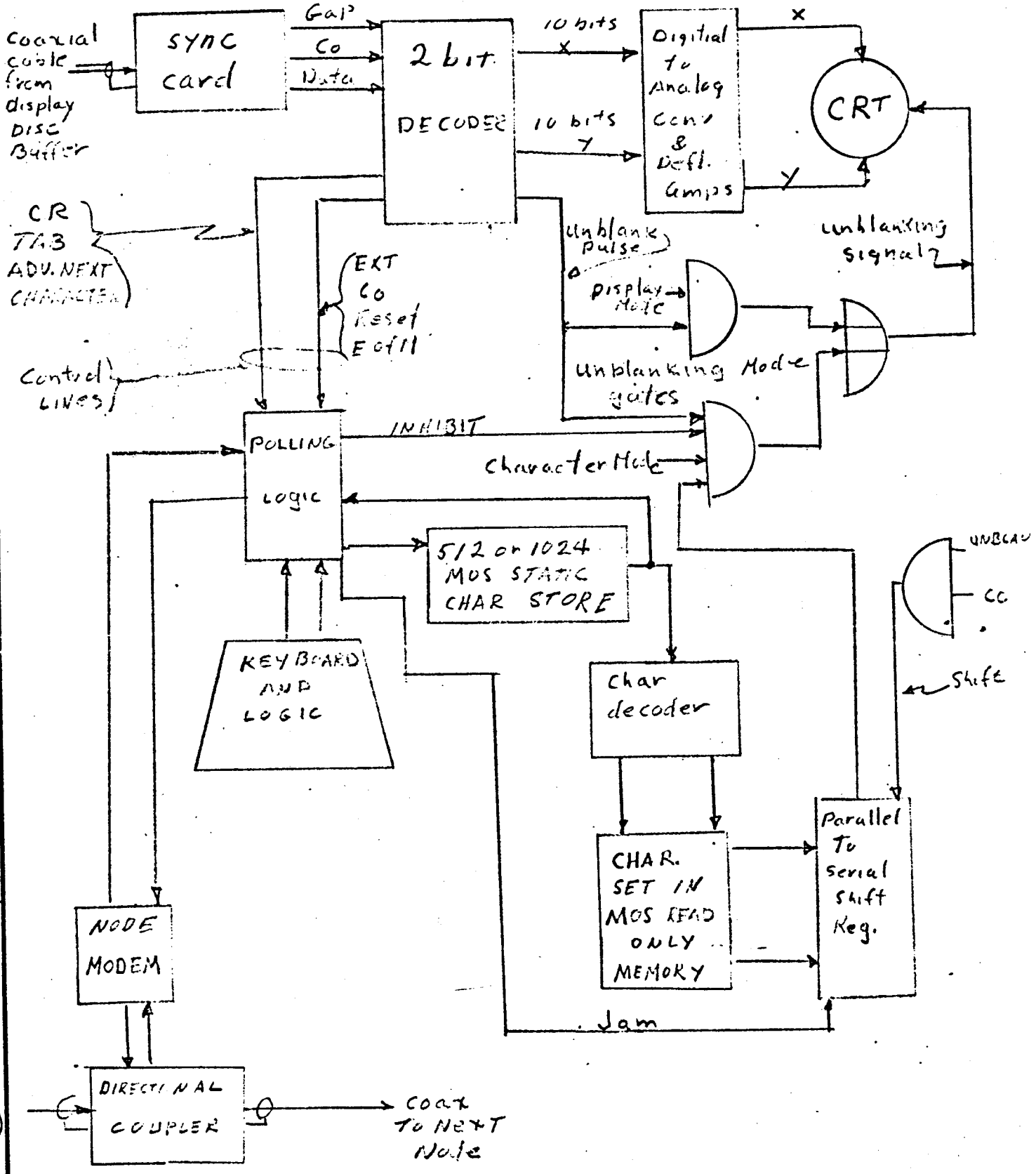


fig 2

ISSUE	ENGR	TITLE	BELL TELEPHONE LABORATORIES INCORPORATED
	DRAWN	2 MODE DISPLAY	SHEET
		Aug 22, 1968	NO. OF SHEETS PER SET

PRINTED IN U.S.A. E-1812-A-1 (9-65)

3501A4A

1024-BIT STATIC READ-ONLY MEMORY

MOS INTEGRATED CIRCUIT

8 66 ea

GENERAL DESCRIPTION — The 3501 read-only memory code A4A is programmed to store information for generating the letters @ and A through O in a 5 x 8 dot pattern display. The memory stores the information by using 5 words of 8 bits for each figure or symbol.

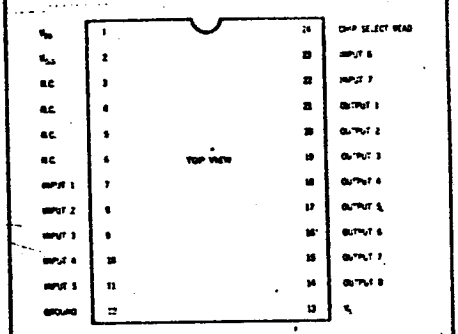
OPERATIONAL AND ELECTRICAL CHARACTERISTICS

Refer to the 3501 general data sheet.

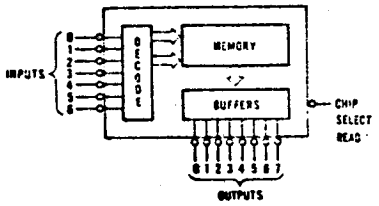
ORDER INFORMATION

Specify A6G3501A4A (−55°C to +85°C)
Specify A6G3501A9A (0°C to +70°C)

PIN CONFIGURATION



LOGIC DIAGRAM



*WHEN CHIP SELECT READ IS AT GROUND THE OUTPUTS ARE FLOATING

3501A4A TRUTH TABLE

WORD		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
INPUTS	I_1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	I_2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	I_3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	I_4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	I_5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	I_6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	I_7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OUTPUTS	O_1	0	0	1	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	1	0	0	0	0
	O_2	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
	O_3	1	0	0	1	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
	O_4	1	0	1	0	0	1	0	1	1	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0
	O_5	1	0	1	0	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
	O_6	1	0	0	1	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
	O_7	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	1	1	1	0	0	0	0
	O_8	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: See Electrical Characteristics for voltage value.

fig #3

313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

FAIRCHILD MOS INTEGRATED CIRCUIT 3501A4A

WORD	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
INPUTS I_1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
I_2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
I_3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
I_4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
I_5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
I_6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
I_7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OUTPUTS O_1	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0
O_2	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
O_3	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
O_4	1	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0
O_5	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
O_6	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
O_7	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0
O_8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

WORD	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
INPUTS I_1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
I_2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
I_3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
I_4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
I_5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
I_6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I_7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OUTPUTS O_1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
O_2	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0
O_3	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
O_4	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0
O_5	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
O_6	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0
O_7	1	1	1	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
O_8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

WORD	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
INPUTS I_1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
I_2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
I_3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
I_4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
I_5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
I_6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
I_7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
OUTPUTS O_1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0
O_2	1	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0
O_3	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0
O_4	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0
O_5	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
O_6	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
O_7	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0
O_8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

fig #4

Dave → DUAL 100 BIT MOS STATIC SHIFT REGISTER

[illegible]-17-[illegible] 1.45

BERRY CASH [illegible] 7

[illegible] OUR PROGRESS ON DUAL 100 BIT STATIC MOS SHIFT REGISTER

[illegible] ARE YOU PROGRESSING. WHEN WILL WE HAVE PRODUCT AVAILABLE. [illegible] IDEA OF OUR PRICEING STRUCTURE.

[illegible]
[illegible]
[illegible] ANDY [illegible]

V
AV
DLA 7-20-69 1008A

ANY [illegible] UVV 2 .

DUAL 100 SAMPLES WILL BE AVAILABLE AUGUST 23--1K PRICE IS $24.00
-[illegible] $37.50.

[illegible] FOR BERRY CASH 3-989 MS 10 GS

fig 5