July 10, 1978

TO: RICHARD CHANG

FROM: DAVE CHANDLER

SUBJECT: BACK-UP VIDEO SYSTEM

It is clear that we should continue to strive to get our system completed
for the January C.E.S. based on the G.I. STIC chip set. However, in light
of the facts that the schedule for obtaining F.C.C. approval outlined by
G.I. is quite tight for January C.E.S., cost reductions in the forms of
40K ROMS and a consolidated chip set will not be available for 1979 pro-
duction, and the $40^{\circ}C$ temperature specification on the STIC chip set
promises to cause problems and expense, it seems wise to pursue a back-up
system.

An interesting candidate for a back-up system appears feasible based on a
combination of Signetics PVI chip set and MOS Technology's VIC chip. The
VIC provides better background capability than we now have, with higher
resolution and better alphanumerics. The PVI system provides more flex-
ible foreground capability, primarily because of the multiplexing capability.
All the chips exist now, functioning hardware can be put together right
away. The lowest temperature spec on any of these chips is $55^{\circ}C$. There
is the necessity to marry the two systems and while I have found no inherent
obstacles to such a marriage, there could still be some problems.

I am proposing a three stage approach to pursuing this back-up system:

1. Proceed as quickly as possible to breadboard a system which would
    incorporate 1 VIC chip and 4 PVI chips.

2. Assuming the breadboard looks good, design and build PC boards to fit
    into our present housing, again based on 1 VIC chip and 4 PVI's. This
    system could be put through F.C.C. for January C.E.S. and used for
    limited early production, if desired.

3. Fund Signetics to lift the portions from PVI which generate moving
    objects, expand them to 16 lines high and put 8 moving objects in one
    new chip for us (call it MOVI). Off-the-top-of-the-head estimates by
    Signetics are that this could be done in about 6 months. That could
    permit us to use this chip for the quantity production and would appear
    to give us a chip set cost comparable to the STIC set.

It would be good if we could be in a position to discuss the MOVI chip with Signetics management when they come here July 17.

To minimize the problems associated with creating another competitive system which we might not use, I would propose that the breadboard be put together at APh but with them having no contact with either Signetics or MOS Technology. All of the coordination would come through here and we would not let either company know the full nature of the systems we are putting together. They would also not know where it is being put together.
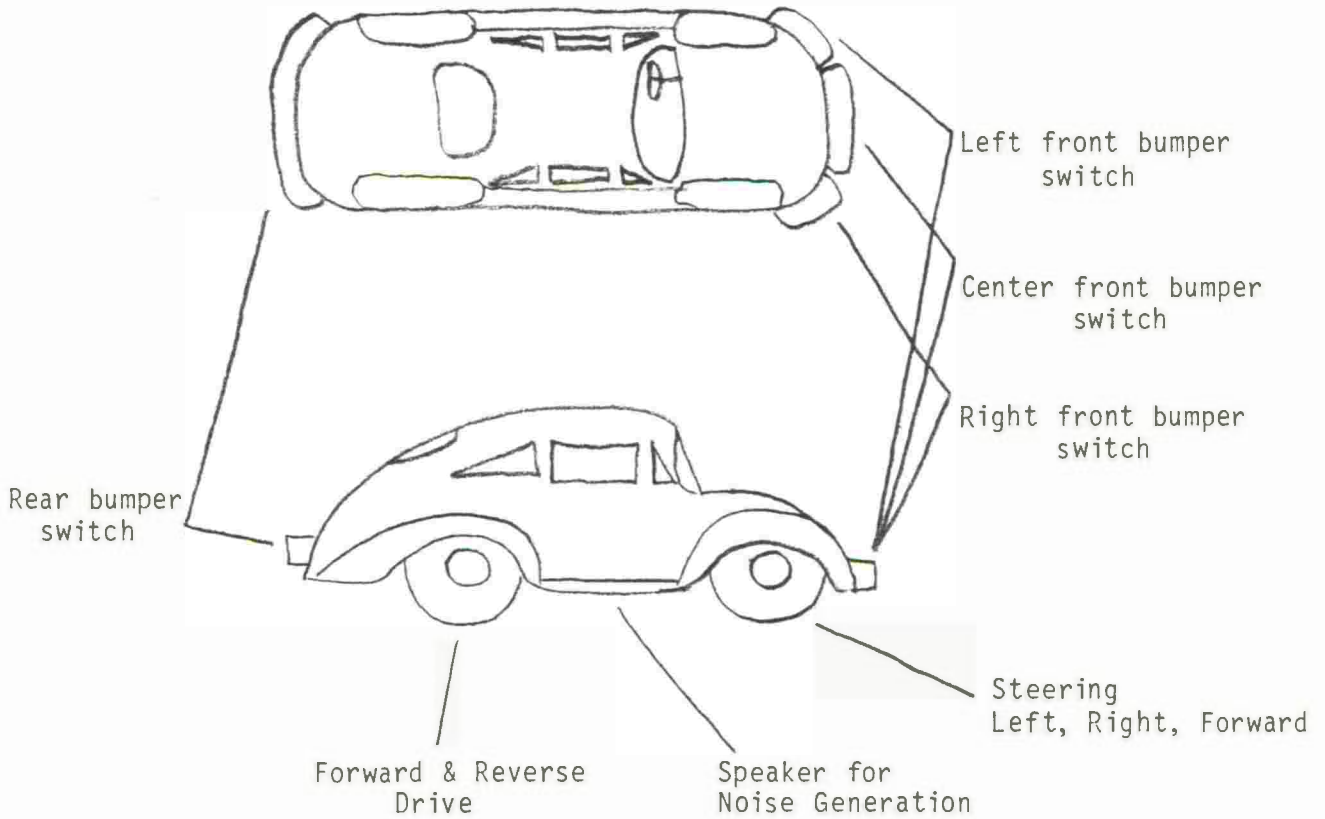

DPC:lb

cc: Denis Bosley
      Josh Denham
      Ed Krakauer
      Jeff Rochlis

Proposal

for a

COMPUTER CONTROLLED CAR

Left front bumper
switch

Center front bumper
switch

Right front bumper
switch

Rear bumper
switch

Steering
Left, Right, Forward

Forward & Reverse
Drive

Speaker for
Noise Generation

B. Willis
10/12/78

I. MOTION

A motor is included to provide both forward and reverse drive.

A. FORWARD DRIVE

Proportional speed control will be limited to a fixed acceleration curve in three steps, to simulate gear changes. Such acceleration will only be used while steering straight ahead.

Otherwise a slow deliberate speed will be used during left or right steering.

B. REVERSE DRIVE

Reverse motion will be used to back away from obstacles encountered in front of the vehicle.

Speed in the reverse direction will be as in forward turns, whether turning or backing straight.

II. STEERING

The three steering settings are:

> FULL LEFT,
> FULL RIGHT, or
> CENTER (STRAIGHT AHEAD)

Left and right steering is used for manuvering around encountered obstacles.

The amount of steering will depend entirely upon the duration of a left or right turn setting.

III. BUMPER SWITCHES

Four bumper switches detect collisions with objects. They are located in the rear, in the center front, at the right front corner, and at the left front corner.

BUMPER SWITCHES (cont.)

A. REAR BUMPER SWITCH

This switch detects rear-end collisions and is used to initiate other actions such as forward motion.

B. CENTER FRONT BUMPER SWITCH

This switch can detect head-on collisions and together with the LEFT and RIGHT BUMPER SWITCHES can be used to determine corrective or evasive action. Only reverse drive will be used to correct a head-on collision.

C. LATERAL BUMPER SWITCHES

These switches can detect glancing collisions to the left or right of the vehicle. It will be assumed that forward or reverse motion can correct for a glancing collision.

IV. NOISE GENERATION

A. MOTOR ACCELERATION

In synchronization with the acceleration curve, a motor noise is generated.

B. CRASH

Upon any collision, a crash noise is generated.

C. BEEP-BEEP

While backing up, a "beep-beep" warning tone is generated.

V. OPERATION

A. The vehicle is powered by batteries and is turned on with a simple switch.

B. The vehicle drives straight forward and begins the acceleration curve accompanied by the accelerating motor noise.
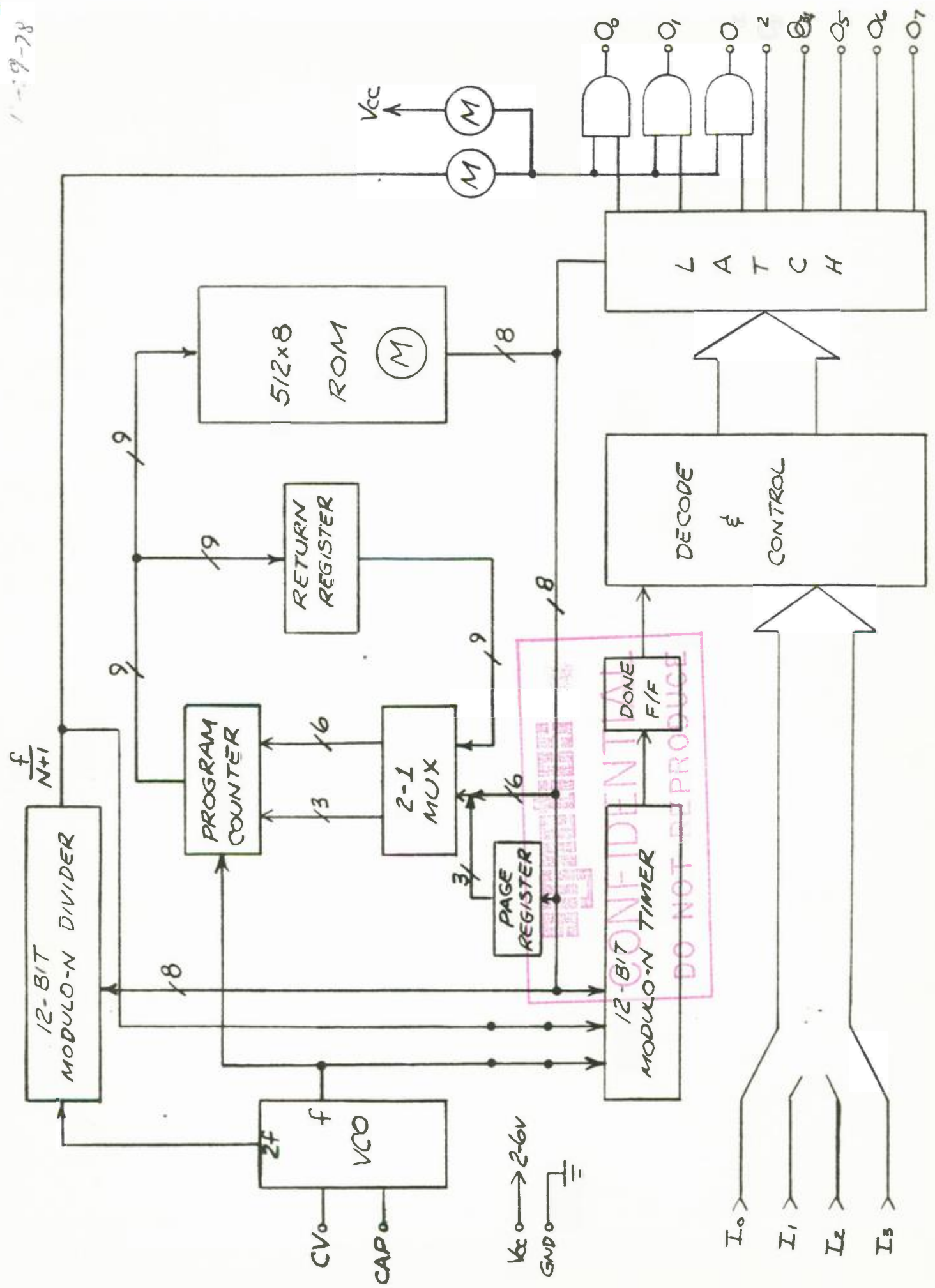
C. If a glancing collision occurs, the vehicle stops and a crash noise is heard. Then the vehicle procedes forward slowly, but steers to avoid the obstacle. After going around the obstacle, operation continues with step B above.

V. OPERATION (cont.)

D. If a head-on collision occurs, the vehicle stops and a crash noise
    is heard. If a right side collision is also sensed, then the steering
    turns to the right and the vehicle slowly backs up, with a "beep-beep"
    warning tone. After backing sufficiently, the vehicle goes around
    the obstacle on the left. If no right side collision is sensed, the
    vehicle backs and goes around the right side of the obstacle. After
    going around the obstacle, operation continues with step B above.

E. If no collision has occured before the "top-end" has been reached, the
    vehicle executes a "three-point" turn and heads off in a new direction
    with step B above.

F. If anytime during the operation, a rear-end collision is detected,
    the vehicle stops, makes a crash noise, drives slowly straight forward,
    stops, and then continues the operation it was doing when the crash oc-
    cured.

B. Willis
10/12/78

CµC   VERSION 'A'

1-19-78

$\dfrac{f}{N+1}$

12-BIT MODULO-N DIVIDER

2F

VCO   f

CV○
CAP○

Vcc○ → 26v
GND○

M M → Vcc

512×8 ROM (M)

RETURN REGISTER

PROGRAM COUNTER

2-1 MUX

PAGE REGISTER

DONE F/F

12-BIT MODULO-N TIMER

/9
/9
/9
/8
/8
/16
/13
/16
/3
/9
/16
/8

DECODE & CONTROL

L A T C H

Q_0 Q_1 Q_2 2 Q_4 Q_5 Q_6 Q_7

I_0
I_1
I_2
I_3

CMC VERSION 0

O_0 O_1 O_2 O_3 O_4 O_5 O_6 O_7

Vcc

M
M
M

256 × 8 ROM

L A T C H

RETURN REGISTER

DECODE & CONTROL

PROGRAM COUNTER

2-1 MUX

DONE F/F

9-BIT MODULO-N DIVIDER

$\dfrac{f}{N+1}$

PAGE REGISTER

9-BIT MODULO-N REPRODUCE TIMER

DONE

VCO

f

2f

CV

CAP

Vcc → 26v

GND

I_0 I_1 I_2 I_3

8 8 8 8 8 8

16 16 2 2

CµC VERSION 'C'

CµC VERSION 'D'

VCO   f

CV
AP

Vcc ○——→ 26v
GND ○

PROGRAM COUNTER

2-1 MUX

PAGE REGISTER

RETURN REGISTER

256×8 ROM   Ⓜ

8
8
8
18
18
8
16
16
12
12

DECODE & CONTROL

L A T C H

O₀ O₁ O₂ O₃ O₄ O₅ O₆ O₇

I₀ I₁ I₂ I₃
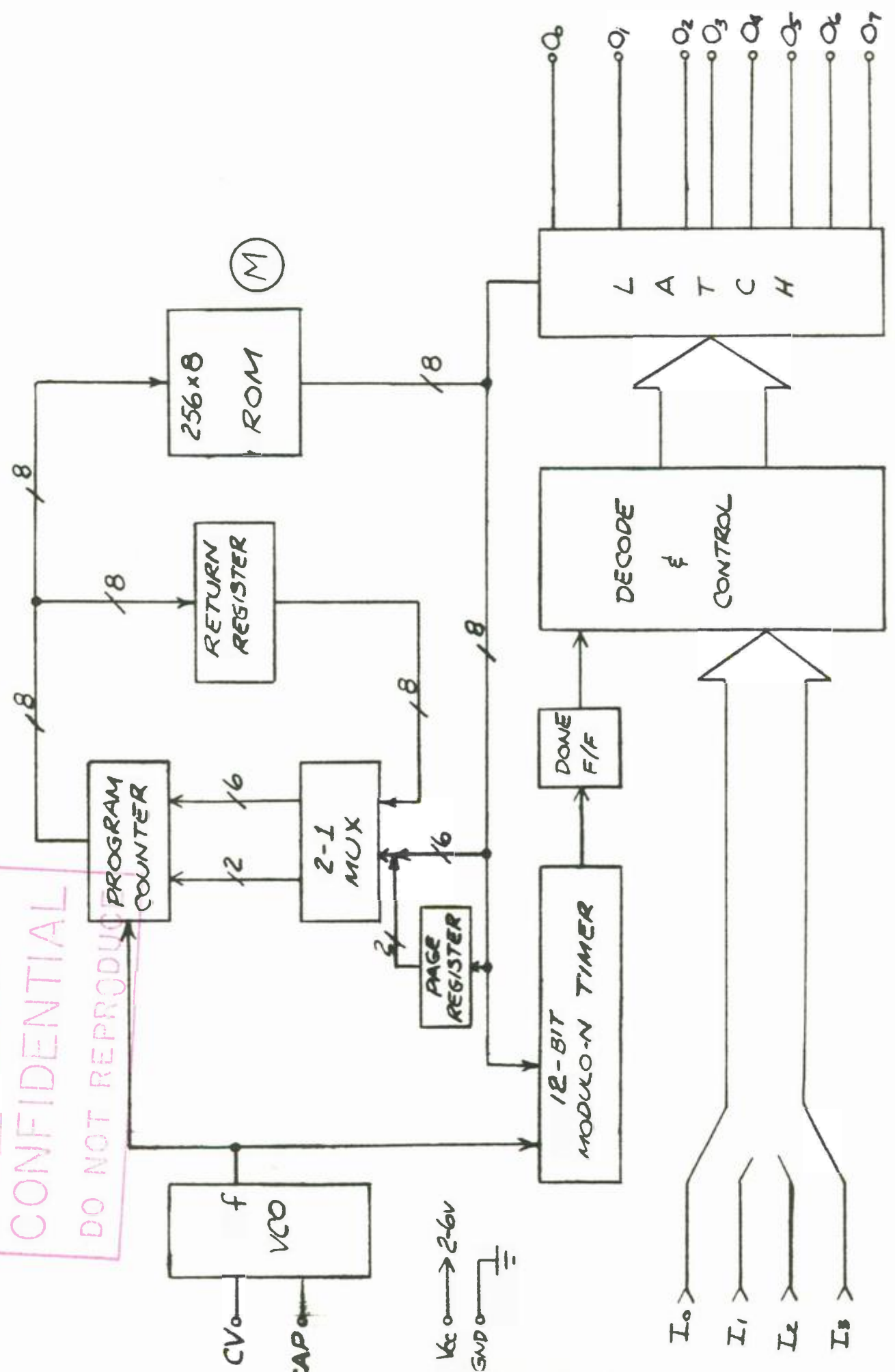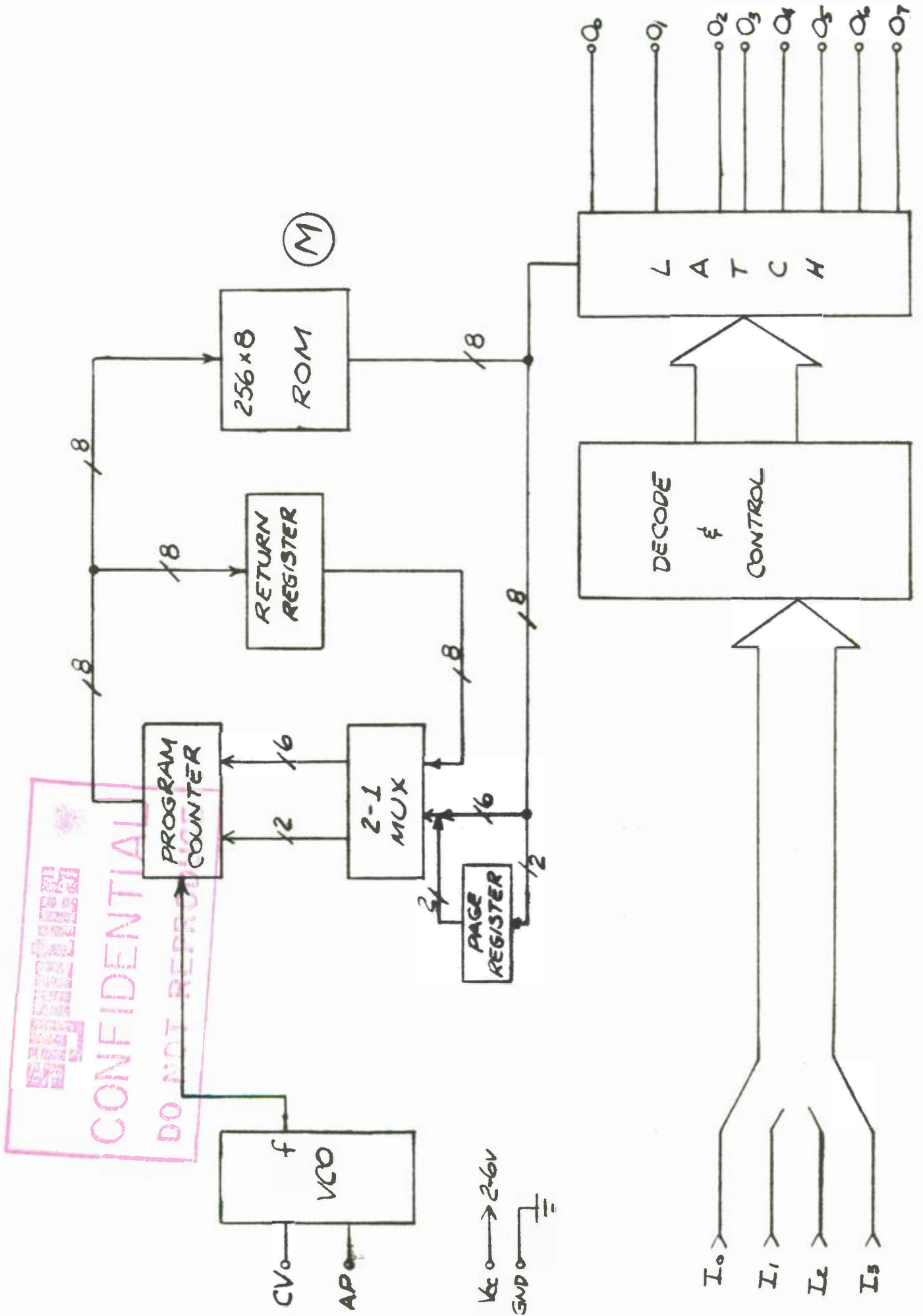
ISSUE	DESCRIPTION	DATE	APPROVAL
A	ORIGINAL ISSUE	11/27	15
B	INSERT FTMR STMR INST + MISC CORRECTIONS	11/27/78	

MNEMONIC	NAME	FORMAT	DESCRIPTION
LDIV	LOAD DIVIDER	1 0 0 E M	DIVIDER $\leftarrow M \times 8^E$ (OTHER EXPONENTS OF 8 REMAIN UNCHANGED)
LTMR	LOAD TIMER	1 0 1 E M	TIMER $\leftarrow M \times 8^E$ (OTHER EXPONENTS OF 8 REMAIN UNCHANGED)
TMRT	TIMER TEST	1 1 1 1 0 0 0	IF TIMER IS DONE, THEN SKIP $(PC \leftarrow PC+2)$.
FTMR	FAST TIMER	1 1 1 1 1 0 1 0	TMCLK $\leftarrow$ CLK
STMR	SLOW TIMER	1 1 1 1 1 0 1 1	TMCLK $\leftarrow$ DIV
JMP	JUMP	0 0 A	$PC_{5-0} \leftarrow A$
JSR	JUMP TO SUBROUTINE	0 1 A	RETURN REGISTER $\leftarrow PC+1$ $PC_{5-0} \leftarrow A$
LDPG	LOAD PAGE	1 1 1 0 A	$PC_{8-6} \leftarrow A$ (AFTER NEXT INSTRUCTION) (JMP & JSR BECOME GLOBAL IF PRECEDED BY LDPG)
WRT	WRITE OUTPUT	1 1 1 0 D N	OUTPUT No. N $\leftarrow$ D
INPT	INPUT TEST	1 1 0 T $S_3 S_2 S_1 S_0$	IF ALL INPUTS (I_3, I_2, I_1, I_0) SELECTED (BY S_3, S_2, S_1, S_0) ARE EQUAL TO T, THEN SKIP $(PC \leftarrow PC+2)$.
RTN	RETURN	1 1 1 1 1 0 0 1	PC $\leftarrow$ RETURN REGISTER
NOP	NO OPERATION	1 1 0 0 0 0 0 0	PC $\leftarrow$ PC+1

NOTE: UNLESS OTHERWISE INDICATED, PC $\leftarrow$ PC + 1 WITH EACH INSTRUCTION.

CMC Schedule

Timeline (weeks): IOD — 9/11 — 12 — 13 — 6/11 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10 — 11

Milestones: Customer Emulator (5) · First Parts (9) · Code 3 (11)

EMULATOR: DESIGN (E) — WRAP (T) — DEBUG (A/E) — LIST (T) — BUILD (C)

ASSEMBLER: DEBUG (D.S/E) — INSTALL (D.S.)

M TEST PROGRAM: WRITE/DEBUG (EN)

SIMULATOR: DEFINITION (D.S.) — WRITE/DEBUG (D.S.) — TEST (D.S.) — INSTALL (D.S.)

DOCUMENTATION: PRELIM (A) — FINAL (A/C)

CUSTOMER APPL. ASS'T: (A)
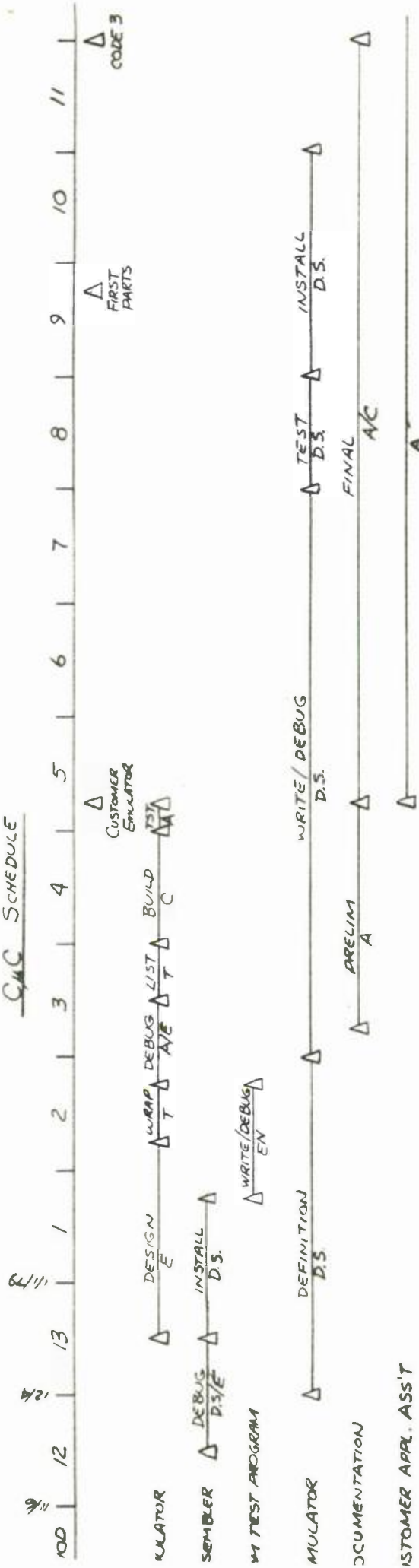
LOGIC: MODELING/CKT DESIGN (EN)

LAYOUT (EN)

MASK — WAFER — E-SORT — CHARACTERIZATION (EN)

KEY:
A - APPLICATIONS
C - OUTSIDE CONTRACT
D.S. - DEVELOPMENT SYS.
E - BRIAN WILLIS
EN - DESIGN ENG.
T - TECHNICIAN

FAB 11-10-78

ƧμC PRICE INDEX

ƧμC VERSION	1980	1981
A	1.00	0.56
B	0.74	0.43
C	0.66	0.41
D	0.50	0.35