SUPER MUSIC CARD

"MUSTALGAME"

INSTALLATION

Just plug your MUSTAL6AME card into the slot specified by the software (usually slot 4). Connect the jet of the stereo speaker provided and then RUN your software. Adjust the individual Volume of each channel for loudness.

If you want to amplify the sound further using your own power amplifier, connect the inputs of the amplifier to the LINE-OUTs of the MUSTAL6AME. You can get the best sound effects.

To play save turn your computer's power supply off while you are doing insertions or connections.

PROGRAMMING

The MUSTAL6AME can be programmed to produce various types of sound including musical note, game sound effects and human voice.

The hardwares that actually produces the sound is GI's sound generation chip AY-3-891X. Therefore it is very important to know how to programme the sound chip.

There are 16 registers within the sound chip which is listed below:-

Register	Description	
R0	Channel A Freq Fine tune	(8 bits)
R1	Channel A Freq Coarse tune	(4 bits)
R2	Channel B Freq Fine tune	(8 bits)
R3	Channel B Freq Coarse tune	(4 bits)
R4	Channel C Freq Fine tune	(8 bits)
R5	Channel C Freq Coarse tune	(4 bits)
R6	Noise Freq	(5 bits)
R7	Enable	(8 bits)
R8	Channel A Amplitude	(5 bits)
R9	Channel B Amplitude	(5 bits)
R10	Channel C Amplitude	(5 bits)
R11	Envelope Period Fine tune	(8 bits)
R12	Envelope Period Coarse tune	(8 bits)
R13	Envelope Shape / Cycle	(4 bits)
R14	I / O Port X	(8 bits)
R15	I / O Port Y	(8 bits)

APPLE ADDRESS	FUNCTION
$C400	Speaker 1 Function Select
$C480	Speaker 2 Function Select
$C401	Speaker 1 Data In/Out
$C481	Speaker 2 Data In/Out

$C400	X	X	X	X	X	B2	B1	B0	
						0	X	X	Reset
						1	1	1	
						1	0	0	Select Register
						1	1	0	
						1	0	0	Latch Data

$C401	X	X	X	X	B3	B2	B1	B0	
Select Register :					0	0	0	0	R0
						To			
					1	1	1	1	R15

$C401	B7	B6	B5	B4	B3	B2	B1	B0	
Latch Data :	0	0	0	0	0	0	0	0	Value 0
					To				
	1	1	1	1	1	1	1	1	Value 255

Register	Description
R0,R1 : CH.A Freq	1 (63.94KHz) to 4095 (15.6Hz)
R2,R3 : CH.B Freq	1 (63.94KHz) to 4095 (15.6Hz)
R4,R5 : CH.C Freq	1 (63.94KHz) to 4095 (15.6Hz)
R6 : Noise Freq	1 (63.94KHz) to 31 (2.06KHz)
R7 : ENABLE	BIT 0 : 0 = TONE A ENABLE (SPEAKER 1)
	BIT 1 : 0 = TONE 1 (63.94KHz) to 4095 (15.6Hz)

R4,R5 : CH.C Freq 1 (63.94KHz) to 4095 (15.6Hz)

R6 : Noise Freq 1 (63.94KHz) to 31 (2.06KHz)

R7 : ENABLE
- BIT 0 : 0 = TONE A ENABLE (SPEAKER 1)
- BIT 1 : 0 = TONE B ENABLE (SPEAKER 1)
- BIT 2 : 0 = TONE C ENABLE (SPEAKER 1)
- BIT 3 : 0 = NOISE A ENABLE (SPEAKER 1)
- BIT 4 : 0 = NOISE B ENABLE (SPEAKER 1)
- BIT 5 : 0 = NOISE C ENABLE (SPEAKER 1)
- BIT 6 : 0 = OUTPUT TO PORT X (SPEAKER 1)
- BIT 7 : 0 = OUTPUT TO PORT Y (SPEAKER 2)

R8 : CH.A Amplitude level = 0 to 15 ; > 16 amplitude define by R13

R9 : CH.B Amplitude level = 0 to 15 ; > 16 amplitude define by R13

R10 : CH.C Amplitude level = 0 to 15 ; > 16 amplitude define by R13

R11,R12 : Envelope Freq 1 (3996Hz) to 65535 (0.061Hz)

R13 : Envelope Shape / Cycle :
- BIT 0 : HOLD
- BIT 1 : ALTERNATE
- BIT 2 : ATTACK
- BIT 3 : CONTINUE

R14 : PORT X DATA REGISTER : FOR 8 BIT D/A CONVERT

R15 : PORT Y DATA REGISTER : FOR 8 BIT D/A CONVERT

THE DEFINITION OF EACH FUNCTION

HOLD — When set to logic "1", limits the envelope to one cycle, holding the last count of the envelope counter (E3--E0==0000 or 1111, depending on whether the envelope counter was in a count-down or count-up mode, repectively).

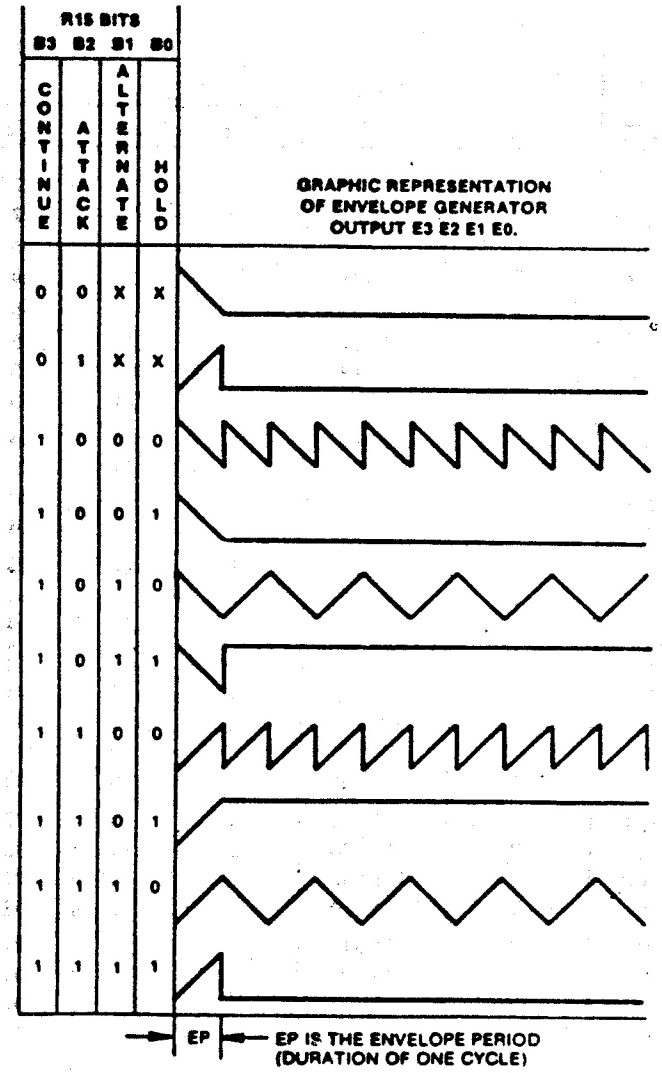
ALTERNATE — When set to logic "1", the envelope counter reverses count direction (up-down) after each cycle.

ATTACK — When set to logic "1", the envelope counter will count up (attack) from E3 E2 E1 E0 == 0000 to E3 E2 E1 E0 == 1111; when set to logic "0", the envelope counter will count down (decay) from 1111 to 0000.

CONTINUE — When set to logic "1", the cycle pattern will be as defined by the Hold bit; when set to logic "0", the envelope generator will reset to 0000 after one cycle and hold at that count.

NOTE : When both the Hold bit and the Alternate bit are ones, the envelope counter is reset to its initial count before holding.

ENVELOPE SHAPE/CYCLE CONTROL



APPENDIX Equal Tempered Chromatic Scale
(fCLOCK- 1,023 MHz)
(adapted from General Instrument Programmable Sound Generator Data Manual)

NOTE	OCTV	NOTE FREQ	TONE PERIOD (DEC) CRSE	TONE PERIOD (DEC) FINE	TONE PERIOD (HEX) CRSE	TONE PERIOD (HEX) FINE
C	1	32.703	7	163	07	A3
C#	1	34.648	7	53	07	35
D	1	36.708	6	205	06	CD
D#	1	38.891	6	108	06	6C
E	1	41.203	6	15	06	0F
F	1	43.654	5	184	05	B8
F#	1	46.249	5	102	05	66
G	1	48.999	5	24	05	18
G#	1	51.913	4	207	04	CF
A	1	55.000	4	138	04	8A
A#	1	58.270	4	73	04	49
B	1	61.735	4	11	04	0B
C	2	65.406	3	209	03	D1
C#	2	69.296	3	154	03	9A
D	2	73.416	3	102	03	66
D#	2	77.782	3	54	03	36
E	2	82.406	3	7	03	07
F	2	87.308	2	220	02	DC
F#	2	92.498	2	179	02	B3
G	2	97.998	2	140	02	8C
G#	2	103.826	2	103	02	67
A	2	110.000	2	69	02	45
A#	2	116.540	2	36	02	24
B	2	123.470	2	5	02	05
C	3	130.812	1	232	01	E8
C#	3	138.592	1	205	01	CD
D	3	146.832	1	179	01	B3
D#	3	155.564	1	155	01	9B
E	3	164.812	1	131	01	83
F	3	174.616	1	110	01	6E
F#	3	184.996	1	89	01	59
G	3	195.996	1	70	01	46

APPENDIX Equal Tempered Chromatic Scale (continued)
(fCLOCK- 1,023 MHz)

NOTE	OCTV	NOTE FREQ	TONE PERIOD (DEC) CRSE	TONE PERIOD (DEC) FINE	TONE PERIOD (HEX) CRSE	TONE PERIOD (HEX) FINE
G#	3	207.652	1	51	01	33
A	3	220.000	1	34	01	22
A#	3	233.080	1	18	01	12
B	3	246.940	1	2	01	02
C	4	261.624	0	244	00	F4
C#	4	277.184	0	230	00	E6
D	4	293.664	0	217	00	D9
D#	4	311.128	0	205	00	CD
E	4	329.624	0	193	00	C1
F	4	349.232	0	183	00	B7
F#	4	369.992	0	172	00	AC
G	4	391.992	0	163	00	A3
G#	4	415.304	0	153	00	99
A	4	440.000	0	145	00	91
A#	4	466.160	0	137	00	89
B	4	493.880	0	129	00	81
C	5	523.248	0	122	00	7A
C#	5	554.368	0	115	00	73
D	5	587.328	0	108	00	6C
D#	5	622.256	0	102	00	66
E	5	659.248	0	96	00	60
F	5	698.464	0	91	00	5B
F#	5	739.984	0	86	00	56
G	5	783.984	0	81	00	51
G#	5	830.608	0	76	00	4C
A	5	880.000	0	72	00	48
A#	5	932.320	0	68	00	44
B	5	987.760	0	64	00	40
C	6	1046.496	0	61	00	3D
C#	6	1108.736	0	57	00	39
D	6	1174.656	0	54	00	36
D#	6	1244.512	0	51	00	33

APPENDIX Equal Tempered Chromatic Scale (continued)
(fCLOCK- 1.023 MHz)

NOTE	OCTV	NOTE FREQ	TONE PERIOD (DEC) CRSE	(DEC) FINE	(HEX) CRSE	(HEX) FINE
E	6	1318.496	0	48	00	30
F	6	1396.928	0	45	00	2D
F#	6	1479.968	0	43	00	2B
G	6	1567.968	0	40	00	28
G#	6	1661.216	0	38	00	26
A	6	1760.000	0	36	00	24
A#	6	1864.640	0	34	00	22
B	6	1975.520	0	32	00	20
C	7	2092.992	0	30	00	1E
C#	7	2217.472	0	28	00	1C
D	7	2349.312	0	27	00	1B
D#	7	2489.024	0	25	00	19
E	7	2636.992	0	24	00	18
F	7	2793.856	0	22	00	16
F#	7	2959.936	0	21	00	15
G	7	3135.936	0	20	00	14
G#	7	3322.432	0	19	00	13
A	7	3520.000	0	18	00	12
A#	7	3729.280	0	17	00	11
B	7	3951.040	0	16	00	10
C	8	4185.984	0	15	00	0F
C#	8	4434.944	0	14	00	0E
D	8	4698.624	0	13	00	0D
D#	8	4978.048	0	12	00	0C
E	8	5273.984	0	12	00	0C
F	8	5587.712	0	11	00	0B
F#	8	5919.872	0	10	00	0A
G	8	6271.872	0	10	00	0A
G#	8	6644.864	0	9	00	09
A	8	7040.000	0	9	00	09
A#	8	7458.560	0	8	00	08
B	8	7902.080	0	8	00	08

APPENDIX Assembly Language Program Listings

```
                        1  *PRIMARY ROUTINES
                        2  *FOR SLOT 4
                        3  *
                        4          ORG  $9000
                        5  *                          ;ADDRESSES
                                                       FOR FIRST

                        6  ORB      EQU  $C400       ;PORT B
                        7  ORA      EQU  $C401       ;PORT A
                        8  DDRB     EQU  $C402       ;DATA DIREC-
                                                       TION REGSTR
                                                       (B)
                        9  DDRA     EQU  $C403       ;DATA DIREC-
                                                       TION REGSTR
                                                       (A)
                       10  *                          ;ADDRESSES
                                                       FOR SECOND

                       11  ORB2     EQU  $C480       ;PORT B
                       12  ORA2     EQU  $C481       ;PORT A
                       13  DDRB2    EQU  $C482       ;DATA DIREC-
                                                       TION REGSTR
                                                       (B)
                       14  DDRA2    EQU  $C483       ;DATA DIREC-
                                                       TION REGSTR
                                                       (A)

                       15  *
                       16  *ROUTINES FOR FIRST
                       17  *
9000: A9 FF            18  INIT     LDA  #$FF        ;SET PORT A
                                                       FOR OUTPUT
9002: 8D 03 C4         19          STA  DDRA
9005: A9 07            20          LDA  #$07        ;SET PORT B
                                                       FOR OUTPUT
9007: 8D 02 C4         21          STA  DDRB
900A: 60               22          RTS              ;RETURN
                       23  *
```

```
900B: A9 07     24 LATCH  LDA  #$07   ;SEND "LATCH
                                        COMMAND"
900D: 8D 00 C4  25        STA  ORB    ;TO SOUND

9010: A9 04     26        LDA  #$04   ;THROUGH
                                        PORT B
9012: 8D 00 C4  27        STA  ORB
9015: 60        28        RTS         ;RETURN
                29 *
9016: A9 06     30 WRITE  LDA  #$06   ;SEND "WRITE
                                        COMMAND"
9018: 8D 00 C4  31        STA  ORB    ;TO SOUND

901B: A9 04     32        LDA  #$04   ;THROUGH
                                        PORT B
901D: 8D 00 C4  33        STA  ORB
9020: 60        34        RTS         ;RETURN
                35 *
9021: A9 00     36 RESET  LDA  #$00   ;SEND "RESET
                                        COMMAND"
9023: 8D 00 C4  37        STA  ORB    ;TO SOUND

9026: A9 04     38        LDA  #$04   ;THROUGH
                                        PORT B
9028: 8D 00 C4  39        STA  ORB
902B: 60        40        RTS         ;RETURN
                41 *
                42 *ROUTINES FOR SECOND
                43 *
902C: A9 FF     44 INIT2  LDA  #$FF   ;SET PORT A
                                        FOR OUTPUT
902E: 8D 83 C4  45        STA  DDRA2
9031: A9 07     46        LDA  #$07   ;SET PORT B
                                        FOR OUTPUT
9033: 8D 82 C4  47        STA  DDRB2
9036: 60        48        RTS         ;RETURN
                49 *
```



```
9037: A9 07     50 LATCH2 LDA  #$07   ;SEND "LATCH
                                        COMMAND"
9039: 8D 80 C4  51        STA  ORB2   ;TO SOUND

903C: A9 04     52        LDA  #$04   ;THROUGH
                                        PORT B
903E: 8D 80 C4  53        STA  ORB2
9041: 60        54        RTS         ;RETURN
                55 *
9042: A9 06     56 WRITE2 LDA  #$06   ;SEND "WRITE
                                        COMMAND"
9044: 8D 80 C4  57        STA  ORB2   ;TO SOUND

9047: A9 04     58        LDA  #$04   ;THROUGH
                                        PORT B
9049: 8D 80 C4  59        STA  ORB2
904C: 60        60        RTS         ;RETURN
                61 *
904D: A9 00     62 RESET2 LDA  #$00   ;SEND "RESET
                                        COMMAND"
904F: 8D 80 C4  63        STA  ORB2   ;TO SOUND

9052: A9 04     64        LDA  #$04   ;THROUGH
                                        PORT B
9054: 8D 80 C4  65        STA  ORB2
9057: 60        66        RTS         ;RETURN

                1 *TABLE ACCESS ROUTINE
                2 *FOR SLOT 4
                3 *
                4         ORG  $8000
                5 *                   ;ADDRESSES
                                        FOR FIRST

                6 PTR     EQU  $08    ;DATA
                                        POINTER
                7 ORA     EQU  $C401  ;PORT A
                8 LATCH   EQU  $900B  ;LATCH SUB-
                                        ROUTINE
```

```
                        9  WRITE    EQU  $9016    ;WRITE SUB-
                                                    ROUTINE
                       10  RESET    EQU  $9021    ;RESET SUB-
                                                    ROUTINE
                       11  *                      ;ADDRESSES
                                                    FOR SECOND
                       12  PTR2     EQU  $0A      ;DATA
                                                    POINTER
                       13  ORA2     EQU  $C481    ;PORT A
                       14  LATCH2   EQU  $9037    ;LATCH SUB-
                                                    ROUTINE
                       15  WRITE2   EQU  $9042    ;WRITE SUB-
                                                    ROUTINE
                       16  RESET2   EQU  $904D    ;RESET SUB-
                                                    ROUTINE
                       17  *
                       18  *ROUTINES FOR FIRST
                       19  *
8000: 20 21 90         20  START    JSR  RESET     ;RESET SOUND

8003: A0 00            21           LDY  #$00      ;USED TO IDEN-
                                                    TIFY REGIS-
                                                    TER
8005: 8C 01 C4         22  LOOP     STY  ORA       ;# OF SOUND

8008: 20 0B 90         23           JSR  LATCH
800B: B1 08            24           LDA  (PTR),Y   ;GET DATA
                                                    FROM TABLE
800D: 8D 01 C4         25           STA  ORA
8010: 20 16 90         26           JSR  WRITE     ;STORE IN REG-
                                                    ISTER
8013: C0 0F            27           CPY  #$0F      ;END OF DATA?
8015: F0 04            28           BEQ  DONE      ;YES, EXIT
8017: C8               29           INY
8018: 4C 05 80         30           JMP  LOOP      ;NO, GET NEXT
                                                    SET
```



```
801B: 60               31  DONE     RTS            ;RETURN
                       32  *
                       33  *ROUTINES FOR SECOND
                       34  *
801C: 20 4D 90         35  START2   JSR  RESET2    ;SAME
                                                    INSTRUC-
                                                    TIONS AS
801F: A0 00            36           LDY  #$00      ;ABOVE
8021: 8C B1 C4         37  LOOP2    STY  ORA2
8024: 20 37 90         38           JSR  LATCH2
8027: B1 0A            39           LDA  (PTR2),Y
8029: 8D B1 C4         40           STA  ORA2
802C: 20 42 90         41           JSR  WRITE2
802F: C0 0F            42           CPY  #$0F
8031: F0 04            43           BEQ  DONE2
8033: C8               44           INY
8034: 4C 22 80         45           JMP  LOOP2
8037: 60               46  DONE2    RTS

                        1  *PROCESSOR LOOP
                        2  *FOR LASER AND BOMB
                        3  *SOUND EFFECT
                        4  *
                        5           ORG  $8F00
                        6  *
                        7  *                      ;FOR SECOND

                        8  PTR      EQU  $08      ;DATA POINTE
                        9  TONE     EQU  $0A      ;TONAL VALUE
                       10  TIME     EQU  $0B      ;TIME VALUE
                                                    FOR DELAY
                       11  BASE     EQU  $C400    ;CARD
                                                    ADDRESS
                       12  ORA      EQU  BASE + 1 ;PORT A
                       13  TAR      EQU  $8000    ;TABLE ACCESS
                                                    ROUTINE
                       14  LATCH    EQU  $900B    ;LATCH SUB-
                                                    ROUTINE
```

```
                        15 WRITE    EQU  $9016      :WRITE SUB-
                                                      ROUTINE
                        16 RESET    EQU  $9021      :RESET SUB-
                                                      ROUTINE
                        17 WAIT     EQU  $FCA8      :WAIT SUBROU-
                                                      TINE
                        18 *
                        19 *
8F00: A9 00             20 LASER    LDA  #$00       :LOAD HIGHEST
8F02: 85 0A             21          STA  TONE       :FREQUENCY
                                                      VALUE
8F04: A9 0F             22          LDA  #$0F       :LOAD SHORT
8F06: 85 0B             23          STA  TIME       :TIME DELAY
8F08: 4C 13 8F          24          JMP  START      :AND START
8F0B: A9 30             25 BOMB     LDA  #$30       :LOAD MIDDLE
8F0D: 85 0A             26          STA  TONE       :FREQUENCY
                                                      VALUE
8F0F: A9 40             27          LDA  #$40       :LOAD LONGER
8F11: 85 0B             28          STA  TIME       :TIME DELAY
8F13: A9 90             29 START    LDA  #$90       :SET TABLE
                                                      ADDRESS
8F15: 85 08             30          STA  PTR
8F17: A9 81             31          LDA  #$81
8F19: 85 09             32          STA  PTR+1
8F1B: 20 00 80          33          JSR  TAR        :TRANSFER
                                                      DATA
8F1E: A9 00             34          LDA  #$00       :LATCH FIRST
                                                      REGISTER
8F20: 8D 01 C4          35          STA  ORA        :ADDRESS
8F23: 20 0B 90          36          JSR  LATCH
8F26: A5 0A             37 LOOP     LDA  TONE       :GET TONE
                                                      VALUE
8F28: 8D 01 C4          38          STA  ORA        :STORE IN REG-
                                                      ISTER
8F2B: 20 16 90          39          JSR  WRITE
8F2E: A5 0B             40          LDA  TIME       :GET TIME
                                                      VALUE
```



```
8F30: 20 A8 FC          41          JSR  WAIT       :AND DELAY
8F33: E6 0A             42          INC  TONE       :INCREMENT
                                                      TONE VALUE
8F35: A9 FF             43          LDA  #$FF       :END OF
                                                      INCREASE?
8F37: C5 0A             44          CMP  TONE
8F39: F0 03             45          BEQ  DONE       :YES, EXIT
8F3B: 4C 26 8F          46          JMP  LOOP       :NO, START
                                                      AGAIN
8F3E: A5 0B             47 DONE     LDA  TIME       :GET TIME
                                                      VALUE
8F40: 20 A8 FC          48          JSR  WAIT       :DELAY
8F43: A9 00             49          LDA  #$00       :RESTORE
                                                      ORIGINAL
8F45: 85 0A             50          STA  TONE       :TONE VALUE
8F47: 20 21 90          51          JSR  RESET      :CLEAR SOUND
                                                      CHIP
8F4A: 60                52          RTS             :REGISTERS
                                                      AND
                                                      RETURN
```

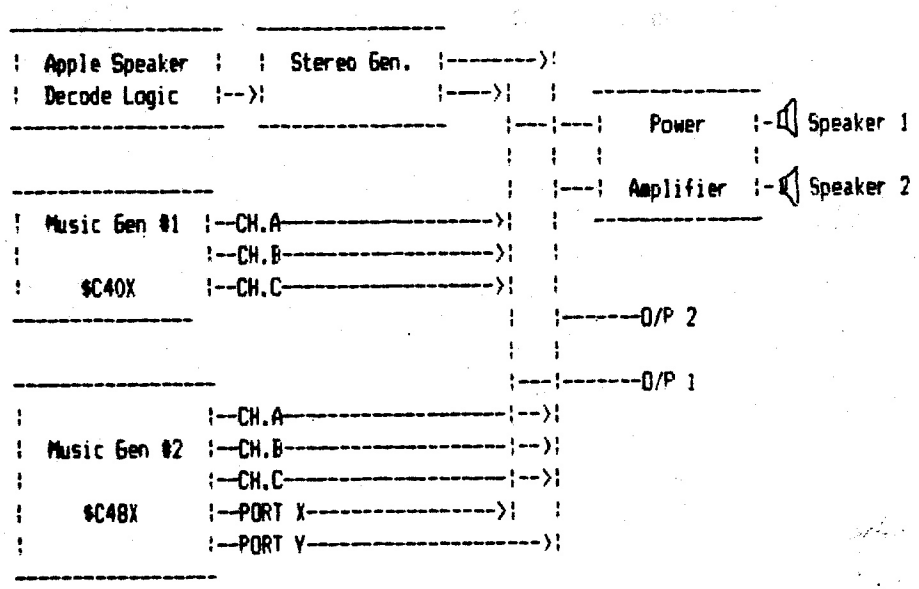
THE MUSTALGAME CARD

The name stands for MUSIC, TALK and GAME SOUND EFFECTS. It generates a remarkable array of sound effects and music. It is a programmable sound generations system that enhances your APPLE II computer's sound capability. Moreover it can also be used as a dual channel talk card to produce human voice.

Hundreds of software were written especially for this MUSTALGAME card. It includes:-

- MUSIC CONSTRUCTION SET
- MUSIC SYNTHESIZER
- MOCKING BOARD DEMONSTRATION SOFTWARE
- LOTS OF GAMES LIKE POPPYE, LADY TUDE, SPYSTRIKES, TONY WAR.....ECT.
- R.A.M. Remote Automatic Mouth, Cantonese, Speak and Spell

What's more, it also amplifies the APPLE II's own speaker voice and change it into stereophonic sound . Therefore all the game that produce sound is suitable but there is no need for any interconnecting cable.



BLOCK DIAGRAM OF MUSTALGAME