

C/MS PROGRAMMING INFORMATION

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1. MEMORY MAP

I/O address can be installed by jumper selection at one of the following addresses:

210H
220H
230H
240H
250H
260H

The internal register locations are addressed using only four external I/O address:

For voice 1 to voice 6:

Write 2x1 with register address
Write 2x0 with data to register

For voice 7 to voice 12:

Write 2x3 with register address
Write 2x2 with data to register

There are 4 noise generators, each of which is dedicated to 3 voices as follows:

Noise generator 1: Voice 1 to voice 3
Noise generator 2: Voice 4 to voice 6
Noise generator 3: Voice 7 to voice 9
Noise generator 4: Voice 10 to voice 12

2. REGISTER DESCRIPTION

Reg Addr	Data Bus Inputs								Operations
	D7	D6	D5	D4	D3	D2	D1	D0	
00	AR 3	AR 2	AR 1	AR 0	AL 3	AL 2	AL 1	AL 0	ampl R 1/7; ampl L 1/7
01	AR 3	AR 2	AR 1	AR 0	AL 3	AL 2	AL 1	AL 0	ampl R 2/8; ampl L 2/8
02	AR 3	AR 2	AR 1	AR 0	AL 3	AL 2	AL 1	AL 0	ampl R 3/9; ampl L 3/9
03	AR 3	AR 2	AR 1	AR 0	AL 3	AL 2	AL 1	AL 0	ampl R 4/10; ampl L 4/10
04	AR 3	AR 2	AR 1	AR 0	AL 3	AL 2	AL 1	AL 0	ampl R 5/11; ampl L 5/11
05	AR 3	AR 2	AR 1	AR 0	AL 3	AL 2	AL 1	AL 0	ampl R 6/12; ampl L 6/12
06	x	x	x	x	x	x	x	x	
07	x	x	x	x	x	x	x	x	
08	F7	F6	F5	F4	F3	F2	F1	F0	frequency of tone 1/7
09	F7	F6	F5	F4	F3	F2	F1	F0	frequency of tone 2/8
0A	F7	F6	F5	F4	F3	F2	F1	F0	frequency of tone 3/9
0B	F7	F6	F5	F4	F3	F2	F1	F0	frequency of tone 4/10
0C	F7	F6	F5	F4	F3	F2	F1	F0	frequency of tone 5/11
0D	F7	F6	F5	F4	F3	F2	F1	F0	frequency of tone 6/12
0E	x	x	x	x	x	x	x	x	
0F	x	x	x	x	x	x	x	x	
10	x	OC2	OC1	OC0	x	OC2	OC1	OC0	octave 2/8; octave 1/7
11	x	OC2	OC1	OC0	x	OC2	OC1	OC0	octave 4/10; octave 3/9
12	x	OC2	OC1	OC0	x	OC2	OC1	OC0	octave 6/12; octave 5/11
13	x	x	x	x	x	x	x	x	
14	x	x	E6/12	E5/11	E4/10	E3/9	E2/8	E1/7	frequency enable
15	x	x	N6/12	N5/11	N4/10	N3/9	N2/8	N1/7	noise enable
16	x	x	NG1	NG1	x	x	NG1	NG0	noise gen2/4; noise gen1/3
17	x	x	x	x	x	x	x	x	
18	x	x	x	x	x	x	x	x	
19	x	x	x	x	x	x	x	x	
1A	x	x	x	x	x	x	x	x	
1B	x	x	x	x	x	x	x	x	
1C	x	x	x	x	x	x	RST	SE	frequency reset(all channels) sound enable (all channels)
1D	x	1D	x	x	x	x	x	x	
1E	x	1E	x	x	x	x	x	x	
1F	x	1F	x	x	x	x	x	x	

NOTE:

- A. ampl R 1/7 denotes register for amplitude control of right channel of
 - a. voice 1 when accessed using port 2x1H and 2x0H
 - b. voice 7 when accessed using port 2x3H and 2x2H

- B. E1/7 denotes frequency enable bit of
 - a. voice 1 when accesses using port 2x1H and 2x0H
 - b. voice 7 when accessed using port 2x3H and 2x2H

Bit	Description
AR 3;AR 2; AR 1;AR 0;	4 bits amplitude control of right channel 0000 minimum amplitude (off) 1111 maximum amplitude
AL 3;AL 2;	4 bits for amplitude control of left channel 0000 minmum amplitude (off) 1111 maximim amplitude
F7 to F0	8 bits for frequency control of the 12 frequency generators 0000 0000 lowest frequency 1111 1111 highest frequency
OC2;OC1;OC0	3 bits for octave control 000 lowest octave (28 Hz to 55 Hz) 001 (55Hz to 109 Hz) 010 (109 Hz to 218 Hz) 011 (218 Hz to 437 Hz) 100 (437 Hz to 874 Hz) 101 (875 Hz to 1.75 kHz) 110 (1.75 kHz 3.50 kHz) 111 highest octave (3.50 kHz 6.99 kHz)
En (n=1 to 12)	frequency enable bit (one tone per generator) En=0 indicates that frequency 'n' is off
Nn (n=1 to 12)	noise enable bit (one tone per generator) Nn=0 indicates that noise 'n' is off
NG1;NG0	2 bits for noise generator control These bits select the noise generator rate (noise 'color') Nn1 Nn0 clock frequency 0 0 28.0 kHz 0 1 14.0 kHz 1 0 6.8 kHz
SE	SE sound enable for all channels (reset on power-up to 0) 0 all channels disabled 1 all channels enabled
RST	Reset signal to all frequency generators 0 all generators enabled 1 all generators reset and synchronized

3. FREQUENCY TABLE FOR MUSIC NOTE

Note	Octave Value	Freq. Value	Note	Octave Value	Freq. Value	Note	Octave Value	Freq. Value
A	0	3	A	3	3	A	6	3
A#	0	31	A#	3	31	A#	6	31
B	0	58	B	3	58	B	6	58
C	0	83	[C]	3	83	C	6	83
C#	0	107	C#	3	107	C#	6	107
D	0	130	D	3	130	D	6	130
D#	0	151	D#	3	151	D#	6	151
E	0	172	E	3	172	E	6	172
F	0	191	F	3	191	F	6	191
F#	0	209	F#	3	209	F#	6	209
G	0	226	G	3	226	G	6	226
G#	0	242	G#	3	242	G#	6	242
A	1	3	A	4	3	A	7	3
A#	1	31	A#	4	31	A#	7	31
B	1	58	B	4	58	B	7	58
C	1	83	C	4	84	C	7	83
C#	1	107	C#	4	107	C#	7	107
D	1	130	D	4	130	D	7	130
D#	1	151	D#	4	151	D#	7	151
E	1	172	E	4	172	E	7	172
F	1	191	F	4	191	F	7	191
F#	1	209	F#	4	209	F#	7	209
G	1	226	G	4	226	G	7	226
G#	1	242	G#	4	242	G#	7	242
A	2	3	A	5	3			
A#	2	31	A#	5	31			
B	2	58	B	5	58			
C	2	83	C	5	83			
C#	2	107	C#	5	107			
D	2	130	D	5	130			
D#	2	151	D#	5	151			
E	2	172	E	5	172			
F	2	191	F	5	191			
F#	2	209	F#	5	209			
G	2	226	G	5	226			
G#	2	242	G#	5	242			

Note:

- A. [C] is the middle C.
- B. Octave value is the value output to the 6 octave registers (2 voices each) at register address 10H to 12H.
- C. Frequency value is the value output to the 12 frequency registers at address 08H to 0DH.

4. PROGRAMMING EXAMPLE:

To program middle C for voice# 1, assume that the I/O address is set at 220H

;Following codes initialize the music chip by setting all in internal :
;register to 0, including those spare registers. :

;—initial voice# 1-6

MOV DX,221H ;Address Register for voice# 1-6
MOV AL,0 ;start with regs. address 0

LABEL1:

OUT DX,AL ;select internal register
MOV AH,AL ;preserve regs. address
DEC DX ;point to Data Register
SUB AL,AL
OUT DX,AL ;init. to 0
INC DX ;point to Address Register again
MOV AL,AH ;recover regs. address
INC AL ;move to next address
CMP AL,20H
JB Label1

MOV AL,1CH ;select frequency reset register
OUT DX,AL
DEC DX
MOV AL,2
OUT DX,AL ;reset frequency for voice# 1-6

;—initial voice# 7-12

MOV DX,223H ;Address register for voice# 7-12
MOV AL,0

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LABEL2:    OUT    DX,AL    ;select internal register
           MOV    AH,AL    ;preserve regs. address
           DEC    DX      ;point to Data Register
           SUB    AL,AL
           OUT    DX,AL    ;init. to 0
           INC    DX      ;point to Address Register again

           MOV    AL,AH    ;recover regs. address
           INC    AL      ;move to next address
           CMP    AL,20H
           JB     LABEL2

           MOV    AL,1CH    ;select frequency reset register
           OUT    DX,<AL
           DEC    DX
           MOV    AL,2
           OUT    DX,AL    ;reset frequency for voice# 7-12
```

```
;-----
;Following codes enable sound for all voices  :
;-----
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```
MOV    DX,221H
MOV    AL,1CH
OUT    DX,AL    ;select sound enable register
DEC    DX
MOV    AL,1
OUT    DX,AL    ;select all sound for voice# 1-6

MOV    DX,223H
MOV    AL,1CH
OUT    DX,AL    ;select sound enable register
DEC    DX
MOV    AL,1
OUT    DX,AL    ;enable all sound for voice# 7-12
```

;Following codes output music note middle C to voice# 1 :

```
MOV    DX,221H        ;address register for voice# 1
                        ;-program the amplitude

MOV    AL,0
OUT    DX,AL          ;select internal amplitude regs
DEC    DX              ;point to Data Regs
MOV    AL,3AH         ;left amplitude 10, right amplitude 3

                        ;program the frequency

INC    DX              ;point to Address Regs. again
MOV    AL,8
OUT    DX,AL          ;select internal frequency regs
DEC    DX              ;point to Data Regs
MOV    AL,83          ;frequency value for middle C
OUT    DX,AL

                        ;program the octave

INC    DX              ;point to Address Regs. again
MOV    AL,10H
OUT    DX,AL          ;select internal octave regs
DEC    DX              ;point to Data Regs
MOV    AL,03H         ;octave value 3 (middle C) for voice# 1
OUT    DX,AL          ;octave value 0 for voice# 2

                        ;frequency enable

INC    DX              ;point to Address Regs. again
MOV    AL,14H
OUT    DX,AL          ;select internal octave regs
DEC    DX              ;point to Data Regs
MOV    AL,01H         ;enable voice# 1 frequency
OUT    DX,AL
```