MOS INTEGRATED CIRCUIT

M 252

RHYTHM GENERATOR

- LOW POWER DISSIPATION: < 120 mW
- DRIVES 8 COUND GENERATORS (INSTRUMENTS)
- 15 PROGRAMMABLE RHYTHMS (NOT AVAILABLE IN COMBINATION)
- MASK PROGRAMMABLE RESET COUNTS: 24 or 32
- DOWN BEAT OUTPUT
- EXTERNAL RESET
- OPEN DRAIN OUTPUTS
- STANDARD MUSIC CONTENT AVAILABLE
- TECHNICAL NOTE NO 131 AVAILABLE FOR FULL INFORMATION

The M252 is a monolithic rhythm generator specifically designed for electronic organs and other musical instruments.
Constructed on a single chip using low threshold P-channel silicon gate technology it is supplied in a 16-lead dual in-line plastic package.

ABSOLUTE MAXIMUM RATINGS*

V_{GG}**	Source supply voltage	-20 to 0.3	V
V_i**	Input voltage	-20 to 0.3	V
I_o	Output current (at any pin)	3	mA
T_{stg}	Storage temperature	-65 to 150	°C
T_{op}	Operating temperature	0 to 70	°C

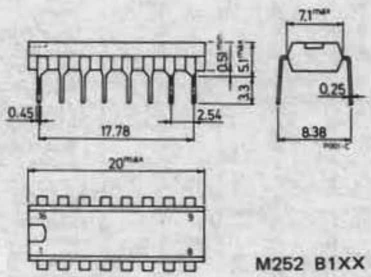
* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other condition above those indicate in the "Recommended operating conditions" section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

** This voltage is with respect to V_{SS} pin voltage.

ORDERING NUMBERS: M252 B1 XX for dual in-line plastic package
M252 B1 AA and AD for standard music content

MECHANICAL DATA

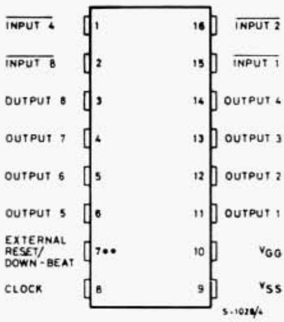
Dimensions in mm



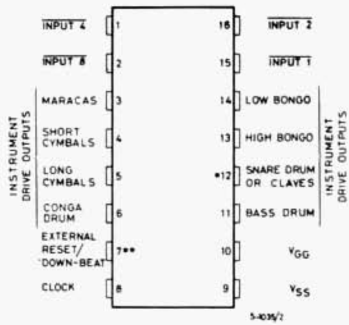
M252 B1XX

M 252

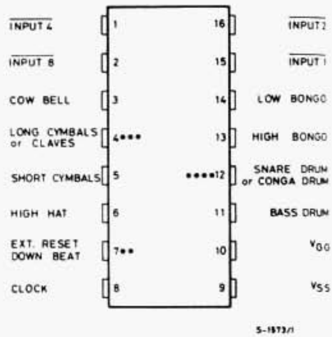
CONNECTION DIAGRAMS



Standard content configuration
M252 B1 AA



Standard content configuration
M252 B1 AD



* This output must be connected so as to drive the "snare drum" when the rhythms from 1 to 9 (see rhythm selection) are selected, and the "claves" when the rhythms from 10 to 15 (see rhythm selection) are selected.

** This pin generates a down-beat trigger which can be used to drive an external lamp to indicate the first beat of the first bar of each rhythm.

*** This output must be connected so as to drive the "long cymbals" when the rhythms number 1, 3, 4, 12 and 14 are generated, and the "claves" when the rhythms number 5, 8, 9, 10, 11 and 13 are generated.

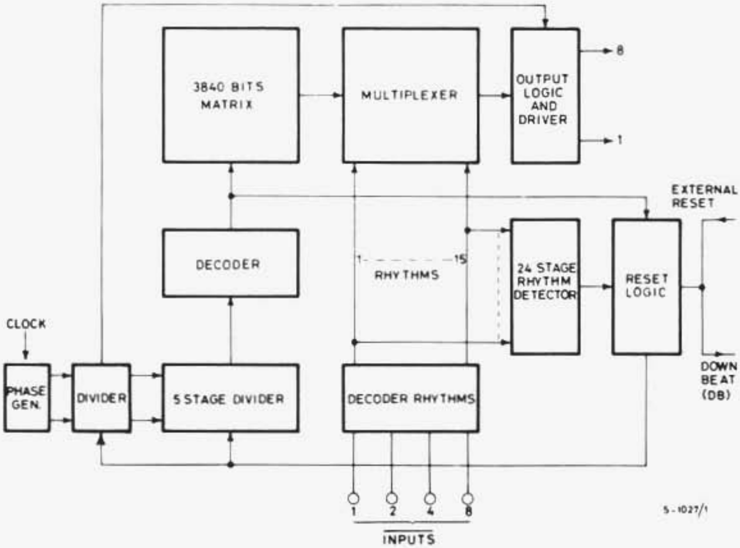
**** This output must be connected so as to drive the "snare drum" when the rhythms number 1, 3, 4, 6, 7, 9, 12, 14 and 15 are generated, and the "conga drum" when the rhythms number 5, 8, 10, 11 and 13 are generated.

RHYTHM SELECTION

The following binary code must be generated to select each rhythm (positive logic)

RHYTHM	CODE				STANDARD CONTENT-AA	STANDARD CONTENT-AD
	INPUT 8	INPUT 4	INPUT 2	INPUT 1		
1	1	1	1	0	Waltz 3/4	Waltz 3/4
2	1	1	0	1	Jazz Waltz 3/4	Tango 2/4
3	1	1	0	0	Tango 2/4	March 2/4
4	1	0	1	1	March 2/4	Swing 4/4
5	1	0	1	0	Swing 4/4	Mambo 4/4
6	1	0	0	1	Foxtrot 4/4	Slow Rock 6/8
7	1	0	0	0	Slow Rock 6/8	Beat 4/4
8	0	1	1	1	Pop Rock 4/4	Samba 4/4
9	0	1	1	0	Shuffle 2/4	Bossa Nova 4/4
10	0	1	0	1	Mambo 4/4	Cha Cha 4/4
11	0	1	0	0	Beguine 4/4	Rhumba 4/4
12	0	0	1	1	Cha Cha 4/4	Beguine 4/4
13	0	0	1	0	Bajon 4/4	Bajon 4/4
14	0	0	0	1	Samba 4/4	Foxtrot 4/4
15	0	0	0	0	Bossa Nova 4/4	Shuffle 2/4
No selected rhythm	1	1	1	1		

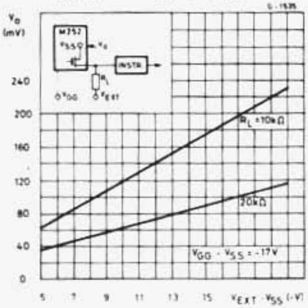
BLOCK DIAGRAM



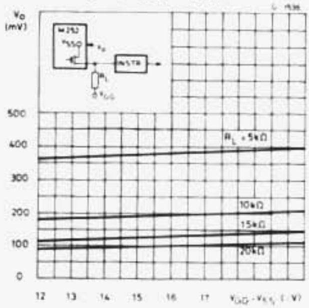
STATIC ELECTRICAL CHARACTERISTICS (positive logic, V_{GG} = -11.4 to -12.6V, V_{SS} = 4.75 to 5.25V, T_{amb} = 0 to 70°C unless otherwise specified)

Parameter		Test conditions	Values Min.	Values Typ.	Values Max.	Unit
CLOCK INPUT						
V_{IH}	Clock high voltage		V_{SS}-1.5		V_{SS}	V
V_{IL}	Clock low voltage		V_{GG}		V_{SS}-4.1	V
DATA INPUTS ($\overline{IN1}$ ..... $\overline{IN8}$)						
V_{IH}	Input high voltage		V_{SS}-1.5		V_{SS}	V
V_{IL}	Input low voltage		V_{GG}		V_{SS}-4.1	V
I_{LI}	Input leakage current	$V_i = V_{SS}$-10V T_{amb} = 25°C			10	μA
EXTERNAL RESET						
V_{IH}	Input high voltage		V_{SS}-1.5		V_{SS}	V
V_{IL}	Input low voltage		V_{GG}		V_{SS}-4.1	V
R_{IN}	Internal resistance to V_{GG}	$V_o = V_{SS}$-5V	400	600		KΩ
DATA OUTPUTS						
R_{ON}	Output resistance (ON state)	$V_o = V_{SS}$-1 to V_{SS}		250	500	Ω
V_{OH}	Output high voltage	I_L = 1 mA	V_{SS}-0.5		V_{SS}	V
I_{LO}	Output leakage current	$V_i = V_{IH}$ $V_o = V_{SS}$-10V T_{amb} = 25°C			10	μA
POWER DISSIPATION						
I_{GG}	Supply current	T_{amb} = 25°C		7	15	mA

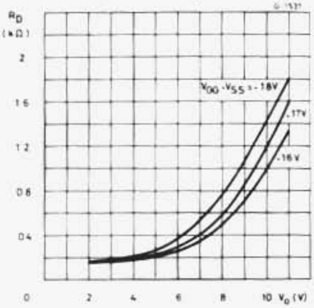
Output voltage vs. external supply voltage ($V_{EXT}-V_{SS}$)



Output voltage vs. supply voltage ($V_{GG}-V_{SS}$)



Output dynamic resistance vs. output voltage



DYNAMIC ELECTRICAL CHARACTERISTICS

(positive logic V_{GG} = -11.4 to -12.6V, V_{SS} = 4.75 to 5.25V, T_{amb} = 0 to 70°C unless otherwise specified)

Parameter		Test conditions	Values			Unit
			Min.	Typ.	Max.	

CLOCK INPUT

f	Clock repetition rate		DC		100	kHz
t_{pw}*	Pulse width		5			µs
t_r**	Rise time				100	µs
t_f**	Fall time				100	µs

EXTERNAL RESET

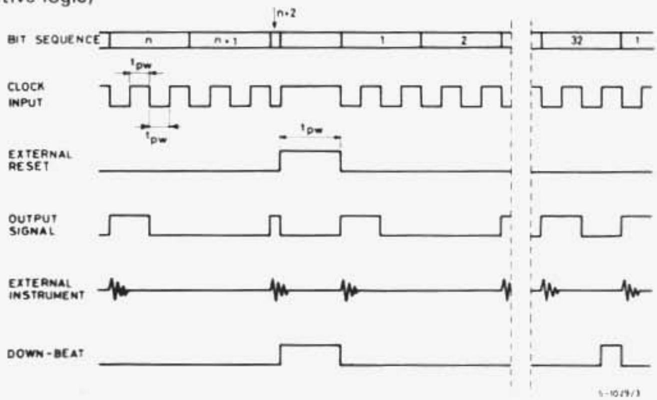
t_{pw}	Pulse width		5			µs

* Measured at 50% of the swing.

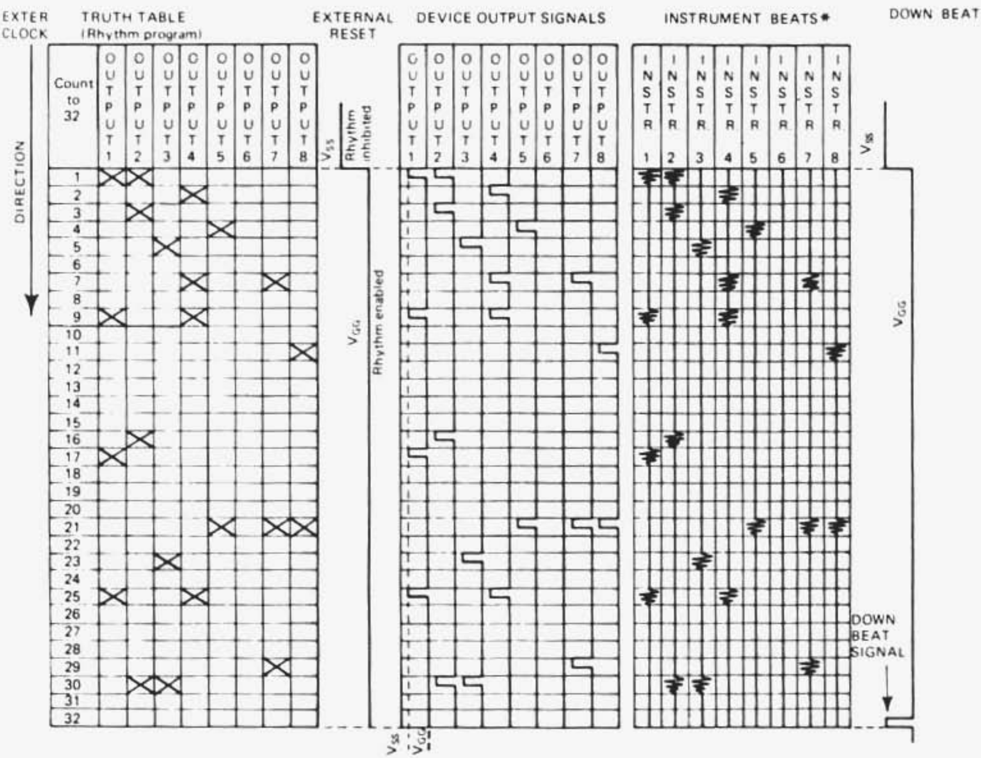
** Measured between 10% and 90% of the swing.

TIMING WAVEFORMS (positive logic)

Note: In these timing waveforms it has been assumed, for example, that in the truth table bits n + 1 and 2 have not been programmed i.e. the musical instrument has not been introduced. All the other bits have been programmed for the introduction of the instruments.



INSTRUMENT BEATS VERSUS RHYTHM PROGRAM



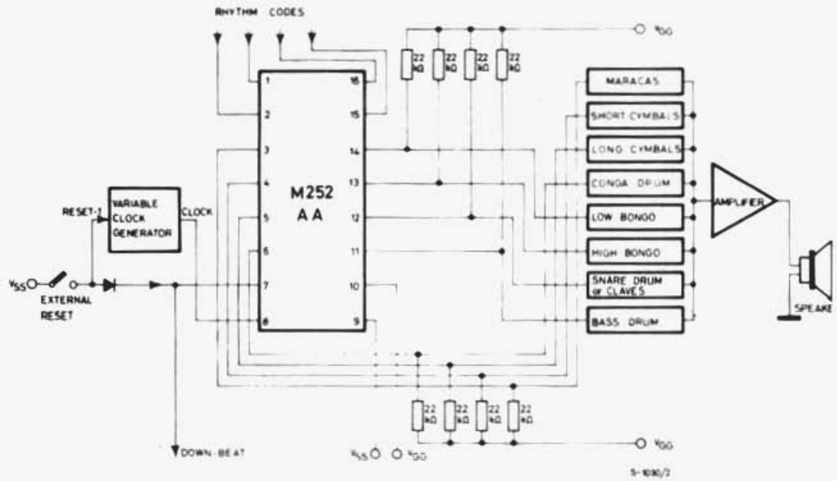
The lowering of the music signals depends on the intrinsic decay time of the sound generator and not on the length of the enable pulses. Each beat can therefore last for more than one elementary time.

TYPICAL APPLICATIONS

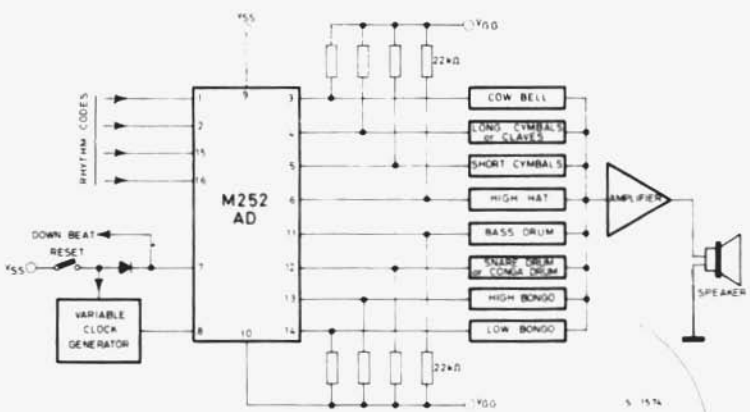
Figure 1 shows the typical application of the M252 (AA) and M252 (AD).
With two M252 devices it is possible to increase the number of rhythms or the number of instruments available, or the number of elementary times, as shown in figures 2, 3 and 4 respectively.
The use of a memory matrix allows the customer complete flexibility, since modification of the memory is quick and relatively cheap.

Fig. 1 - Rhythm system (standard contents)

a) M252 AA



b) M252 AD



TYPICAL APPLICATIONS (continued)

Fig. 2 - Increase in number of rhythms (positive logic)

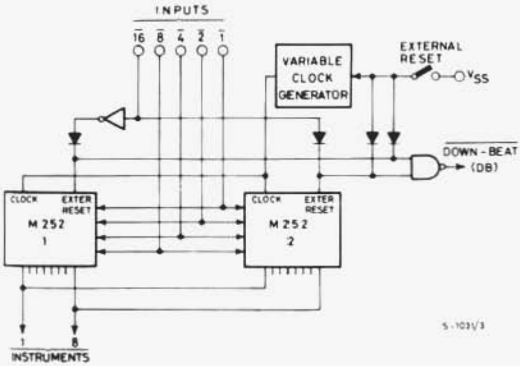


Fig. 3 - Increase in number of instruments

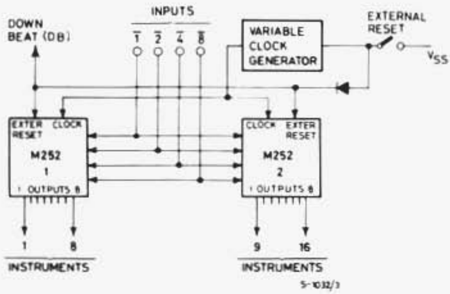
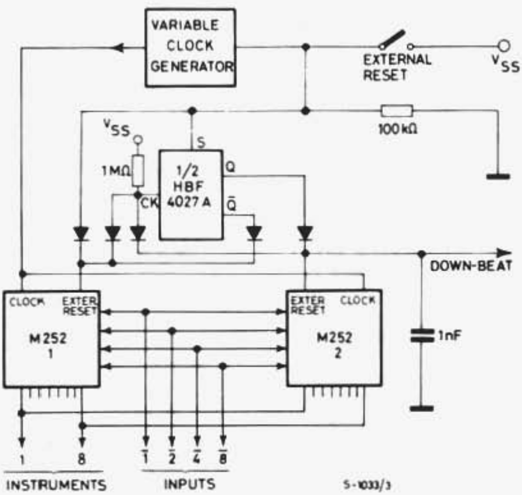
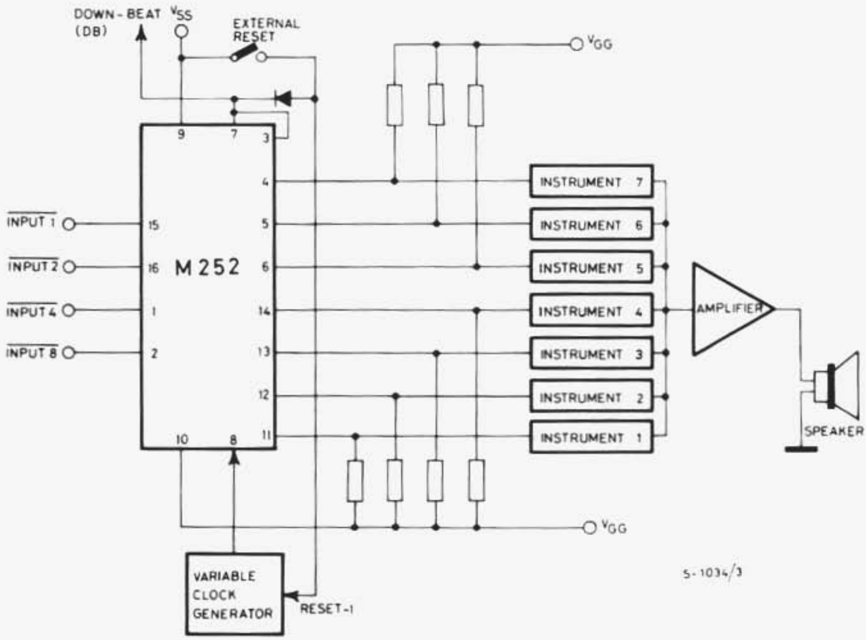


Fig. 4 - Increasing the number of elementary times



Note: The total number of elementary times is given by the sum of the elementary times of the individual devices.

CIRCUIT FOR CHANGING THE NUMBER OF ELEMENTARY TIMES



To obtain a required number of elementary times "N" simply put a cross in the "N + 1" position of the column which now represents the reset output, rather than the 8th instrument.
The DB output can be used as down-beat because it apperas at the beginning of each measure. Since the pulse is only 2 - 3 μs long it must, however, be stretched and buffered to enable it to drive a lamp.
Full information on the use of the M252 in electronic organs and other applications will be found in Technical Note no. 131 available on request.

COMPLETING THE TRUTH TABLE

The ROM truth table has been organized in 32 rows which represent elementary times and 120 columns (15 groups of 8) where each group represents a rhythm which has as its disposition 8 programmable instruments. To programme each rhythm one indicates (with a cross) in the appropriate boxes the timing for each beat required for each instrument.
Each cross corresponds to a beat of the indicated instrument or, in logic terms, to the presence of a "1" level (positive logic) at the output.
The absence of a cross indicates that the corresponding instrument is not used in that part of the rhythm. Table 1 and 2 show the standard music content programmed into M252 AA and M252 AD respectively.

TABLE 1(M252 AA)

COUNT FOR 32	RHYTHM 1								RHYTHM 2								RHYTHM 3								RHYTHM 4								RHYTHM 5							
	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X					X			X								X	X							X					X			X					X		
2																																								
3																																								
4										X																														
5		X								X							X	X								X								X					X	
6																																								
7																																								
8																																							X	
9		X								X				X			X	X							X					X			X					X		
10																																								
11																																								
12																																								
13	X					X			X								X	X								X								X					X	
14																																								
15		X															X	X				X																		
16										X																													X	
17		X								X							X	X							X					X			X					X		
18																																								
19																																								
20										X																														
21		X								X				X			X	X								X								X						
22																																								
23																																								
24										X					X																								X	
25																	X	X							X					X			X						X	
26																																								
27																																								
28																																							X	
29																	X	X								X								X					X	
30																		X								X														
31																	X	X				X				X														
32																		X								X													X	

COUNT FOR 32	RHYTHM 6								RHYTHM 7								RHYTHM 8								RHYTHM 9								RHYTHM 10							
	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X							X	X						X		X							X	X	X					X		X	X		X				X
2																																								
3															X		X							X		X									X					X
4																									X	X					X									
5		X				X									X			X					X	X										X		X				X
6																										X														
7										X					X									X	X	X					X		X		X					X
8																		X																						
9	X							X							X		X							X		X								X		X				X
10																		X							X	X					X									
11									X						X		X							X										X	X					X
12																										X														
13		X					X		X						X			X					X	X	X	X					X		X			X	X			X
14																																								
15		X					X								X		X							X		X								X	X		X			X
16															X										X	X					X									
17	X							X							X		X							X									X			X				X
18																										X														
19										X					X		X							X	X	X					X			X	X					X
20																																								
21		X				X									X			X					X	X		X										X				X
22																									X	X					X									
23									X						X									X									X	X	X					X
24																		X								X														
25	X							X									X							X										X		X				X
26																		X																						
27							X										X							X											X					X
28																																								
29		X																X					X	X									X	X		X	X			X
30																																								
31							X										X							X											X		X			X
32																		X																						

M 252

COUNT FOR 32	RHYTHM 11								RHYTHM 12								RHYTHM 13								RHYTHM 14								RHYTHM 15							
	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X							X	X	X	X					X	X	X		X				X	X	X		X				X	X	X						X
2																																								
3		X	X	X			X	X								X								X								X								X
4							X																																	
5							X	X		X	X					X								X		X		X			X	X							X	X
6																																								
7		X	X			X		X	X							X		X		X				X								X	X	X					X	X
8																																								
9	X							X	X	X	X					X		X		X				X	X	X		X				X	X							X
10																																								
11		X	X					X								X								X								X								X
12																																								
13	X							X	X	X	X	X				X	X		X					X			X				X	X		X					X	X
14																																								
15		X	X					X		X	X	X				X			X					X		X	X					X	X						X	X
16																																								
17	X							X	X	X	X					X	X	X		X				X	X			X				X	X							X
18																																								
19		X	X	X			X	X								X								X		X		X				X								X
20							X																																	
21							X	X		X	X					X								X							X	X		X					X	X
22																																								
23		X	X			X		X	X							X		X		X	X			X		X		X				X	X						X	X
24																																								
25	X							X	X	X	X					X		X		X	X			X	X	X		X				X	X							X
26																																								
27		X	X					X								X								X								X		X						X
28																																								
29	X							X	X	X	X	X				X	X		X					X			X				X	X							X	X
30																																								
31		X	X					X		X	X	X				X			X					X								X	X						X	X
32																																								

TABLE 2 (M252 AD)

COUNT FOR 32	RHYTHM 1 (WALTZ)								RHYTHM 2 (TANGO)								RHYTHM 3 (MARCH)								RHYTHM 4 (SWING)								RHYTHM 5 (MAMBO)							
	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X						X		X					X			X						X		X	X	X		X				X				X		X	X
2																																								
3																																	X			X				
4																																				X				
5		X																X							X	X	X		X				X			X	X			
6																																				X				
7																																				X			X	
8																													X					X		X				
9		X							X					X			X	X					X		X				X					X			X			X
10																																								
11																																	X	X			X			
12																																								
13	X						X											X							X	X	X		X				X	X					X	
14																																								
15																																		X			X			
16		X																											X											
17		X							X					X			X						X		X				X				X							X
18																																								
19																																	X			X	X			
20																																								
21		X																X							X	X	X		X				X			X			X	
22																																								
23																																		X		X	X			
24																													X											
25									X					X			X						X		X				X								X		X	X
26																																								
27																																	X	X			X			
28																																		X						
29												X	X	X				X			X				X				X				X				X			
30												X	X																											
31												X	X					X			X										X			X						
32												X	X												X	X	X		X											

COUNT FOR 32	RHYTHM 6 (SLOW ROCK) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X				X	X		
2								
3					X			
4								
5					X			
6								
7		X			X	X		
8								
9					X			
10								
11	X				X			
12								
13	X				X	X		
14								
15					X			
16								
17					X			
18								
19		X			X	X		
20								
21					X			
22								
23		X			X			
24								
25								
26								
27								
28								
29								
30								
31								
32								

COUNT FOR 32	RHYTHM 7 (BEAT) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X				X			
2								
3					X	X		
4								
5		X			X			
6								
7	X				X			
8								
9	X				X			
10								
11					X	X		
12								
13		X			X			
14								
15					X			
16								
17	X				X			
18								
19					X	X		
20								
21		X			X			
22								
23	X				X			
24								
25	X				X			
26								
27					X	X		
28								
29		X			X			
30								
31		X			X			
32								

COUNT FOR 32	RHYTHM 8 (SAMBA) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X			X	X		X	
2								
3					X			X
4								
5		X			X			X
6								
7	X	X		X	X		X	
8								
9	X				X			
10								
11					X			X
12								
13		X		X	X		X	X
14								
15	X	X			X			
16								
17	X				X			
18								
19					X			
20								
21		X		X	X		X	X
22								
23	X				X			
24								
25	X	X			X			
26								
27		X		X	X		X	X
28								
29		X			X			
30								
31	X	X		X	X			
32								

COUNT FOR 32	RHYTHM 9 (BOSSA NOVA) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X	X	X	X	X		X	X
2								
3	X				X			
4								
5					X	X		
6								
7		X	X	X	X	X		X
8								
9	X			X	X	X		
10								
11	X				X		X	
12								
13		X	X	X	X			X
14								
15					X		X	
16								
17	X				X			
18								
19	X				X	X		
20								
21		X	X	X	X			X
22								
23					X	X		
24								
25	X				X			
26								
27	X	X	X	X	X		X	X
28								
29					X		X	
30								
31					X		X	
32								

COUNT FOR 32	RHYTHM 10 (CHA-CHA) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X	X		X	X		X	X
2								
3		X		X	X			
4								
5	X				X		X	X
6								
7					X			
8								
9	X			X	X		X	X
10								
11					X			
12								
13	X			X	X		X	X
14								
15				X	X			
16								
17	X	X		X	X		X	X
18								
19				X	X			
20								
21	X				X		X	X
22								
23					X			
24								
25	X			X	X		X	
26								
27	X			X	X		X	
28								
29	X			X	X		X	
30								
31				X	X			
32		X		X				

COUNT FOR 32	RHYTHM 11 (RUMBA) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X	X					X	X
2								
3					X			
4								
5					X			
6								
7	X				X		X	
8								
9					X			X
10								
11					X			
12								
13	X						X	
14								
15					X			
16								
17	X						X	X
18								
19					X			
20								
21		X			X			
22								
23	X							
24								
25		X			X		X	
26								
27					X			
28								
29	X			X				X
30								
31				X	X			
32								

COUNT FOR 32	RHYTHM 12 (BEGUINE) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X				X			X
2								
3		X	X	X	X		X	
4					X			
5					X			
6								
7				X	X			X
8								
9				X	X			
10				X				
11			X	X	X			
12				X				
13	X				X			X
14								
15			X		X			
16								
17	X				X			
18								
19		X	X	X	X		X	
20					X			
21					X			X
22								
23				X	X			
24								
25	X				X			X
26								
27			X		X			
28								
29	X				X			
30								
31			X		X			
32								

COUNT FOR 32	RHYTHM 13 (BAJON) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X			X	X		X	
2								
3					X			
4								
5					X			
6								
7				X	X		X	
8								
9				X	X		X	
10								
11					X			
12								
13	X		X		X			
14								
15			X		X			
16								
17	X			X	X		X	
18								
19					X			
20								
21					X			
22								
23		X		X	X		X	
24								
25		X		X	X		X	
26								
27					X			
28								
29	X		X		X			
30								
31			X		X			
32								

COUNT FOR 32	RHYTHM 14 (FOX TROT) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X				X			
2								
3								
4								
5		X					X	
6								
7								
8								
9	X				X			
10								
11								
12								
13		X				X		
14								
15		X				X		
16								
17	X				X			
18								
19								
20								
21		X					X	
22								
23								
24								
25	X				X			
26								
27						X		
28								
29		X						
30								
31						X		
32								

COUNT FOR 32	RHYTHM 15 (SHUFFLE) OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8
1	X	X				X		
2								
3		X						
4	X	X				X		
5								
6						X		
7	X	X				X		
8								
9		X						
10	X	X				X		
11								
12								
13	X	X				X		
14								
15		X						
16	X	X				X		
17								
18						X		
19	X	X				X		
20								
21	X	X						
22		X				X		
23		X						
24		X						
25								
26								
27								
28								
29								
30								
31								
32								