RHYTHM GENERATOR

LOW POWER DISSIPATION: < 120 mW
DRIVES 8 SOUND GENERATORS (INSTRUMENTS)
12 PROGRAMMABLE RHYTHMS (ALSO AVAILABLE IN COMBINATION)
MASK PROGRAMMABLE RESET COUNTS: 24 or 32
DOWN BEAT OUTPUT
EXTERNAL RESET
OPEN DRAIN OUTPUT
STANDARD MUSIC CONTENT AVAILABLE
TECHNICAL NOTE NO 131 AVAILABLE FOR FULL INFORMATION

The M253 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 24-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 range	-65 to 150	°C
T_{op}	Operating temperature range	0 to 70	°C

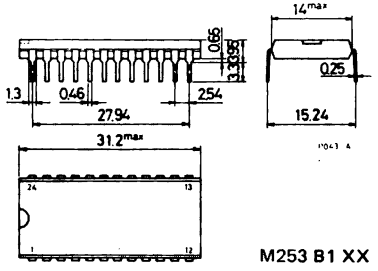
* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other condition above those indicate in the "Recommended operating conditions" section of this specification is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

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

ORDERING NUMBERS: M253 B1 XX for dual in-line plastic package
M253 B1 AA and AC for standard music content

MECHANICAL DATA

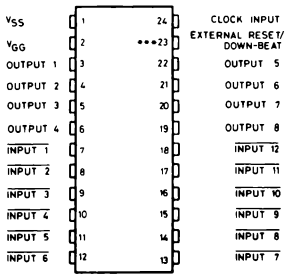
Dimensions in mm

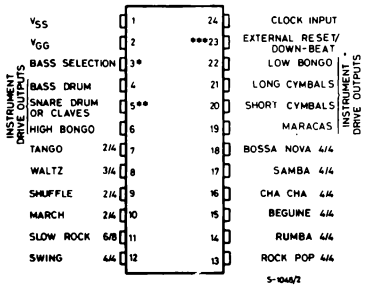


M253 B1 XX

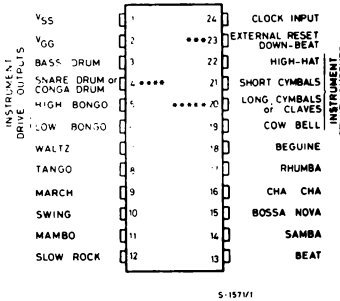
CONNECTOR DIAGRAMS

Standard content configuration
M253 B1 AA





Standard content configuration
M253 B1 AC



* This output allows the musician to obtain a "basso alternato" accompaniment using two notes of his choice.

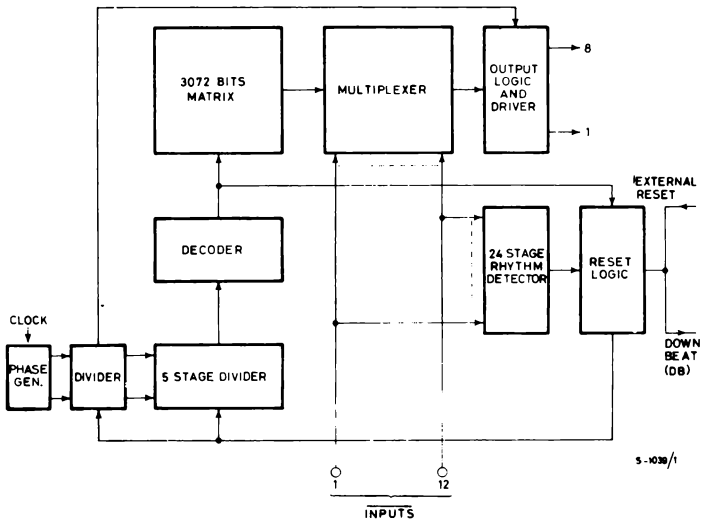
** This output must be connected so as to drive the "snare drum" when the rhythms corresponding to pins 7, 8, 9, 10, 11, 12 and 13 are generated, and the "claves" when the rhythms corresponding to pins 14, 15, 16, 17 and 18 are generated. It can also be used to modulate a chord played on the organ.

*** 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 "snare drum" when the rhythms corresponding to pins 7, 9, 10, 12, 13, 15 and 18 are generated, and the "conga drum" when the rhythms corresponding to pins 11, 14, 16 and 17 are generated.

***** This output must be connected so as to drive the "long cymbals" when the rhythms corresponding to pins 7, 9, 10 and 18 are generated, and the "claver" when the rhythms corresponding to pins 11, 14, 15, 16 and 17 are generated.

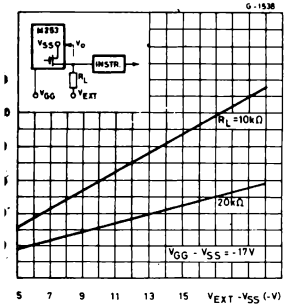
BLOCK DIAGRAM



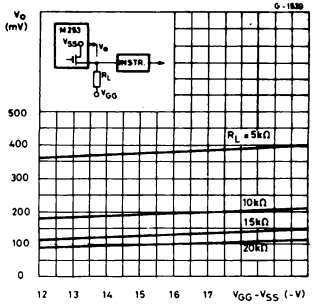
STATIC ELECTRICAL CHARACTERISTICS (positive logic, V_{GG} = -11.4 to -12.6V, V_{SS} = 4.75 to 5.25V, T_{amb} = 0 to 70°C unless otherwise specified)

Parameter		Test conditions	Values			Unit
			Min.	Typ.	Max.	
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 ($\overline{IN1}$ ..... $\overline{IN12}$)						
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

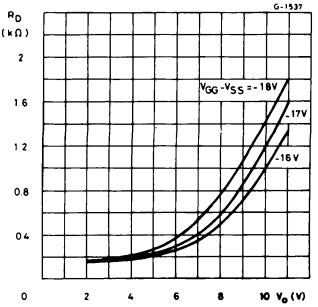
Output voltage vs. external supply voltage (V_{EXT}-V_{SS})



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



Output dynamic resistance vs. output voltage

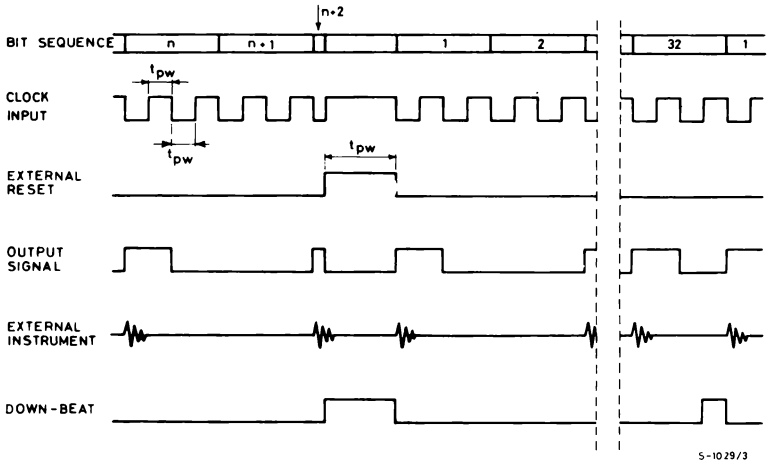


DYNAMIC ELECTRICAL CHARACTERISTICS (positive logic, V_{GG} = -11.4 to -12.6V, V_{SS} = 4.75 to 5.25V, T_{amb} = 0 to 70°C unless otherwise specified)

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

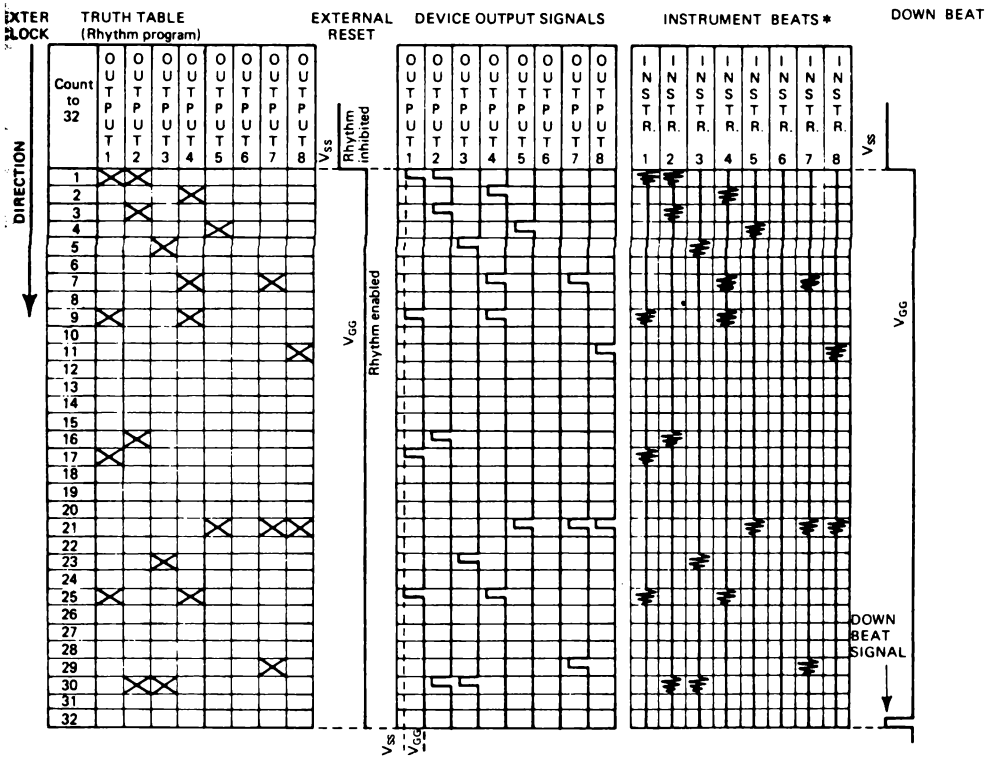
* Measured at 50% of the swing.
** Measured between 10% and 90% of the swing

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 instrument.

INSTRUMENT BEATS VERSUS RHYTHM PROGRAM



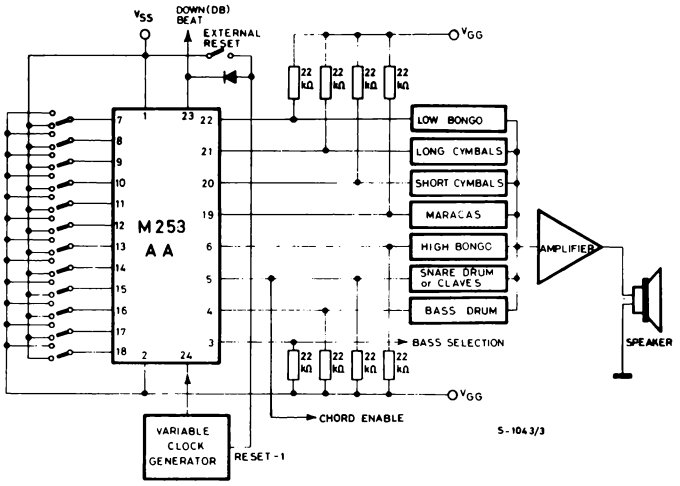
The lowering of the music signals depends on the intrinsic decay time of the sound generator and not on the length of the enable pulses. Each beat can therefore last for more than one elementary time.

TYPICAL APPLICATIONS

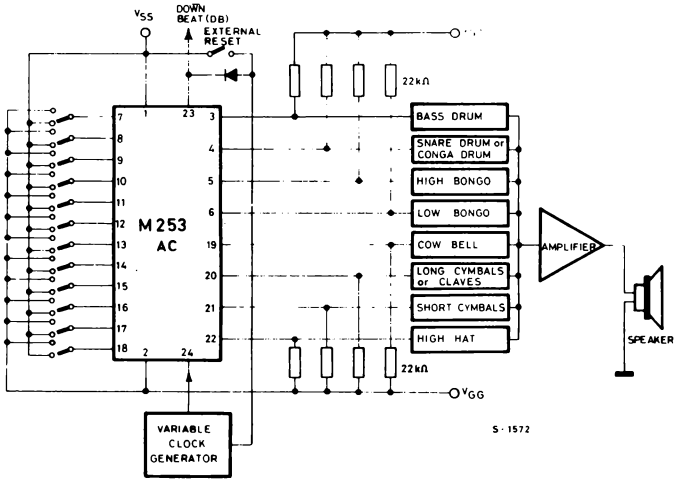
Figure 1 shows the typical application of the M253 (AA) and M253 (AC).
With two M253 devices it is possible to increase the number of rhythms or the number of instruments available, or the number of elementary times, as shown in figures 2, 3 and 4 respectively.
The use of a memory matrix allows the customer complete flexibility, since modification of the memory is quick and relatively cheap.

Fig. 1 - Rhythm ststem (standard contents)

a) M253 AA



b) M253 AC



TYPICAL APPLICATIONS (continued)

Fig. 2 - Increase in number of rhythms

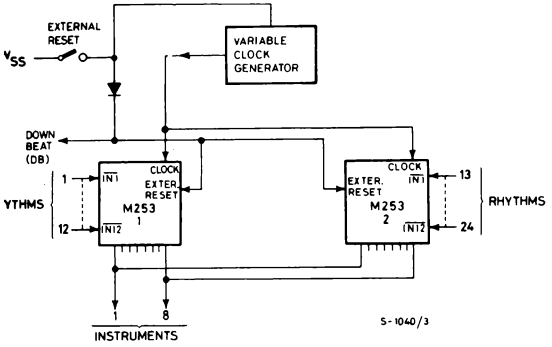
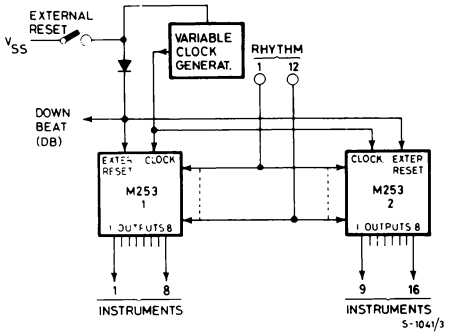
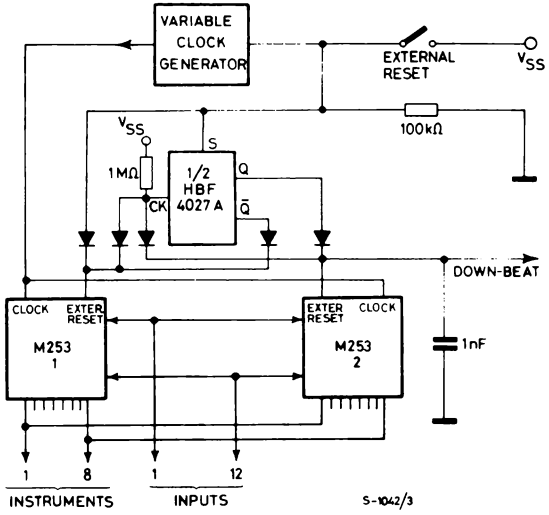


Fig. 3 - Increase in number of instruments



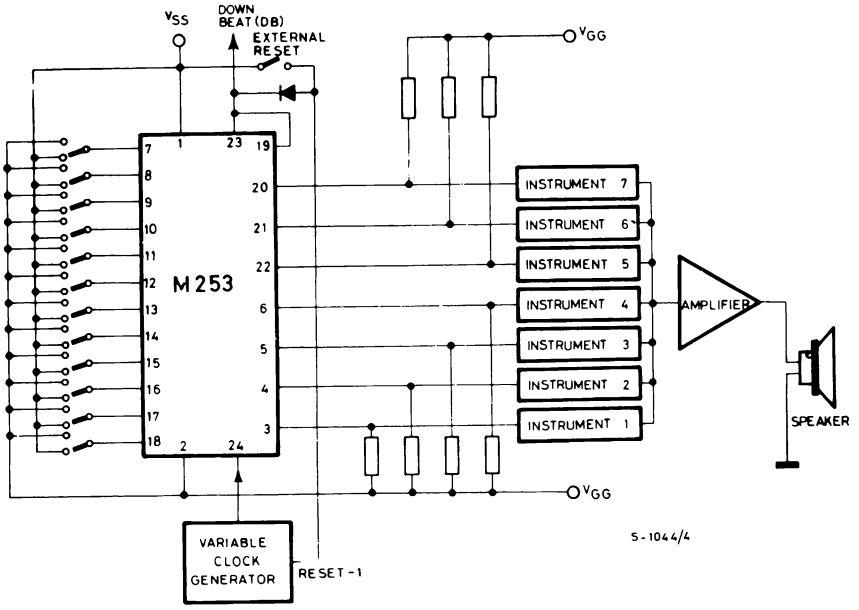
The rhythms may be selected from both devices simultaneously.

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 appears 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 M253 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 96 columns (12 groups of 8) where each group represents a rhythm which has at 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 M253 AA and M253 AC respectively.

TABLE 1 (M253 AA)

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

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

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

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

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

COUNT FOR 32	RHYTHM 6							
	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							X	
9	X	X				X		
10								
11								
12								
13			X				X	
14								
15								
16							X	
17		X				X		
18								
19								
20								
21			X					
22								
23								
24							X	
25	X	X					X	
26								
27								
28							X	
29			X				X	
30								
31								
32							X	

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

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

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

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

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

TABLE 2 (M253 AC)

	RHYTHM 1 (WALTZ)								RHYTHM 2 (TANGO)								RHYTHM 3 (MARCH)								RHYTHM 4 (SWING)								RHYTHM 5 (MAMBO)							
COUNT FOR 32	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											

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

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

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