MOS INTEGRATED CIRCUIT

M 254

RHYTHM GENERATOR

- DRIVES 12 SOUND GENERATORS (INSTRUMENTS) OR SOME INSTRUMENTS AND M 251 OR M 108
- 5 BIT COUNTER
- 8 RHYTHMS PER INSTRUMENT
- EXTERNAL RESET

The M 254 is a monolithic rhythm generator specifically designed for electronic organs and other musical instruments. Constructed on a single chip using 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	-65 to 150	°C
T_{op}	Operating temperature	0 to 70	°C

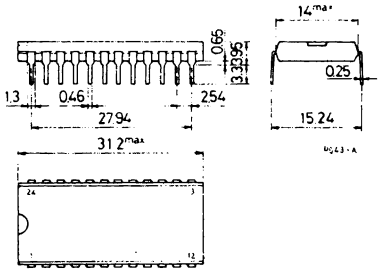
* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other condition above those indicated in the operational sections of this specification is not implied. Exposure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

** All voltages value are referred to V_{SS} pin voltage.

ORDERING NUMBERS: M 254 XX for dual in-line plastic package
M 254 B1AD for standard music content
M 254 B1AM for standard music content

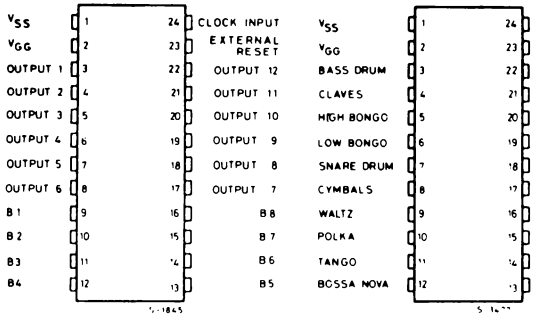
MECHANICAL DATA

Dimensions in mm

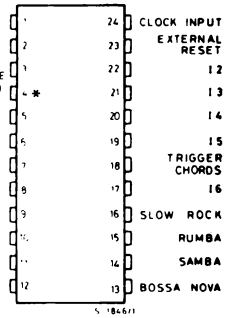


CONNECTION DIAGRAMS

M 254 B1AM Standard content configuration



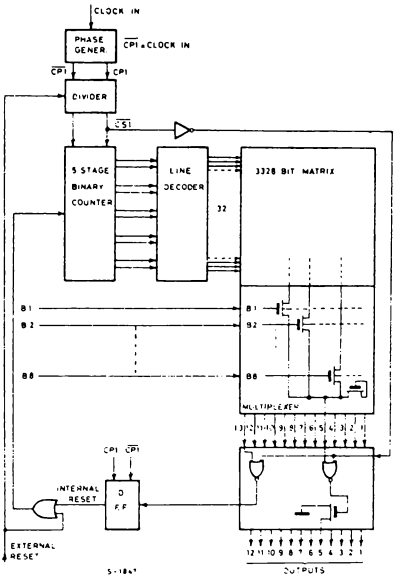
M 254 B1AD Standard content configuration



* This output must be connected so as to drive the "snare drum" when the rhythms corresponding to pins 9, 10, 11, 12 and 16 are generated, and the "claves" when the rhythms corresponding to pins 13, 14 and 15 are generated. I2 to I8 drive the corresponding inputs of the M 251.

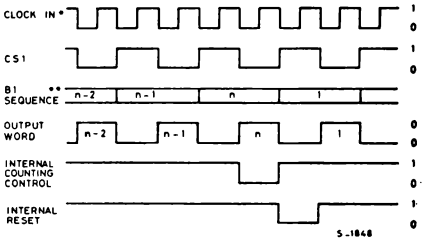
** These outputs must be connected so as to drive the bass switching inputs A, B, C of the M 108.

BLOCK DIAGRAM

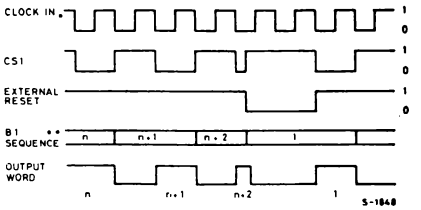


TIMING WAVEFORMS (positive logic)

Output words versus external reset



Output words versus internal reset



* External gating allows resetting of the variable clock generator to ensure that the beat starts exactly at the right moment.

** i= 1.....8; in this timing waveform it has been assumed that in the truth table all bits have been programmed.

DEVICE DESCRIPTION

The M 254 contains a ROM which can drive 12 sound generators (instruments) with a selection of 8 rhythms for each generator. An external clock drives a phase generator which produces complementary outputs, these signals are then divided-by-2, to produce the signals to enable the output buffers and drive a 5-stage binary counter.
The outputs of the counter are decoded, being the 32 rows of the memory matrix which has 104 columns. The 104 columns are divided into 13 groups of 8. A multiplexer is used such that any number of columns in the 13 groups can be selected from 1 to 8. Of the 13 groups in the memory matrix, 12 have buffered outputs via an enabling circuit (the enabling conditions being CS1 = "0" and at least one multiplex input at logic "1").
The 13th group in the matrix controls the internal reset which is synchronised with the counter and controls the counting sequence.

STATIC ELECTRICAL CHARACTERISTICS (positive logic, V_{GG} = GND; V_{SS} = 14 to 18V; T_{amb} = 0 to 70°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
CLOCK INPUT						
V_{IH}	Clock high voltage		V_{SS}-1			V
V_{IL}	Clock low voltage				V_{SS}-10	V
DATA INPUTS (B1 . . . . . B8)						
V_{IH}	Input high voltage		V_{SS}-1			V
V_{IL}	Input low voltage				V_{SS}-10	V
I_{LI}	Input leakage current	V_i=V_{SS}-14V T_{amb}= 25°C			10	µA
DATA OUTPUTS						
R_{ON}	Output resistance (ON state)	V_o=V_{SS}-2V		1	2	kΩ
I_{OH}	Output high current	V_{SS}= 18V			100	µA
POWER DISSIPATION						
I_{GG}	Supply current	V_{GG}=V_{SS}-18V T_{amb}= 25°C		10		mA

DYNAMIC ELECTRICAL CHARACTERISTICS (positive logic, V_{GG} = GND; V_{SS} = 14 to 18V; T_{amb} = 0 to 70°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
CLOCK INPUT						
f	Clock repetition rate		DC		100	kHz
t_{pw}*	Pulse width	Duty cycle = 50%	5			µs
t_d	Pulse delay		5			µs
t_r**	Rise time	T_{amb} = 25°C			5	µs
t_f**	Fall time				5	µs

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

TYPICAL APPLICATIONS

Figure 1 shows the typical application of the M 254 AD.
Figure 2 shows the typical application of the M 254 AM.
With two M 254 devices it is possible to increase the number of rhythms or the number of instruments available, as shown in figures 3 and 4 respectively.

Fig. 1 - Rhythm and accompaniment system (standard contents). M 254 AD

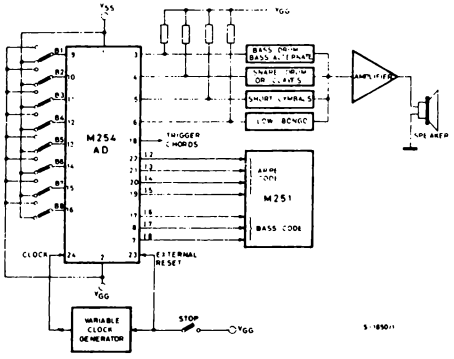
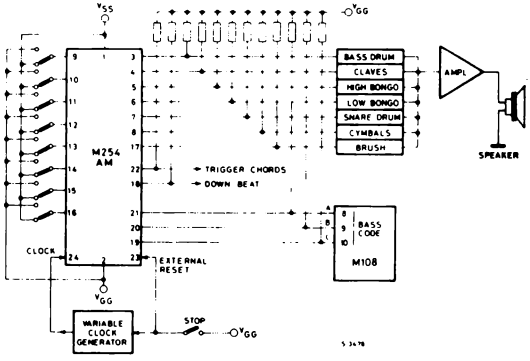


Fig. 2 - Rhythm and accompaniment system (standard contents). M 254 AM



TYPICAL APPLICATIONS (continued)

Fig. 3 - Increase in number of rhythms

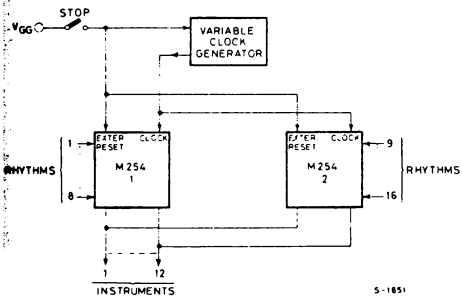
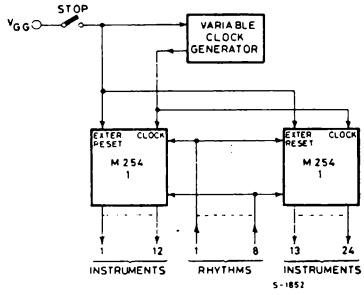


Fig. 4 - Increase in number of instruments



COMPLETING THE TRUTH TABLE

The ROM truth table has been organized in 32 rows which represent the elementary times and 104 columns.

The first 8 groups of 12 columns represent the rhythms which have 12 programmable outputs. The timing for the beats required for each instrument is programmed by crossing the appropriate box.

The 9th group of 8 columns represents the COUNTING control information which specifies the number of elementary times in a given rhythm.

If count N is crossed for rhythm X this rhythm will have N elementary times. If the counting control column for a particular rhythm does not contain a cross that rhythm will have 32 elementary times.

Table 1 and 2 show the truth tables of the M 254 AD and M 254 AM, standard contents, respectively.

It can be seen that in the table 1 the rhythms 1 and 8 and in the table 2 the rhythms 1,6 and 7, have 24 elementary times.

M 254

M 254 AD (standard)

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

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

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

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

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

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

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

M 254 AM (standard)

	RHYTHM 1 (WALTZ)												RHYTHM 2 (POLKA)												RHYTHM 3 (TANGO)											
COUNT FOR 32	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 9	OUTPUT 10	OUTPUT 11	OUTPUT 12	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 9	OUTPUT 10	OUTPUT 11	OUTPUT 12	OUTPUT 1	OUTPUT 2	OUTPUT 3	OUTPUT 4	OUTPUT 5	OUTPUT 6	OUTPUT 7	OUTPUT 8	OUTPUT 9	OUTPUT 10	OUTPUT 11	OUTPUT 12
1	X					X		X			X		X					X		X			X		X				X		X	X			X	X
2																																				
3					X		X					X					X		X					X												
4																																				
5					X		X					X	X					X		X	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		X		X			X
10																																				
11					X		X					X					X		X					X												
12																																				
13	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
16																	X												X							
17					X		X					X	X					X		X			X		X				X		X	X			X	X
18																																				
19	X					X		X	X								X		X					X												
20																																				
21					X		X					X	X					X		X	X				X				X		X			X		X
22																																				
23					X		X					X					X		X					X												
24																																				
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	X	X
30																																				
31																	X		X					X					X	X	X					X
32																																				

M 254

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

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

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

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

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