

LR34651 Analog Clock Driver LSI with Electronic Melody Generator

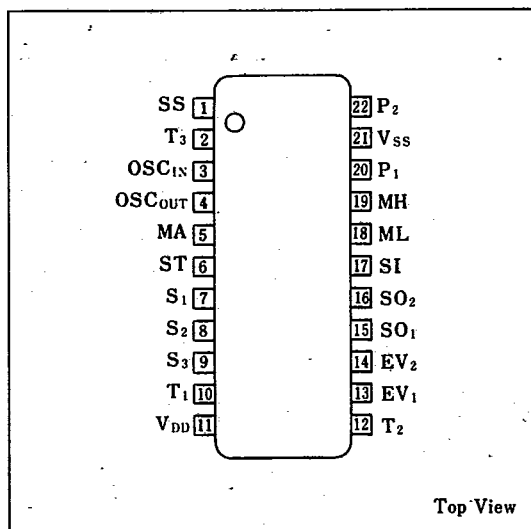
Description

The LR34651 is a CMOS LSI for electronic analog clocks using a 32.768kHz crystal with stepper motor driver circuit, providing melodies and alarm functions.

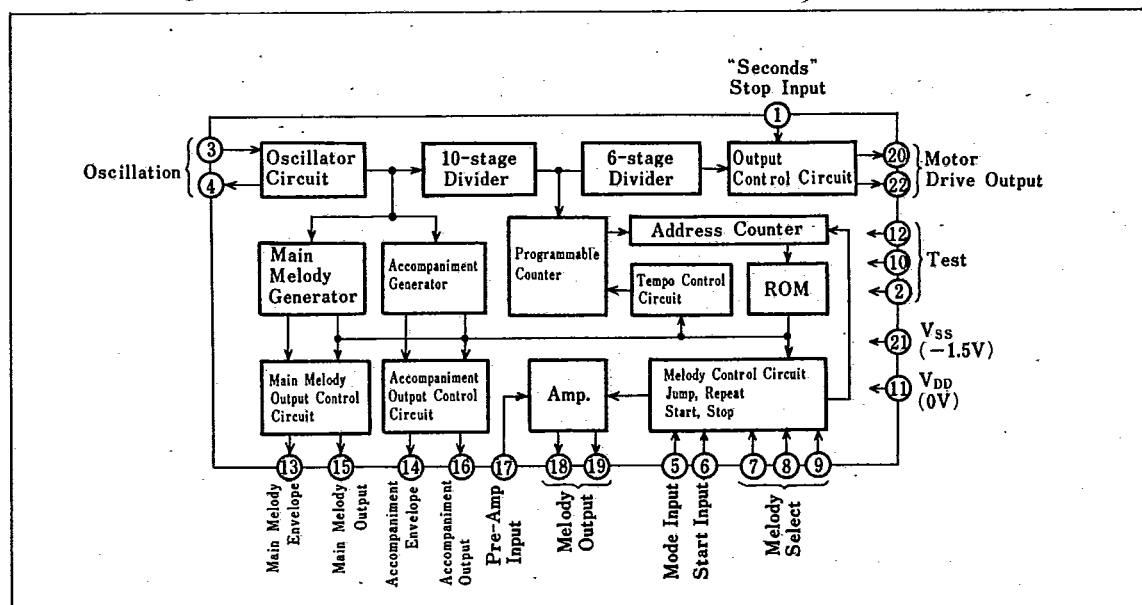
Features

1. Low resistance outputs for stepper motor
2. "Seconds" stop function
3. Melody performance with accompaniment
4. Mask ROM programmable
5. 8 melodies selected by S_1 - S_3
6. Loudness volume control function
7. Melody envelope controlled by external CR oscillator
8. 32.768kHz crystal oscillator
9. Single power supply : -1.5V
10. CMOS process
11. 22-pin dual-in-line package

Pin Connections



Block Diagram



T-49-15-02

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Pin voltage*	V_{SS}	-0.3 to +0.3	V
	V_{IN}	$V_{SS}-0.3$ to +0.3	V
	V_{OUT}	$V_{DD}-0.3$ to +0.3	V
Storage temperature	T_{stg}	-55 to +150	°C
Operating temperature	T_{opr}	-10 to +50	°C

* Referenced to V_{DD}

Recommended Operating Conditions

Parameter	Symbol	Ratings	Unit
Supply voltage	V_{DD}	-2.0 to -1.2	V
Oscillator frequency	f_{osc}	32.768 (TYP.)	kHz
Oscillation start voltage	V_{osc}	-1.4	V

Electrical Characteristics

 $(V_{DD}=0V, V_{SS}=-11.5V, T_a=25°C)$

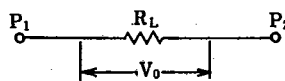
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Current consumption	I_{SSS}	Standby no load			5	μA	1
	I_{SSa}	Melody-ON no load			1	mA	
Oscillation start time	T_{osc}	$V_{DD}=1.4V$			10	s	1
Input voltage	V_{IH}		-0.3			V	2
	V_{IL}				-1.2	V	
Input current 1	I_{IH1}	$V_{IN}=0V$		2	10	μA	2
Input current 2	I_{IH2}	$V_{IN}=0V$	10		200	μA	3
Output current 1	I_{OH1}	$V_{OUT}=-0.5V$	250			μA	4
	I_{OH2}	$V_{OUT}=-0.5V$	3			μA	
Output current 2	I_{OL2}	$V_{OUT}=-1.0V$	3			μA	5
	I_{OH3}	$V_{OUT}=-0.5V$	5			μA	
Output current 3	I_{OL3}	$V_{OUT}=-1.0V$	200			μA	6
	I_{OH4}	$V_{OUT}=-0.5V$	200			μA	
Output current 4	I_{OL4}	$V_{OUT}=-1.0V$	5			μA	7
	V_{OUT}	$V_{SS}=-1.2V, R_L=300\Omega$	0.9			V	
Output pulse width	t			31.25		ms	9
Output cycle	T_1			2		s	9
Output phase difference	T_2			1		s	9
Oscillation stability	$\Delta f/f$	$V_{SS}=-1.7$ to 1.2V			2.5	ppm/0.1V	1

Note 1: $C_D=C_C=22pF$ Note 2: Applied to pins ST_1, ST_1-S_3 and MA

Note 3: Applied to SI pin. Melody OFF time

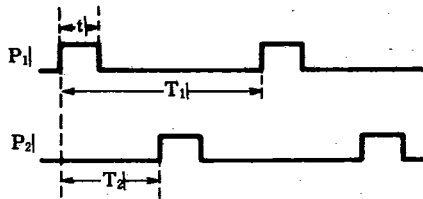
Note 4: Applied to pins EV_1 and EV_2 Note 5: Applied to pins SO_1 and SO_2 Note 6: Applied to ML pin. The value of I_{OH} for melody OFF time.Note 7: Applied to MH pin. The value of I_{OL} for melody OFF time.Note 8: Applied to P_1, P_2 pins. $R_L=300\Omega$ (Refer to the right figure).

Note 9: Refer to clock specifications.



■ Clock Specifications

<Step motor drive output>



By altering PLA, the output pulse width t can be selected from the following : 15, 31, 46, 62, 78, 93, 109 (ms).

<Second stop function>

Second counting will be performed and the output for the step motor will turn off while the SS input is ON. On turning the SS input OFF, the second counter is enabled to start. (Maximum error : 31.25ms).

■ Melody Specifications

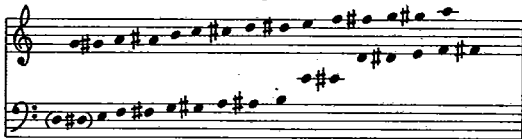
<Number of music> Up to 8 pieces

<ROM> 600 steps × 13 bits

<Sound source> 2 sources

<Range> 2.5 octaves

For the sounds in parentheses (), only the attack sound output will be generated.



<Tempo> 15 speeds for each music (The minimum note length shall be selected from between 31-468ms).

<Note length> 2 kinds (Other notes of different length can be represented by the different number of steps.)

(Example) If the fastest note in a music is ♩, the kinds of note that can be specified by 1 step are ♩ and ♪. The note length control is by "1" and "0".

♩ = ♩ (1) + ♩ (0) 2 steps

♩ = ♩ (1) + ♩ (0) + ♩ (0) 3 steps

♩ = ♩ (1) + ♩ (0) 2 steps

The number in parentheses () represents envelop control.

<Number of performances> 1 to 15 times, endless

<Commands> Melody command

- Control command
 - Snooze command
 - Jump command
 - Repetition number setting command
 - End command

<Command organization>

I ₁₋₅	Predominant melody interval
I ₆	Predominant envelope control
I ₇₋₁₁	Accompaniment interval
I ₁₂	Accompaniment envelope control
I ₁₃	Note length control

<Music selection>

According to the state of the music select input S₁-S₃, one music will be selected from the 8 pieces of music available. The pull-down resistor built into the music select pins allows the pins to be used either connected to V_{SS} or open.

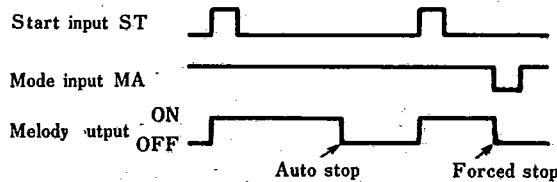
If the music select input state is altered in the middle of performance, the music then specified will be performed from the start. A music selection for the LR34651 in which 8 pieces of music is written in is shown in the table below.

Music select input			Music	Tempo J =	Number of repetitions	
S ₁	S ₂	S ₃			T ₃ =V _{DD}	T ₃ =V _{SS}
H	H	H	Westminster	68.6	1	1
L	H	H	Westminster	96	1	1
H	L	H	*	96	8	1
L	L	H	Spring (Four seasons) Vivaldi	96	10	1
H	H	L	Autumn (Four seasons) Vivaldi	96	8	1
L	H	L	Winter (Four seasons) Vivaldi	40	5	1
H	L	L	Chime	192	Endless	Endless
L	L	L	Alarm	240	Endless	Endless

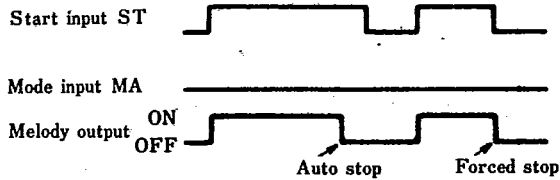
* Twinkle twinkle little star French music
H : V_{DD} L : V_{SS} or open

<Melody start, stop>

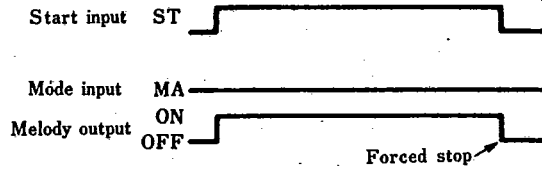
(1) One shot type



(2) Hold type (Number of repetitions 1 to 15 times)



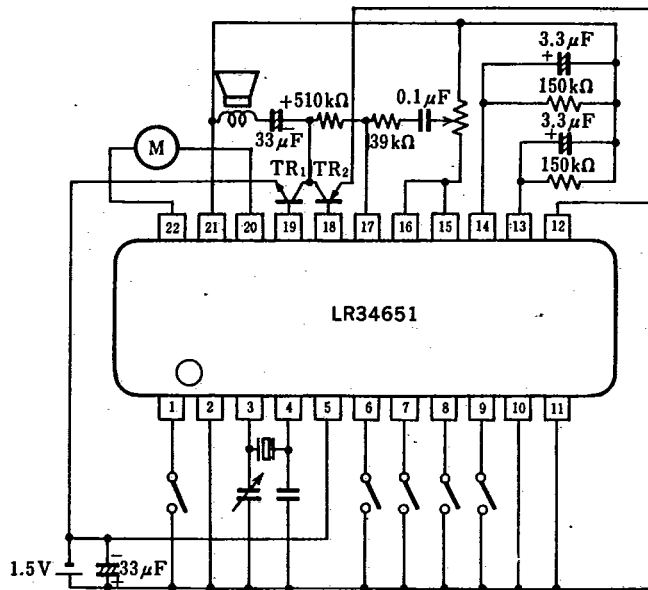
(3) Hold type (Number of repetition Endless)



<Snooze function>

Snooze function allows each music to be programmed into the mask ROM independently. However, the number of musics that can be selected will be reduced because a program in snooze function is one of the melody programs.

■ System Configuration Example



Note TR₁ : 2SC1383
TR₂ : 2SA683

Envelope waveform is determined by the value of R applied to pins 14 and 15.

Make sure that pins 10 and 12 must be connected to pin 11.

Make sure that pin 2 must be connected to pin 11 or pin 21.