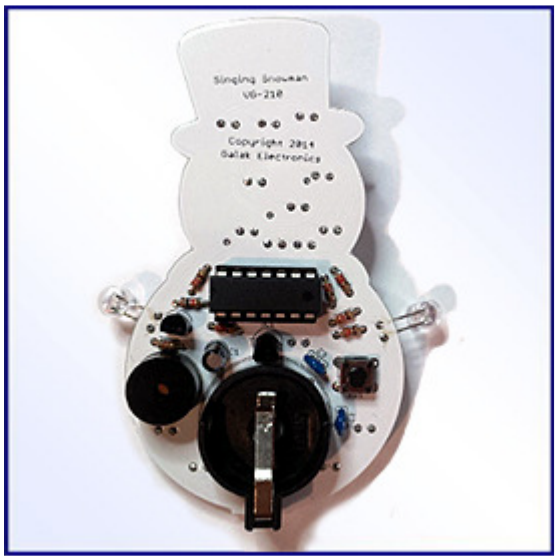
Galak Electronics
Electronic kits and components

Website: GalakElectronics.com
Email: sales@galakelectronics.com
Phone: (302) 832-1978

VG-211 Singing Snowman



Thank you for your purchase of the Singing Snowman Sequencer kit. Our kits are engineered to provide key elements for understanding electronics design and theory. In fact, we make it our goal to produce kits that will apply important electronic principles using analog and digital technology, and easy to find off-the-shelf components.

Our Programmable series of kits incorporate microcontroller technology due to the simplicity of the electronics and ease of assembly. It allows for a greater range of functionality, while maintaining a cost effective solution for some of today's more challenging electronics needs and requirements.

The Singing Snowman uses a simple algorithm to access selected patterns in its internal ROM and sequences these patterns into the LEDs and speaker. Each pattern uses 8 bytes for each step of the unique pattern. If you are interested in learning more about the program feel free to email us at the address listed below.

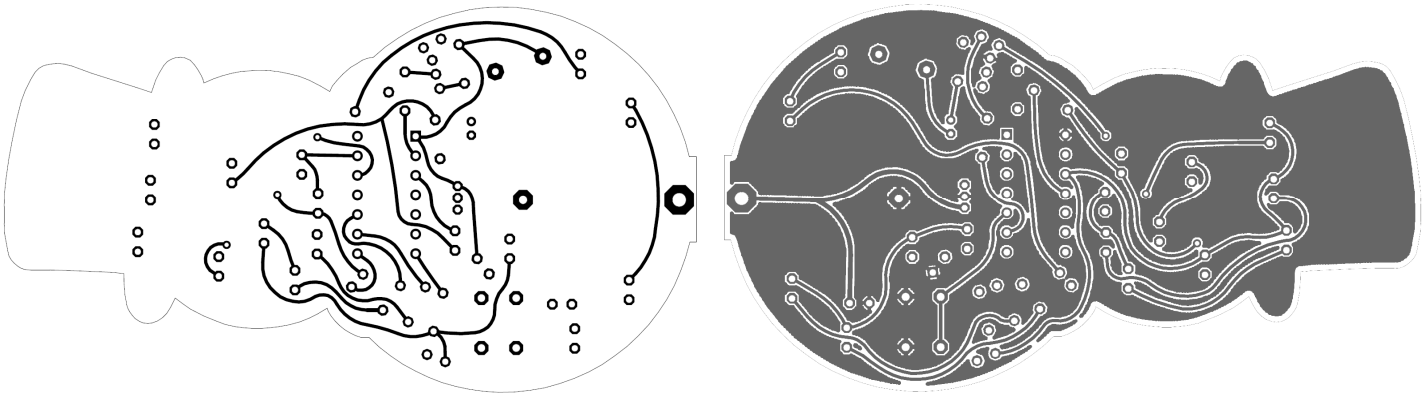
Before getting starting, make sure that your item is undamaged from the shipping process. If you notice any damaged or missing components, please contact us immediately at (302) 832-1978 or online at sales@galakelectronics.com.

We appreciate your business, so feel free to provide us with any suggestions or comments you may have regarding this kit or any other Galak Electronics kit.

Kit Contents

PART DESIGNATOR	DESCRIPTION	QUANTITY
R2 R3 R4 R5 R6 R7	Resistor, 220Ω 1/4 Watt 5% (red red brown gold)	6
R8	Resistor, 1KΩ 1/4 Watt 5% (brown black red gold)	1
R9	Resistor, 330Ω 1/4 Watt 5% (orange orange brown gold)	1
C1	Capacitor, 22uF 16V Aluminum Electrolytic (black)	1
C2	Capacitor, 1.0uF 50V Monolithic Ceramic (105 blue)	1
C3	Capacitor, 0.1uF 50V Monolithic Ceramic (104 yellow)	1
LED1 LED2	LED, water clear t 1 ¾ (5mm) 20° viewing angle	2
LED3-LED18	LED, water clear t 1 (3mm) 20° viewing angle	16
Q1	Transistor, NPN MPSA14G Darlington 30V 500mA	1
IC1	IC, LP2950 5V Voltage Regulator 100mA (TO-92)	1
IC2	IC, Attiny84A 2K Microcontroller (preprogrammed)	1
PB1	Switch Pushbutton, Momentary Normally Open	1
SPK1	Speaker, 16Ω Mini-Tone Transducer	1
BAT1	Battery Holder for (2) CR2032 Button Cells	1
PCB1	PCB, Double-sided 3.5" x 2.0” (8.8 cm x 5.0 cm)	1
INSTR1	Instructions, Singing Snowman kit	1

PC Board Top and Bottom artwork



Creating a Music Generator

The key to creating music through a microcontroller is to generate the appropriate frequency based on an equal-tempered music scale (A_4 = 440 Hz). The following chart illustrates the frequencies generate to create all the notes you hear in your Singing Snowman.

Note	Frequency	Period	Note	Frequency	Period
C5	523.25 Hz	1911 µS	C6	1046.50 Hz	956 µS
$C^{\#}5$	554.37 Hz	1804 µS	$C^{\#}6$	1108.73 Hz	902 µS
D5	587.33 Hz	1703 µS	D6	1174.66 Hz	851 µS
$D^{\#}5$	622.25 Hz	1607 µS	$D^{\#}6$	1244.51 Hz	804 µS
E5	659.25 Hz	1517 µS	E6	1318.51 Hz	758 µS
F5	698.46 Hz	1432 µS	F6	1396.91 Hz	716 µS
$F^{\#}5$	739.99 Hz	1351 µS	$F^{\#}6$	1479.98 Hz	676 µS
G5	783.99 Hz	1276 µS	G6	1567.98 Hz	638 µS
A_b5	830.61 Hz	1204 µS	A_b6	1661.22 Hz	602 µS
A5	880.00 Hz	1136 µS	A6	1760.00 Hz	568 µS
B_b5	932.33 Hz	1073 µS	B_b6	1864.66 Hz	536 µS
B5	987.77 Hz	1012 µS	B6	1975.53 Hz	506 µS

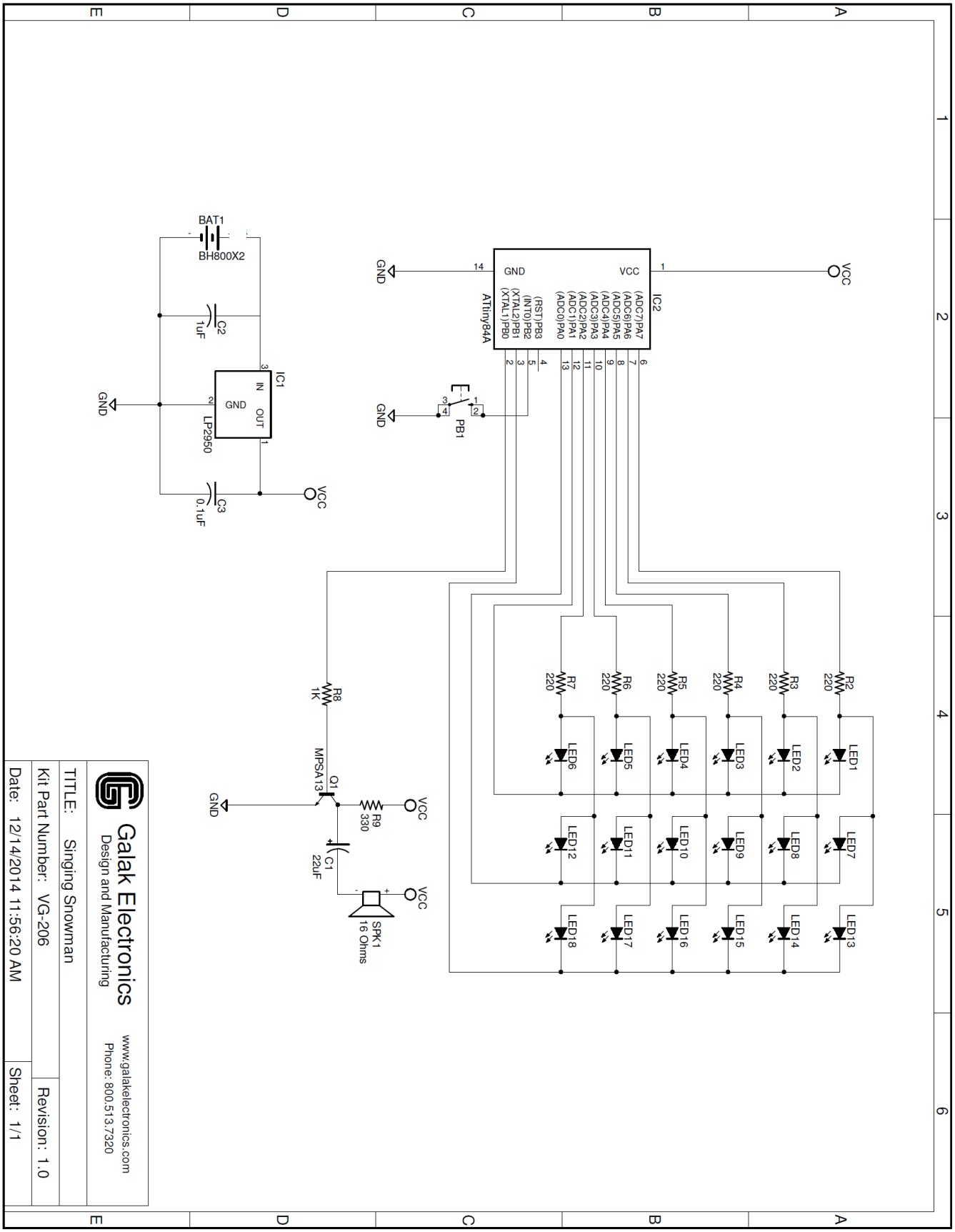
The actual tone is generated by using the period of the selected note and dividing it by two to determine the “on” and “off” time of each waveform. The microcontroller reads the note value and length (stored as 16th through whole notes) and transfers these values to a subroutine that calculates the duration of the note as the total number of waveform cycles. (Note: the duration of a whole note is approximately one second).

For example, if the note is a half note of D5 then the following calculation is made:

Period = 1703 µS ÷ 2 ⟶ 852; Length = half note = 8 x 36 ⟶ 288

Thus, to create a half note of D5 the microcontroller will pulse the output high for 852 µS and then set it low for the same duration. This will generate a square wave with a frequency of about 587 Hz. To maintain a consistent length regardless of frequency, the microcontroller will repeat this frequency a specific number of times based on each specific note (more for higher notes and less for lower notes). In this case, the waveform above will be repeated 288 times to equal a total duration of 490,464 µS. More or less the half second we want for a half note.

Singing Snowman Sequencer Schematic

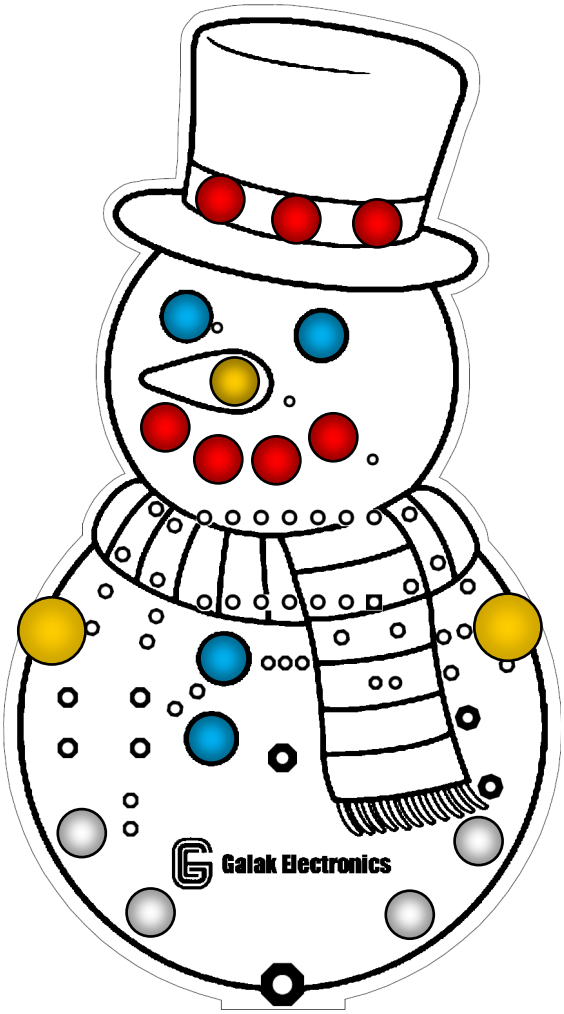


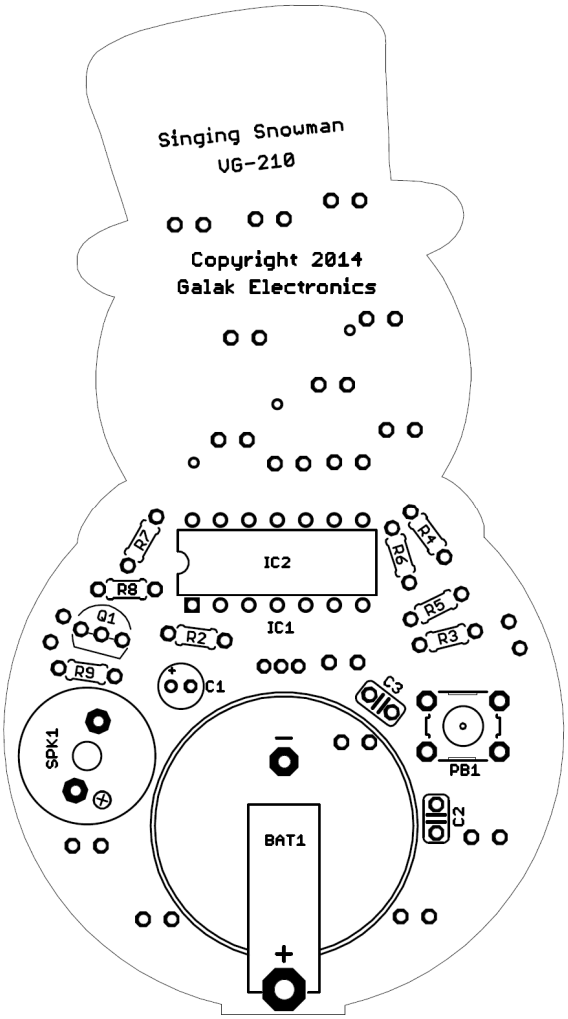
Populating the PC board

Make sure to properly identify each of the components, locating them on the layout and on the parts list included in these instructions. Do not remove the LEDs from their individual packets until you are ready to mount them, as they are color-coded.

To simplify the process of populating the PCB, we highly recommend mounting the LEDs first. The LEDs are not labeled on the board, so follow the pattern to the right. With the exception of LED1 and LED2 all the LEDs are oriented with the cathode to the right, meaning the shorter lead on each LED goes to the right.

LED1 and LED2 are used create the arms. The shorter leads go toward the top of the board. The rest of the LEDs can be mounted however you like, but we recommend using the pattern to the left for the best results.





Once you have all of the LEDs soldered and trimmed, flip the board over and start populating the board with the lower profile components. In this case, they will be the resistors R2-R9. Next, mount C2 and C3.

Now, mount the socket for IC2, orienting the arc to align with the arc on the silkscreen. Now, you can mount PB1 and C1. Note the orientation for C1. The positive lead is the longer lead and should match up with the “+” on the PC board.

Finally, mount SPK1 and battery holder BAT1 again noting the orientation of each device. SPK1 is marked on the bottom with a “+” symbol.

You are now ready to insert IC2 into the socket. Use caution when handling the IC, as it is static sensitive. Orient IC2 such that the arc on the IC aligns with the arc on the socket and carefully press the IC into place. Do not force it as you can bend the pins. If necessary, bend the leads inward by holding the IC at each end and gently pressing the pins against a flat surface.

Powering up the Singing Snowman

Now that you have completed the assembly of your Singing Snowman Sequencer, you are ready to power it up. Insert two (2) CR2032 batteries with the "+" side up, sliding the first battery under the clip. The second battery will require pulling the clip up slightly and will snap firmly into place. Your Singing Snowman should start up immediately. The entire duration off the music and LED show should last about two and a half minutes. Once the entire cycle is complete, your unit will go into a power down mode, consuming just 80 µA of power (Please note: We advise removing the batteries for long periods of inactivity).

To start the cycle again, press the button. The first pattern in the sequence will flash all the LEDs simultaneously while playing *Jingle Bells*. When the song finishes, the LEDs will start the first sequence, sweeping the LEDs from top to bottom. Next the LEDs will light in a random pattern. The last sequence will light the LEDs in a pendulum type motion. These three patterns will repeat 9 times for an overall duration of about 2 minutes.

If you don't get any response from your Singing Snowman after applying power, check your connections. If you still don't get any response please contact Galak industries for further troubleshooting hints. In the event that the problem can't be resolved, we will be happy to repair your unit free of charge. You just pay the shipping costs.

SPECIFICATIONS:	
Supply Voltage	6VDC @ 15mA
Standby Current	Approximately 80µA (battery life approximately 3 months)
Sequential Pattern	Downward sweeping, random and pendulum motion
Pattern Select	Single pushbutton to power up sequence
Board Dimensions	2.0" x 3.5" (5.0mm x 6.6 cm) approximate
Board Material	0.062" (1.6 mm) FR-4, with white solder mask and top/bottom layer silk screen
Finished Weight	0.9 ounces (24 grams)

Good luck and enjoy you new Singing Snowman. We appreciate your business.