M O C K I N G B O A R D

ASSEMBLY GUIDE

VERSION 2.2

TALK TO ME. **Now your computer can tell you the words you've always wanted to hear. Go ahead. Plug in a Mockingboard and feed your computer some lines. Mockingboard speech is easy to understand, unlimited in vocabulary and uses very little memory.**

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KIT ASSEMBLY

All components and assembly parts as listed in Table 1. They are all tested before shipping. As a measure of precaution wear a Ground Strap and take all precautions to prevent static when handling or working with the IC's, even when they are installed on the expansion card.

COMPLETE LIST

QTY.	VALUE	DEVICE	PARTS
2	1N4148	Diode	D1,D2
2	Rockwell 6522	IC CHIP	U2,U5
1	74LS05N	IC CHIP	IC1
2	AY-3-8913	IC CHIP	U1,U4
2	LM386N-1	IC CHIP	IC2,IC3
2	SC-02/SSI-263/Artic263	IC CHIP	U3,U6
2	.01k	Resistor	1/4watt
2	2k	Resistor	1/4watt
2	8.2k	Resistor	1/4watt
3	10k	Resistor	1/4watt
4	3.3k	Resistor	1/4watt
5	1k	Resistor	1/4watt
5	4.7k	Resistor	1/4watt
1	5pF	Ceramic Cap	.1"Lead
3	220uf	Axial-lead Electrolytic 25v	C20,C21,C22
5	10uF	Radial Tantalum 25v	C1,C17,C23,C24,C25
16	.1uF	Ceramic Cap .1" Lead	C2,C3,C4,C5,C6,C7,C8,C10,C11, C12,C13,C14,C15,C16,C26,C27
1	MB Speaker	2pin Header (Connector)	JP1
1	SJ1-3553NG	3.5mm Jack	JP2
IC SOCKETS:			
4	24 Pin .6" for U1, U3, U4, U6		
2	40 Pin .6" for U2, U5		
1	14 Pin .3" for IC1		
2	8 Pin for IC2, IC3		

Table 1

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ASSEMBLY PARTS

The components/parts included with your assembly kit and the PCB have basic labels as seen in Figure 1. There are 315 pads which need to be soldered. Those with intermediate knowledge should have little trouble assembling the kit from just these labels.

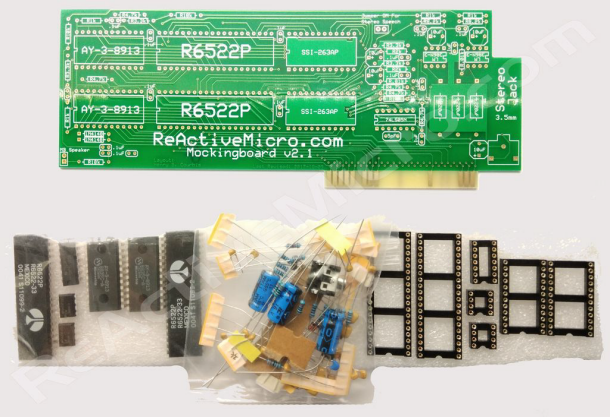

Figure 1

FULLY ASSEMBLED CARD

A fully assembled **MOCKINGBOARD** v2.2 as seen in Figure 2 can also be used for reference or determine orientation of components.

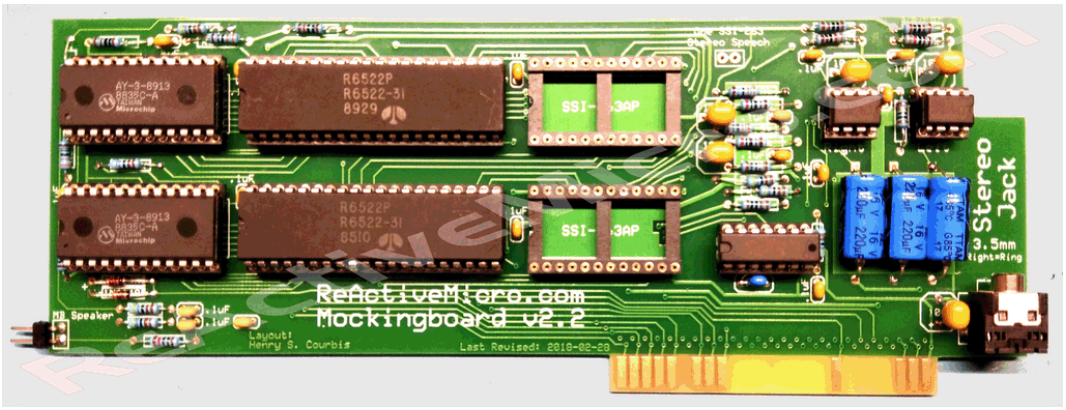

Figure 2

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COMPONENTS

CIRCUIT BOARD - PCB

The printed circuit board has “square pads” (the soldering hole for placement of the components) to denote the POSTIVE side of ALL items with a polarity or Pin 1 of the IC’s.

INTEGRATED CIRCUIT – IC CHIPS

Table 2 represents the main components of the **MOCKINGBOARD**. Take notice that the LM386 IC’s shown in Table 3 are facing a different direction then the rest of the IC’s. Make sure to install all IC Chips correctly or damage to the card and/or computer may occur.

	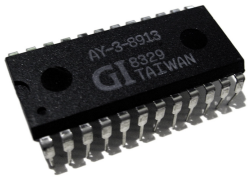	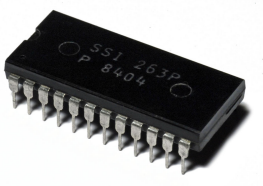
Interface IC	Sound Generator	Speech Synthesizer
R6522P	**AY-3-8913**	**SC-02 / Arctic-02, SSI-263P, SSI-263AP or 78A263A-P**

Table 2

	
Logic IC	Audio Amp.
74LS05N	**LM386N (Audio Amp)**

Table 3

Note: IC chips shown in Table 2 and 3 are not to scale, and may not have the exact same markings as those in the assembly kit, such as the manufacturer, however the identification of the chip such as SN74LS05N will be the same, no matter which company produced the IC chip.

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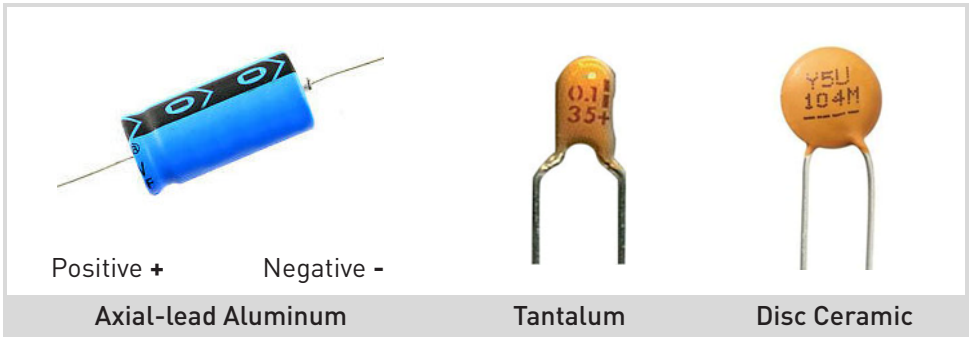
CAPACITORS



Axial-lead Aluminum	Tantalum	Disc Ceramic

Table 4

Note: The assembly kit may include three types of capacitors, or "caps" for short as seen in Table 4. The images shown are not to scale and all caps will have value markings on them, 106 is 10µf and 104 is .1µf. This will help identify the different caps in the kit.

The Aluminum Electrolytic caps have axial leads on both ends, cylindrical aluminum case, insulated with a blue sleeve. A strip pointing to the NEGATIVE **-** end lead.

The Tantalum caps will generally have a marking or stripe to denote (not always pointing to) the POSITIVE lead.

CONSTRUCTION NOTES

The PCB will be clearly marked with **+** signs for all cap locations when the orientation of the part matters, or a polarized part is normally used. Sometimes a non-polarized part is used in place of a polarized one and then its orientation does not matter. A polarized cap installed backwards may damage the component.

Pay attention to the "Positive" side of the 10uF caps, 220uF cap and make sure to install them in the correct polarity on the card. The 10µF caps have a line and a small **+** sign on the positive side and the card is marked with a **+** sign to denote positive. The 220µF caps have a line and a small **-** with an **>** sign pointing toward the negative side and the card is marked with a **+** sign to denote positive.

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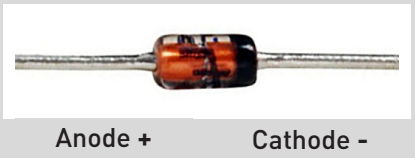
DIODES

The assembly kit includes two diodes. The diagram and image of a diode can be seen in Table 5. The two diode components properly assembled to the MOCKINGBOARD are located below the AY-3 Chip and above the MB speaker connector as seen in Figure 2.



Anode +	Cathode -

Table 5

CONSTRUCTION NOTES

Pay attention to the **Positive +** side of the 1N4148 diodes and make sure to install them in the correct polarity on the card. The diodes have a **Black Stripe** that runs the circumference on the glass casing that denotes the **Negative -** side. Make sure the stripe on the diode is facing the Stereo Jack on the card.

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RESISTORS

Your kit may include the less precise 4 band style Table 6, which are typically 5% tolerance, or the more precise 5 band style Table 7, which are typically 1% tolerance. Refer to the following charts on how to read them and to help make matching locations on the PCB easier.

4-Band Resistor

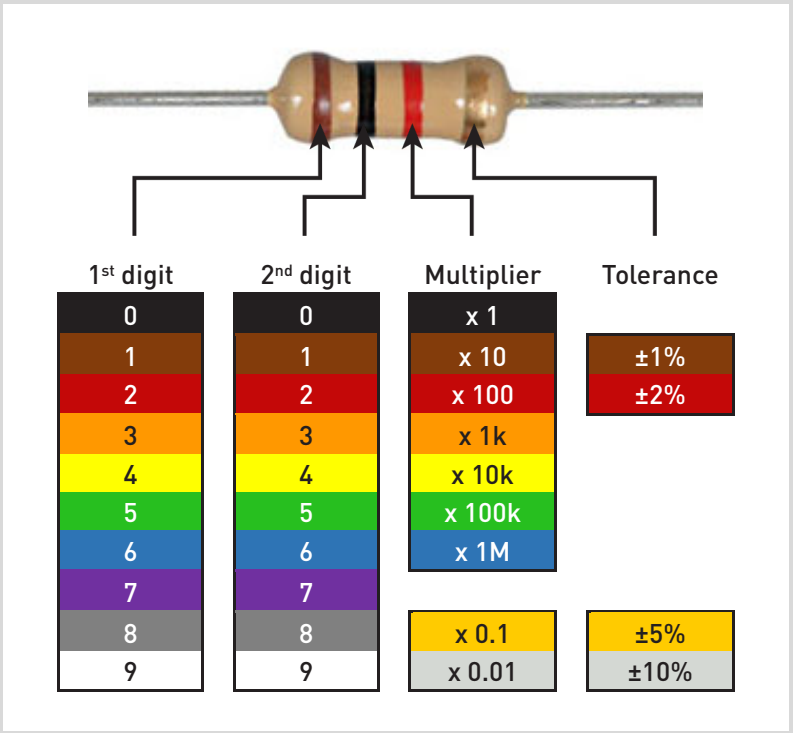

Table 6

Example: Band 1 = Brown, Band 2 = Black, Band 3 = Red, Band 4 = Gold
Resistor Value: 1 (Brown) 0 (Black) x 100 (Red) = 10 x 100 = 1,000
with a 5% tolerance Band 4 (Gold) = 1kΩ (Kilo ohm)

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5-Band Resistor

Color	1st Band Value	2nd Band Value	3rd Band Value	Multiplier	Tolerances
Black	0	0	0	x 1	
Brown	1	1	1	x 10	±1%
Red	2	2	2	x 100	±2%
Orange	3	3	3	x 1,000	±3%
Yellow	4	4	4	x 10,000	±4%
Green	5	5	5	x 100,000	±0.5%
Blue	6	6	6	x 1,000,000	±0.25%
Violet	7	7	7	x 10,000,000	±0.10%
Grey	8	8	8	x 100,000,000	±0.05%
White	9	9	9	x 1,000,000,000	
Gold				x 0.1	±5%
Silver				x 0.01	±10%
No band					±20%

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SOUND CONNECTOR

The Motherboard (MB) sound connection on the card is connected with a 2 pin cable as seen in Figure 3 to the Apple II Motherboard. Disconnect the II's speaker and connect the 2 pin cable to the motherboard and MOCKINGBOARD.

Figure 3

Turn on the Apple II computer and if you hear the system beep through your speakers then the cable is connected correctly.

If no sound is heard, then reverse one of the cable connections and reconnect. If still no sound is heard, then there is an issue with the cable or the MOCKINGBOARD.

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SPEECH CHIP OPTION

The speech chip(s) as seen in Table 2 can be installed on the (PCB) board. The board can accommodate two of these speech chips, both areas on the board are labelled SSI-263AP, the top socket is the primary socket when installing only one of these chips.

The Speech Chips maybe labelled as follows:

- SC-02
- Arctic-02
- SSI-263P
- SSI-263AP or 78A263A-P

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LIVE ASSEMBLY

On February 8th, 2018 Joe Strosnider made an assembly and review of the MOCKINGBOARD v2.1 Kit. He gives some very good feedback and shows his own assembly of the project. The kit is so simple to assemble with some basic knowledge that as Joe has little issue completing his work.

On February 20th, 2018 Chris Torrence's Assembly Lines #62 video podcast did a review of the MOCKINGBOARD v2.1. He doesn't show full assembly like Joe Strosnider does, but it's still a good video to learn more in depth about the project and parts as well as mods, pics, and testing.

YouTube Joe Strosnider Assembly & Review of the MOCKINGBOARD v2.1

Chris Torrence's Assembly and Overview of the MOCKINGBOARD v2.1

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MAIN COMPONENTS OVERVIEW

R6522 VERSATILE INTERFACE ADAPTER

Adapted from Rockwell Document No. 29000D47 Rev. 8, October 1984

The R6522 Versatile Interface Adapter (VIA) is a very flexible I/O control device. In addition, this device contains a pair of very powerful 16-bit interval timers, a serial-to-parallel/parallel-to serial shift register and input data latching on the peripheral ports. Expanded handshaking capability allows control of bidirectional data transfers between VIA's in multiple processor systems.

Control of peripheral devices is handled primarily through two 8-bit bidirectional ports. Each line can be programmed as either an input or an output. Several peripheral I/O lines can be controlled directly from the interval timers for generating programmable frequency square waves or for counting externally generated pulses. To facilitate control of the many powerful features of this chip, an interrupt flag register, an interrupt enable register and a pair of function control registers are provided.

FEATURES	
Two 8-bit bidirectional I/0 ports. Two 16-bit programmable timer/counters.	Expanded “handshake” capability allows positive control of data transfers between processor and peripheral devices.
Serial data port.	
TTL compatible.	Latched output and input registers.
CMOS compatible peripheral control lines.	1 MHz and 2 MHz operation.
	Single +5V power supply.

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SSI 263A PHONEME SPEECH SYNTHESIZER

Adapted from Silicon Systems Data Sheet - 09/85

The SSI 263A Is a versatile, high-quality, phoneme based speech synthesizer circuit contained in a single monolithic CMOS Integrated circuit. It is designed to produce an audio output of unlimited vocabulary, music and sound effects at an extremely low data Input rate.

Speech Is synthesized by combining phonemes, the building blocks of speech, in an appropriate sequence. The SSI 263A contains five eight-bit registers that allow software control of speech rate, pitch, pitch movement rate, amplitude, articulation rate, vocal tract filter response, and phoneme selection and duration.

FEATURES	
Single low-power CMOS Integrated circuit.	Non-dedicated speech, Ideal for text-to-speech programming.
5 Volt supply.	
Extremely low data rate.	Programmable and hard power down/reset mode.
8-bit bus compatible with selectable handshaking modes.	Switched-capacitor-filter technology.

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AY-3-8913

Information datasheet adapted from General Instruments Corporation.

The AY-3-8913 is a register oriented Programmable Sound Generator (PSG). Communication between the processor and the PSG is based on the concept of memory-mapped I/O. Control commands are issued to the PSG by writing to 16 memory-mapped registers. Each of the 16 registers within the PSG is also readable so that the microprocessor can determine, as necessary, present states or stored data values. All functions of the PSG are controlled through the 16 registers which once programmed, generate and sustain the sounds, thus freeing the Apple II system processor for other tasks. The (PSG) is a LSI Circuit which can produce a wide variety of complex sounds under software control.

The (PSG) flexibility makes it useful in applications such as music synthesis, sound effects generation. The analog sound outputs can each provide 4 bits of logarithmic digital to analog conversion. greatly enhancing the dynamic range of the sounds produced.

In order to perform sound effects while allowing the Apple II processor to continue its other tasks, the (PSG) can continue to produce sound after the initial commands have been given by the control processor. The fact that realistic sound production often involves more than one effect is satisfied by the three independently controllable channels available in the (PSG).

All of the circuit control signals are digital in nature and intended to be provided directly by the Apple II microprocessor, this means that one (PSG) can produce the full range of required sounds with no change in external circuitry. Since the frequency response of the (PSG) ranges from sub-audible at its lowest frequency to post-audible at its highest frequency, there are few sounds which are beyond reproduction with only the simplest electrical connections.

FEATURES	
Full Software Control of Sound Generation	Three Independently Programmed Analog Outputs
The AY-3-8913 has no ports and 24 leads	Single +5 Volt Supply

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