## Assembly Tips

All of the parts mount on the top side of the PCB

To make assembling the kit easier, these instructions are sequenced with the shortest components first. After inserting a component, flip the PCB upside down carefully, then solder the component's leads in place.

For parts with more than 2 leads, make sure all of the leads go into the holes, and none are deflected sideways and missing the hole.

Some parts are non-polarized, which means they can be installed facing either direction.
Many parts are polarized, so you must pay close attention to the instructions, or risk accidentally installing a part backwards.

Be sure your soldering iron is in serviceable condition. Touch the tip of the iron to fresh solder. It should melt immediately with a puff of flux vapor. If the solder does not melt immediately when touched with the tip of the iron, the tip may be worn out, dirty/oxidized, or too cold. Wipe the tip of the iron on a damp sponge frequently.

The parts in this kit are RoHS-compliant

## Workspace

Bright lighting is required

Use a magnifying lens to read the printing on the components

The integrated circuit chips should be handled with anti-static precautions

Audio amplifier and MIDI controller are required for testing the unit after assembly

## Solder recommendations

You may use either lead-containing solder such as Sn63/Pb37, or any lead-free electrical solder alloy. You must use rosin-core solder. Solder with a diameter of 0.032" is recommended

This PCB is lead-free.

## Enclosure

This kit is designed to be used as a bare PCB. No enclosure is included. Mount the PCB on the four plastic standoffs using the screws provided. The standoffs serve as legs for the device

If you plan to build your MIDI Narrator with a custom enclosure, don't solder anything until after you have chosen your case, obtained panel mount parts to substitute for the buttons and pots, etc, and drawn complete plans. For your aid, a wiring diagram and drill template are included at the end of this document.

Please save resources - don't print this document

Reference

R1,R2,R3,R4,R5,R6,R7,R10,R13,R14

Value

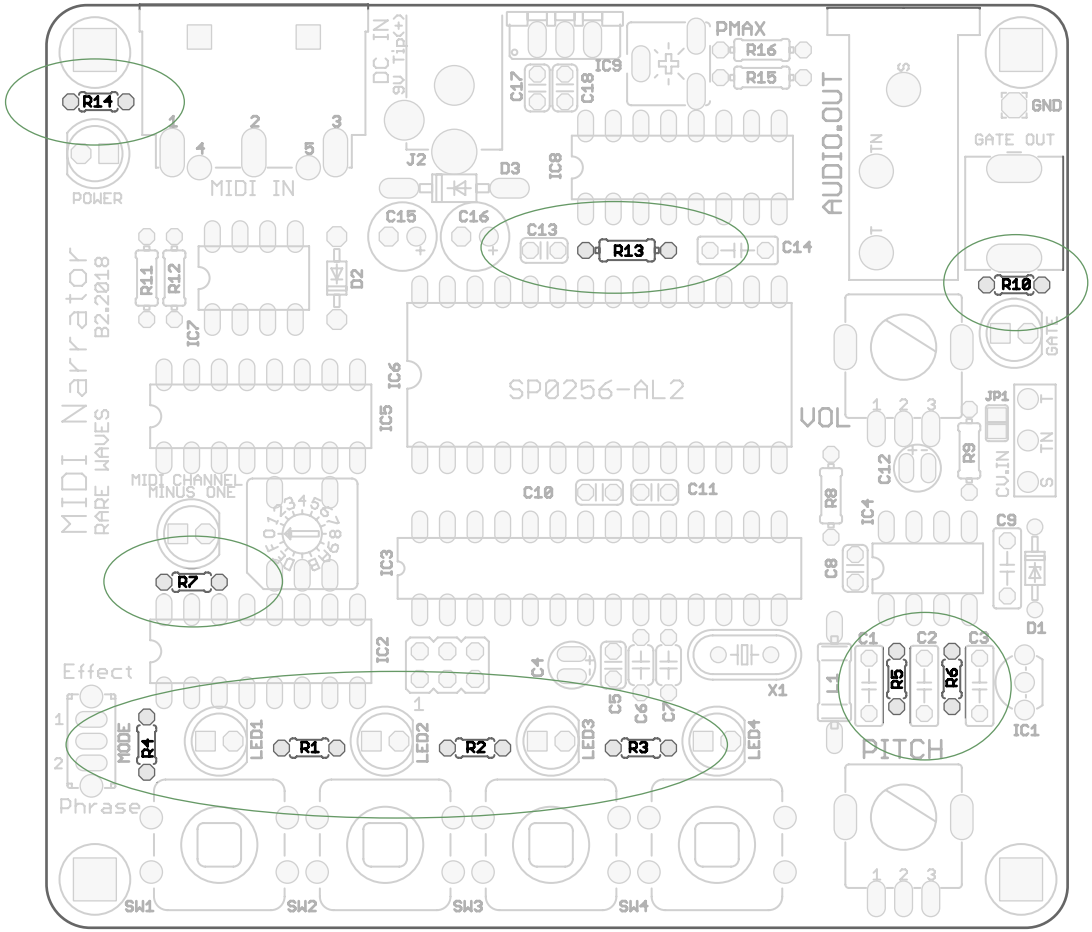
10 kΩ

Component Type

Carbon film resistor 5% 1/8W

Assembly Note

Bend leads at right angle to body, then insert through holes, solder, then clip off excess length.

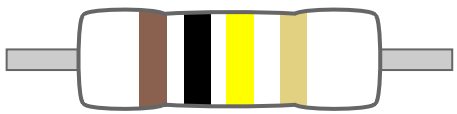


Reference

R9

Value

100 kΩ

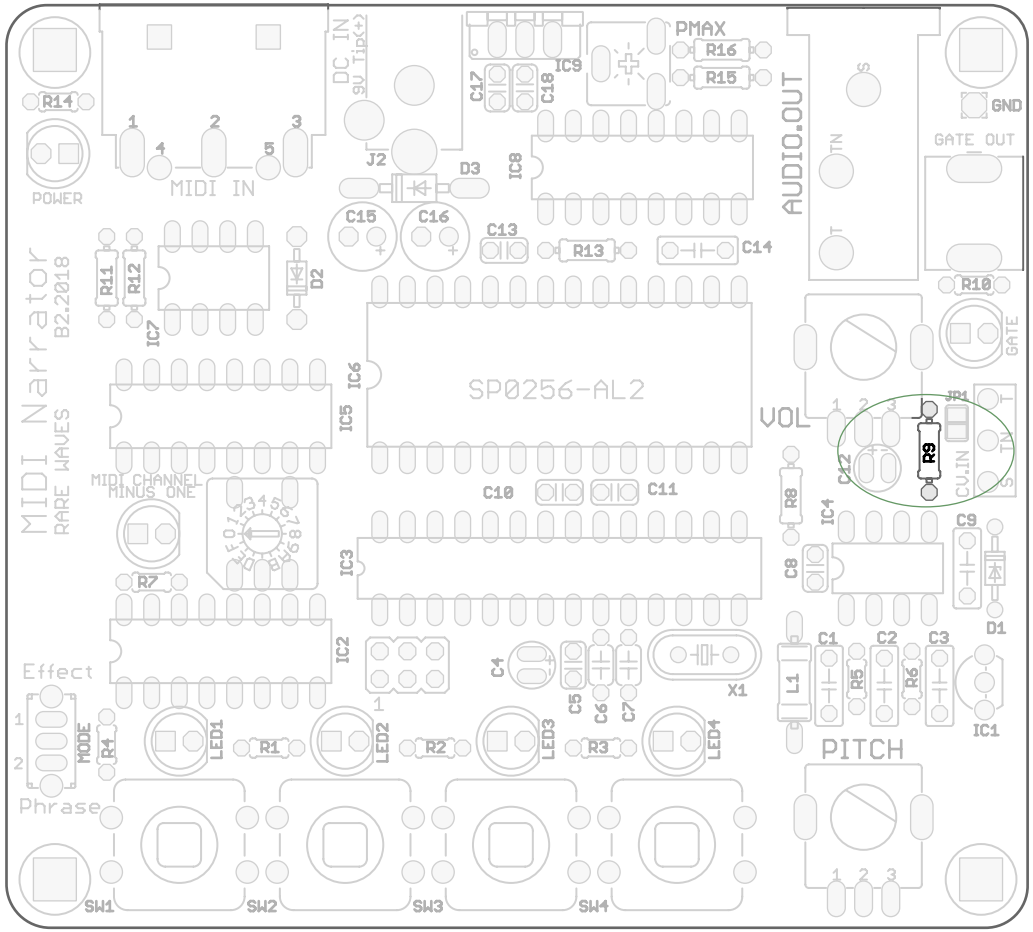


Component Type

Carbon film resistor 5% 1/4W

Assembly Note

Bend leads at right angle to body, then insert through holes, solder, then clip off excess length.




*Step 2*

Reference

R15

Value

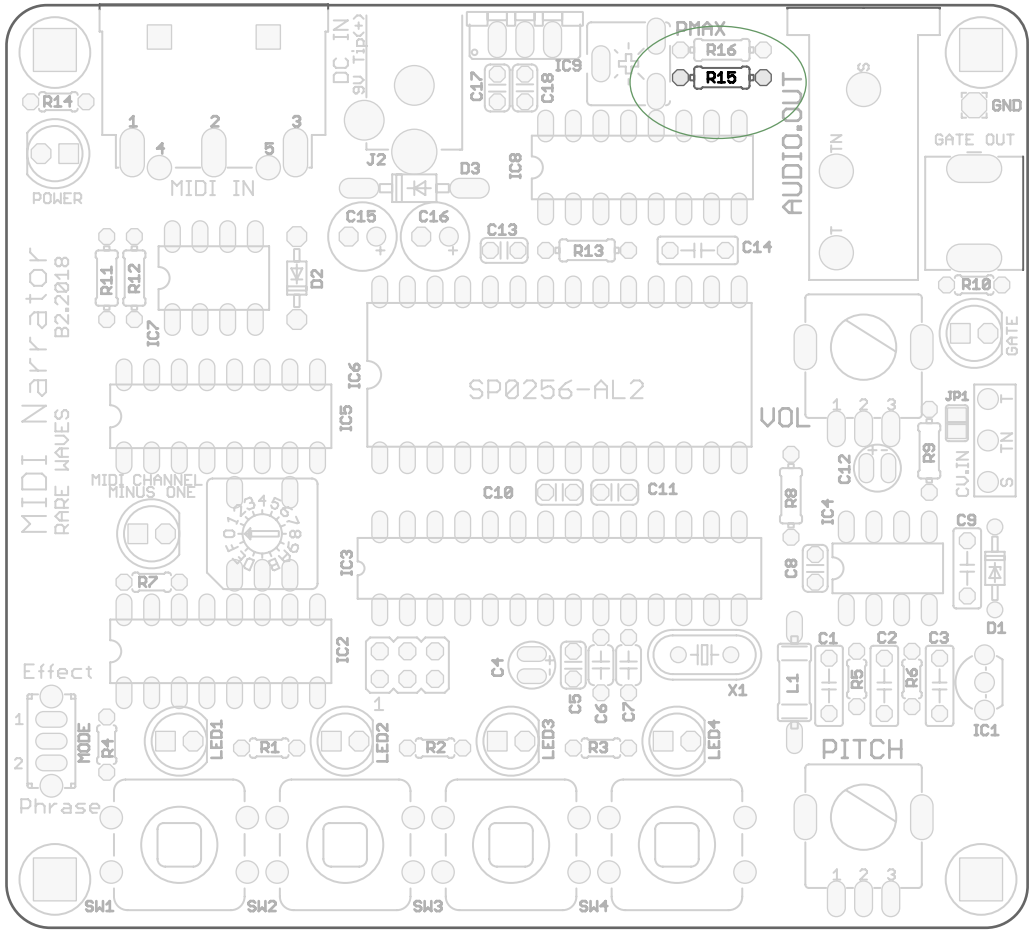
12 kΩ

Component Type

Carbon film resistor 5% 1/4W

Assembly Note

Bend leads at right angle to body, then insert through holes, solder, then clip off excess length.

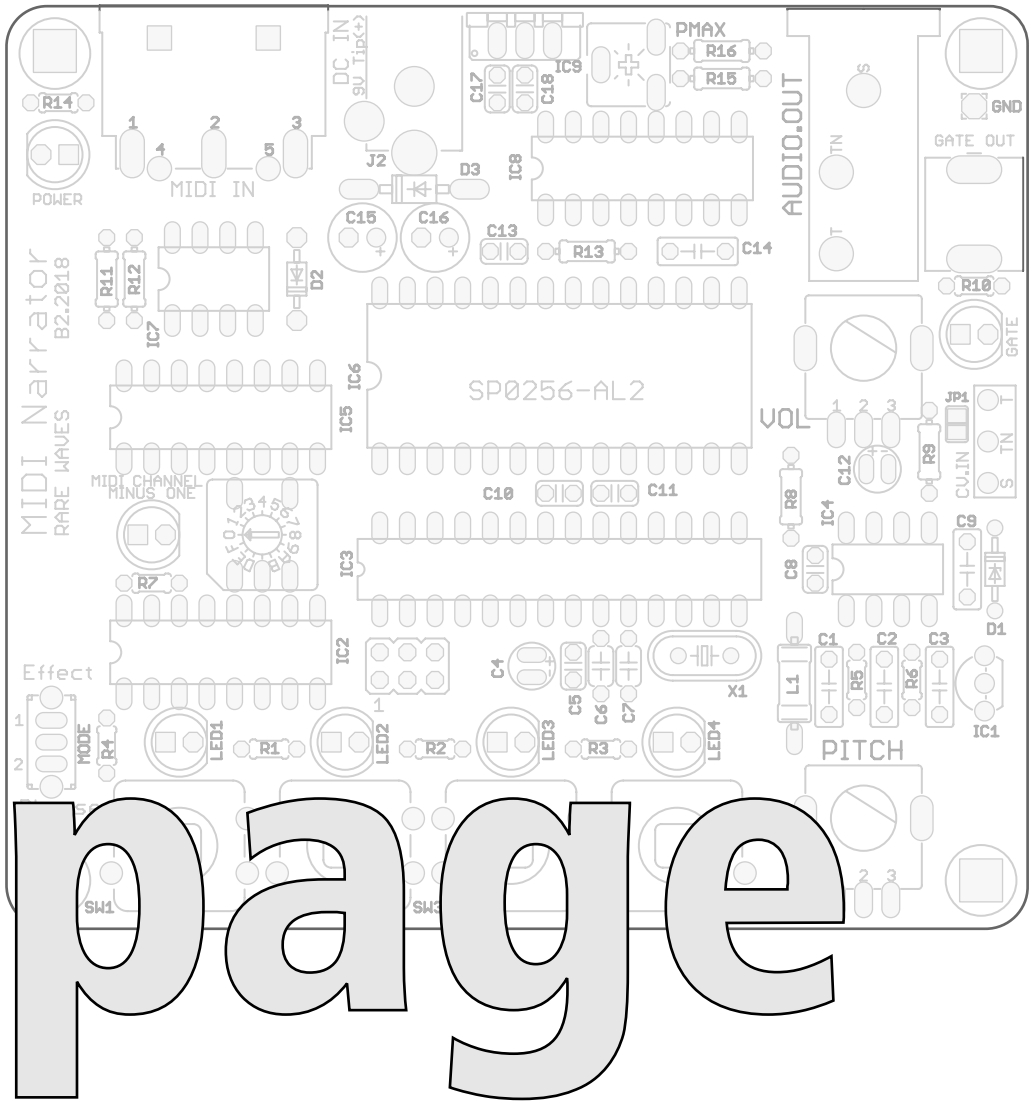


Reference

Value

Component Type

Assembly N




skip this page

*Step 4*

Reference

R12, R16

Value

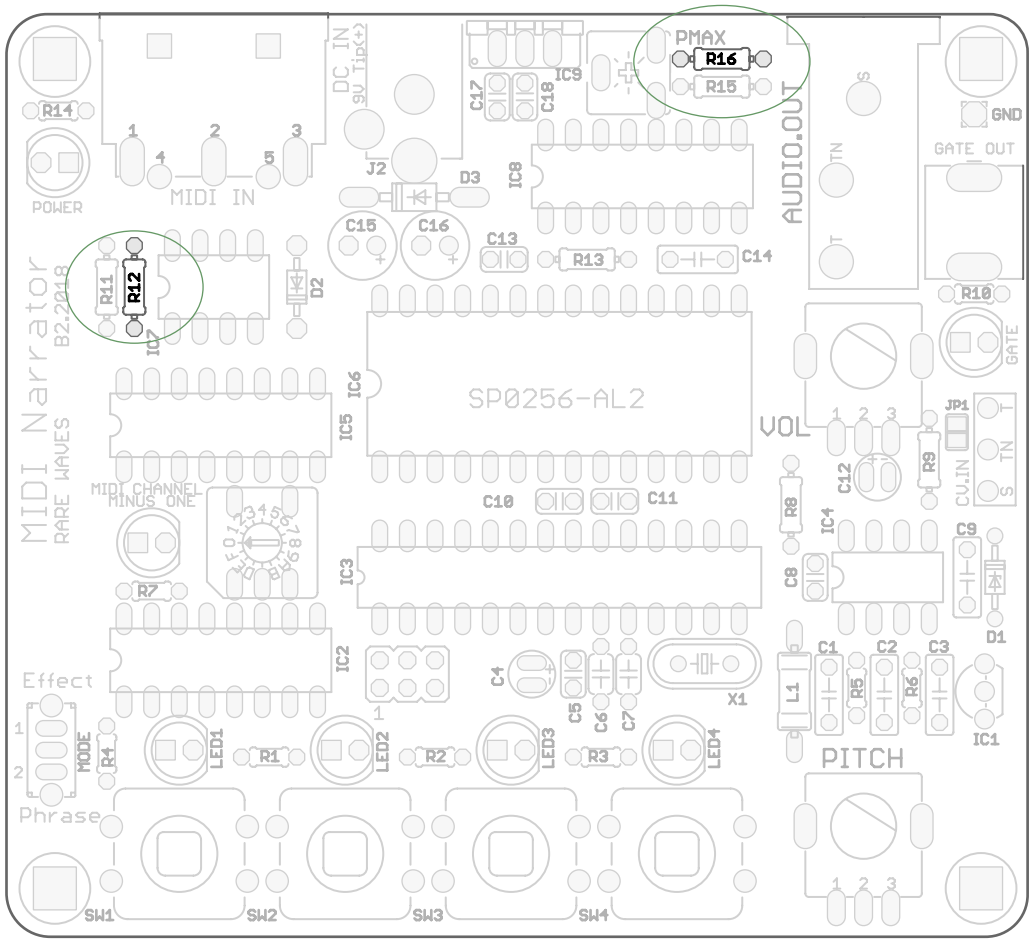
1.5 kΩ

Component Type

Carbon film resistor 5% 1/4W

Assembly Note

Bend leads at right angle to body, then insert through holes, solder, then clip off excess length.




*Step 5*

## Reference

R11

## Value

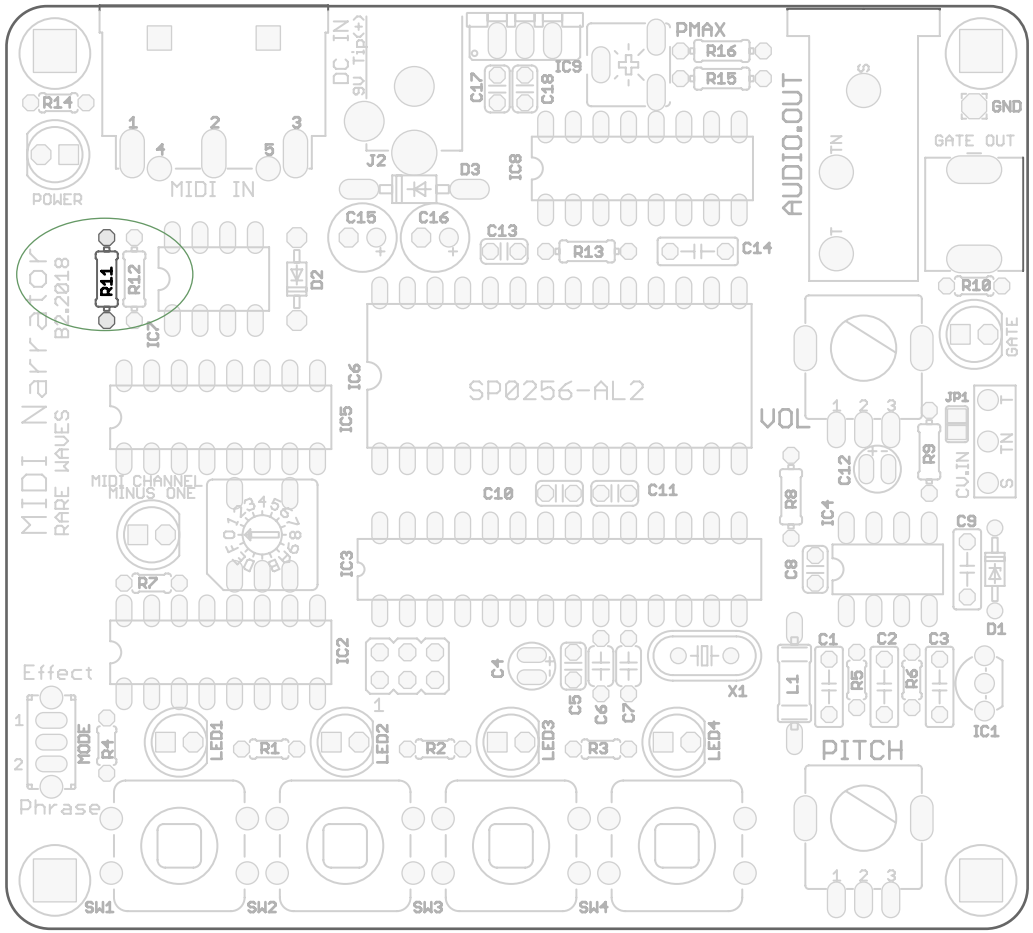
330 Ω

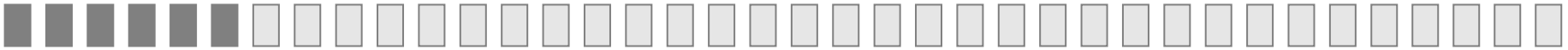
## Component Type

Carbon film resistor 5% 1/4W

## Assembly Note

Bend leads at right angle to body, then insert through holes, solder, then clip off excess length.



*Step 6*

Reference

R8

Value

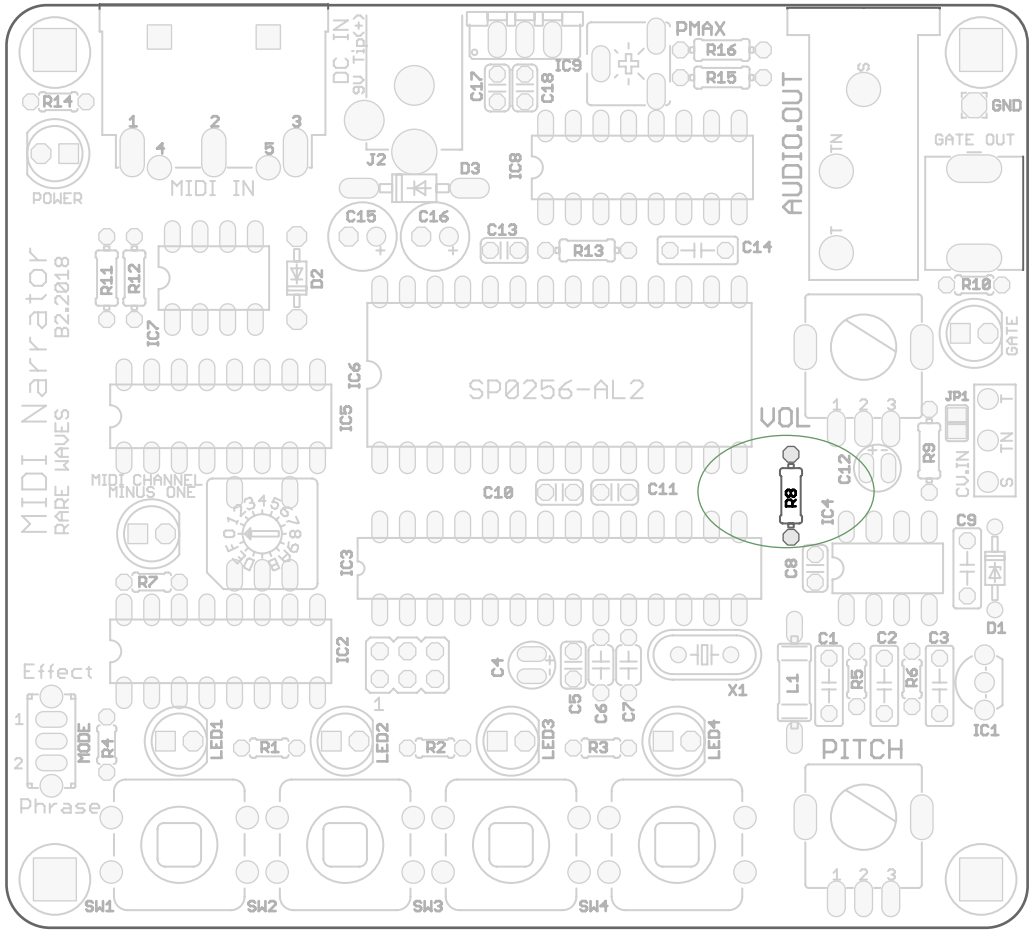
51 Ω

Component Type

Carbon film resistor 5% 1/4W

Assembly Note

Bend leads at right angle to body, then insert through holes, solder, then clip off excess length.



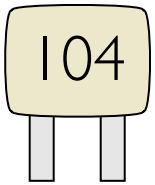

*Step 7*

Reference

C5,C8,C10,C11,C13,C17,C18

Value

0.1 µF

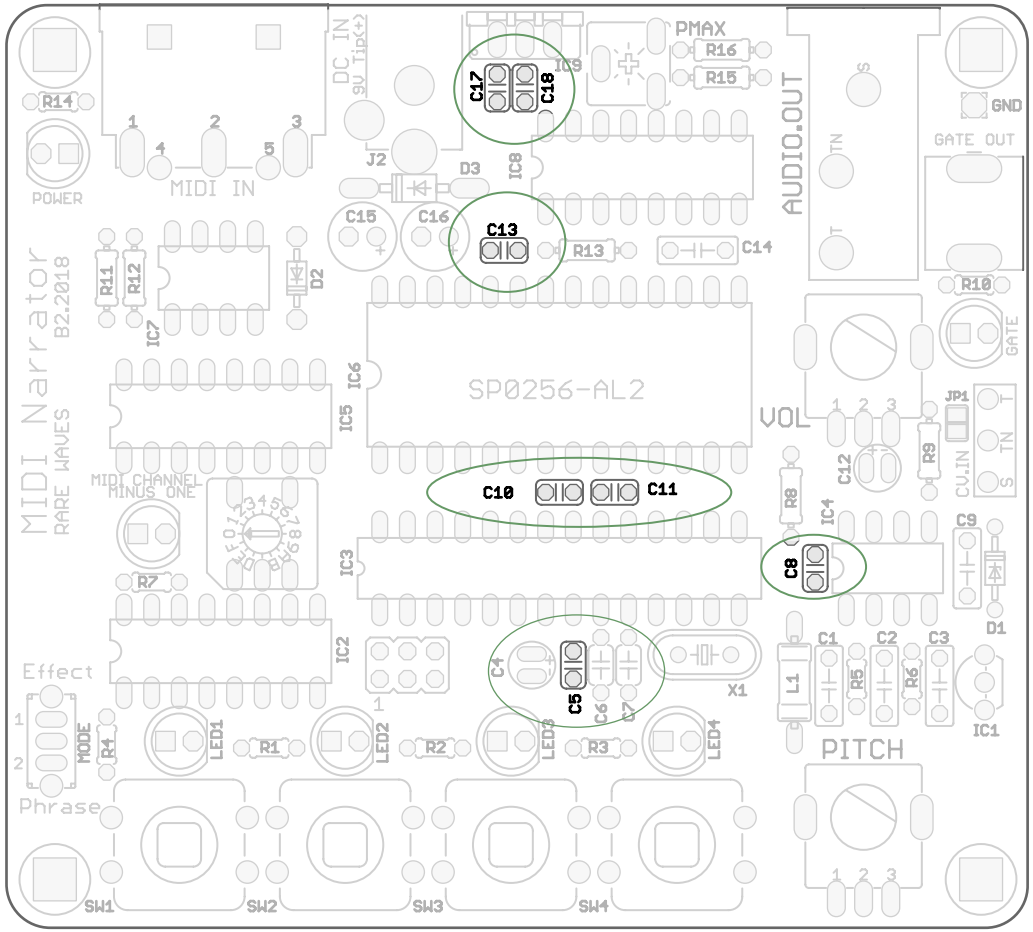



Component Type

Ceramic capacitor X7R 20%

Assembly Note

Non-polarized




*Step 8*

## Reference

D3

## Value

1N4001

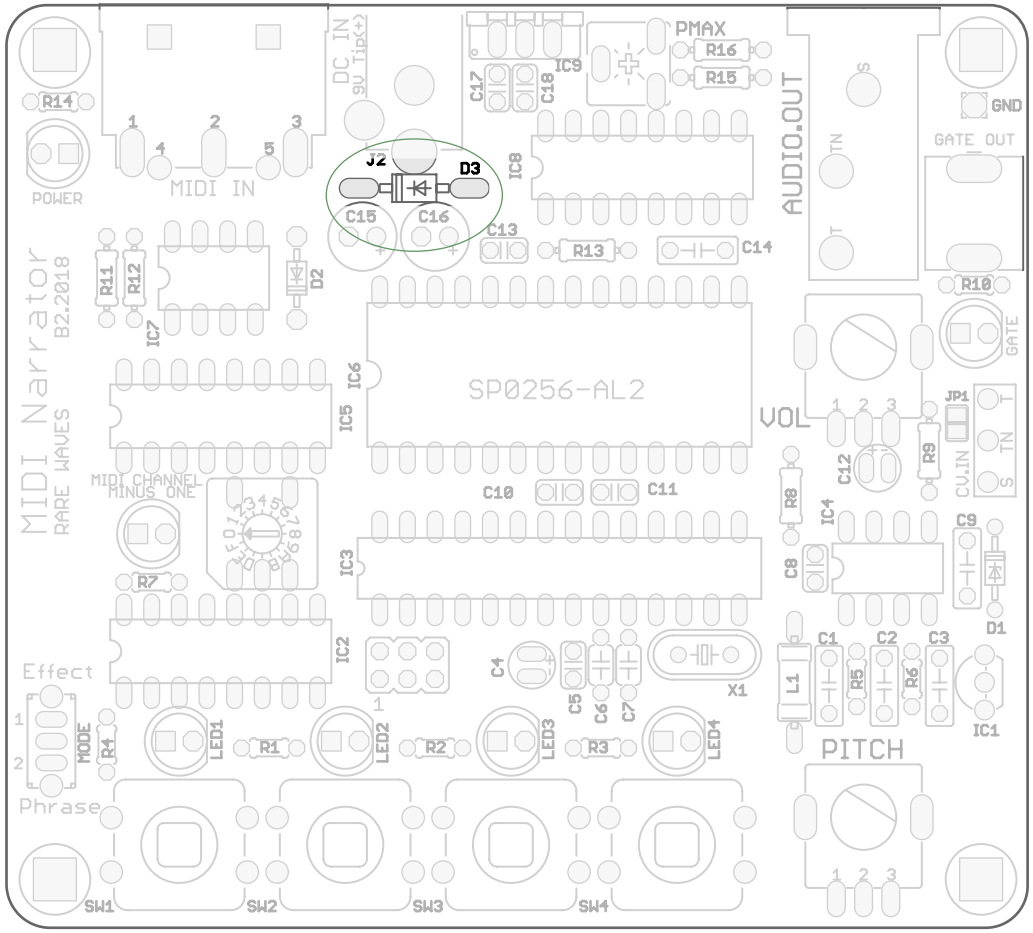
## Component Type

Silicon rectifier diode

## Assembly Note

Bend leads at right angles to body of diode, Use needle nose pliers to hold component lead while making the bends.

Striped end of diode must be oriented as shown on silkscreen.




Reference

D1,D2

Value

1N5231C

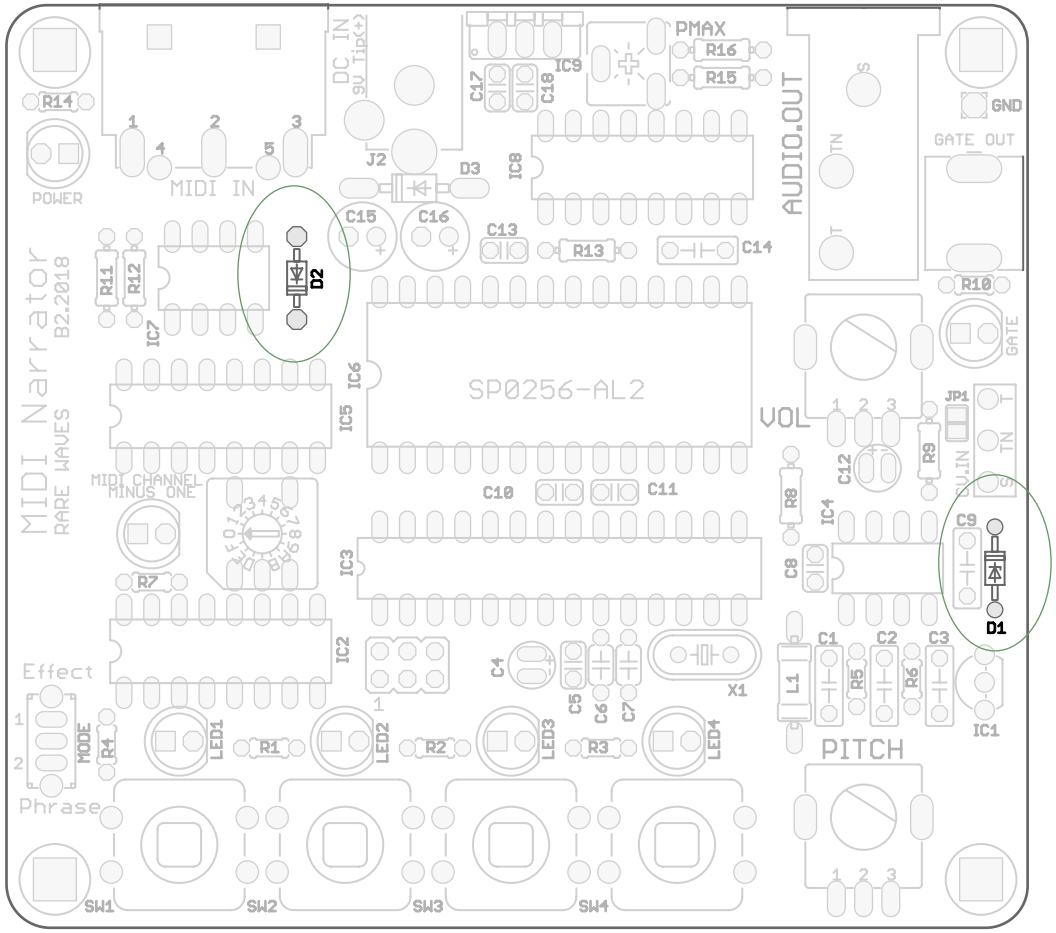
Component Type

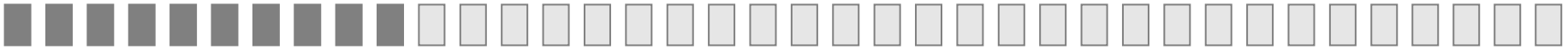
Zener diode 5.1V 500mW

Assembly Note

Bend leads at right angles to body of diode, Use needle nose pliers to hold component lead while making the bends

Striped end of diode must be oriented as shown on silkscreen.



*Step 10*

Reference

IC 6 Socket

Value

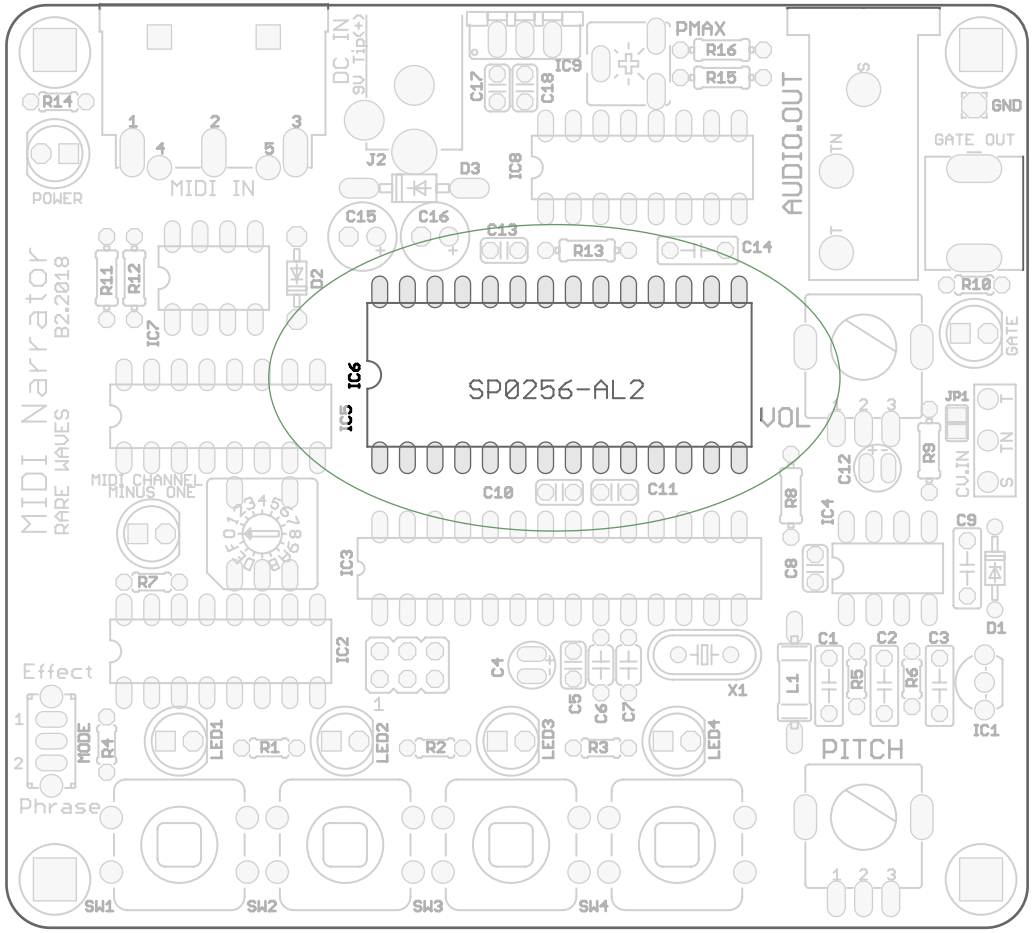
28 pin

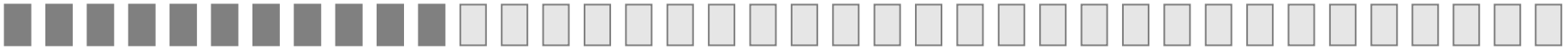
Component Type

DIP-28 wide socket

Assembly Note

Align notch in edge of socket to reference mark on silkscreen.
Do not install the speech chip in the socket yet.



Reference

IC 3 Socket

Value

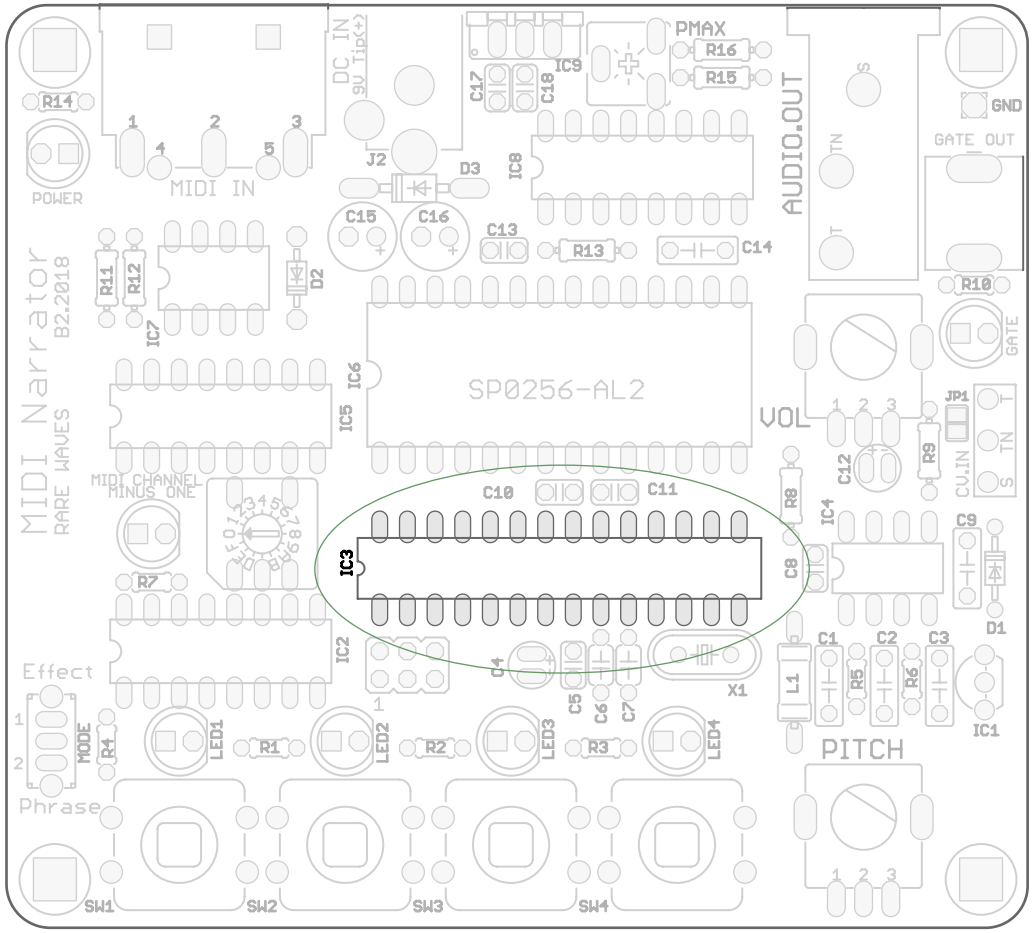
28 pin

Component Type

DIP-28 narrow socket

Assembly Note

Align notch in edge of socket to reference mark on silkscreen.
Do not install the microcontroller in the socket yet.

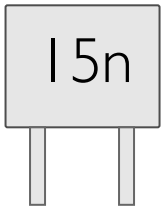


Reference

C2,C3

Value

15 nF



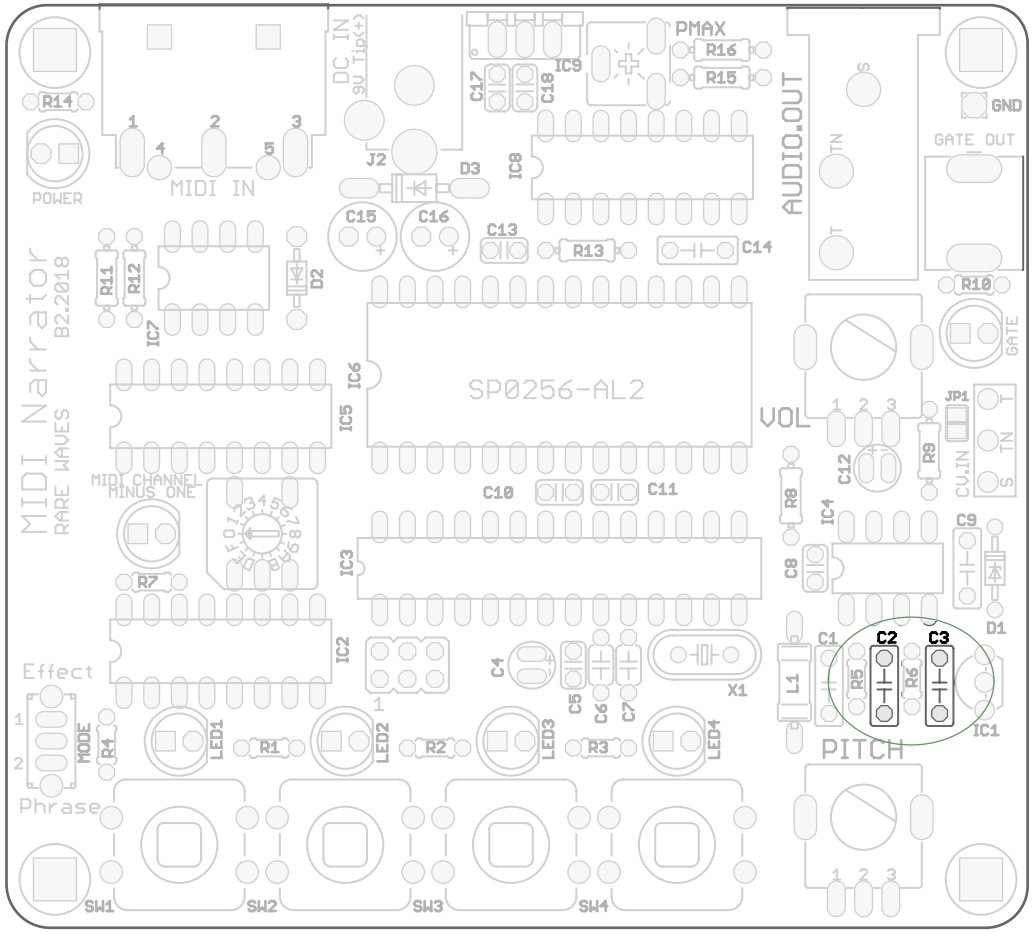

Component Type

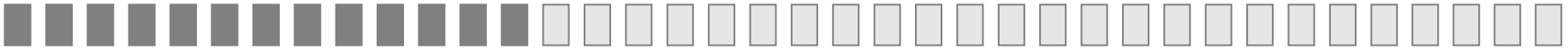
Poly film capacitor 10%

Assembly Note

Non-polarized

Rectangular plastic box



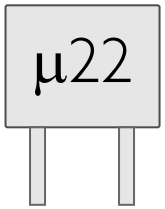
*Step 13*

Reference

C1,C9

Value

220 nF



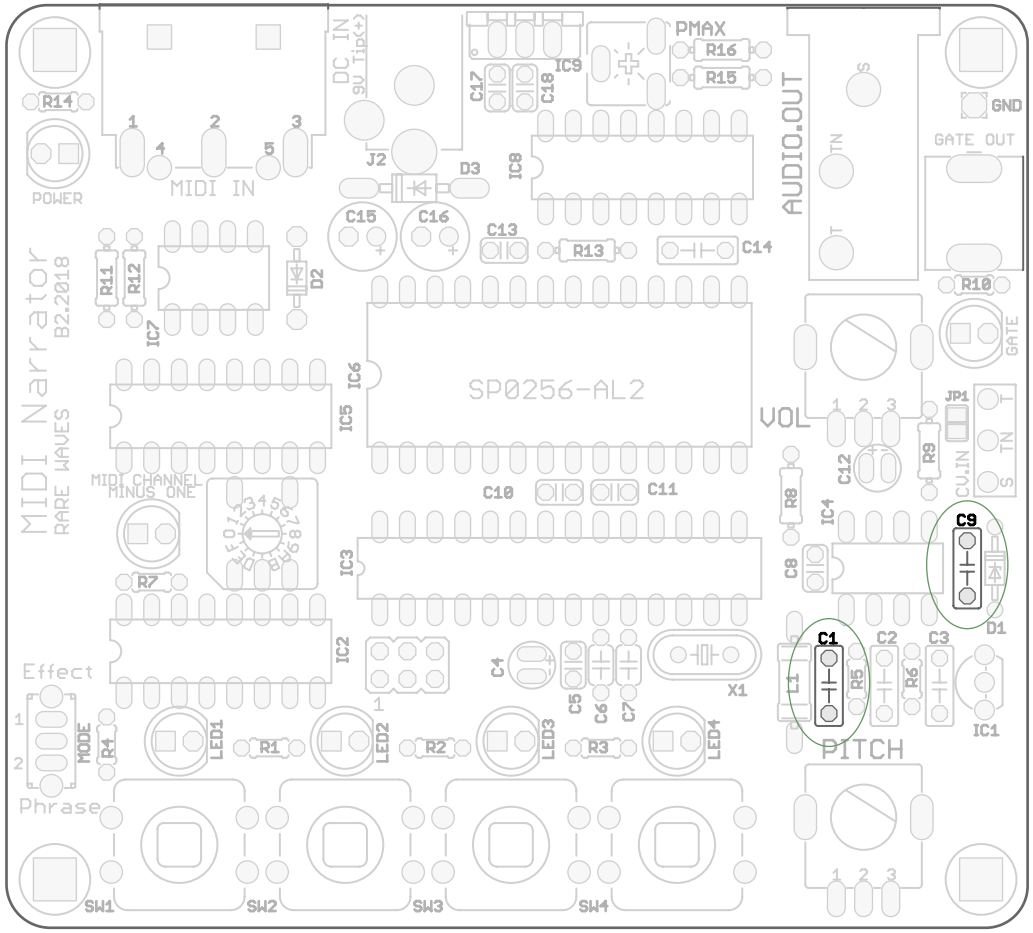

Component Type

Poly film capacitor 10%

Assembly Note

Non-polarized

Rectangular plastic box




*Step 14*

Reference

X1

Value

8.000 MHZ

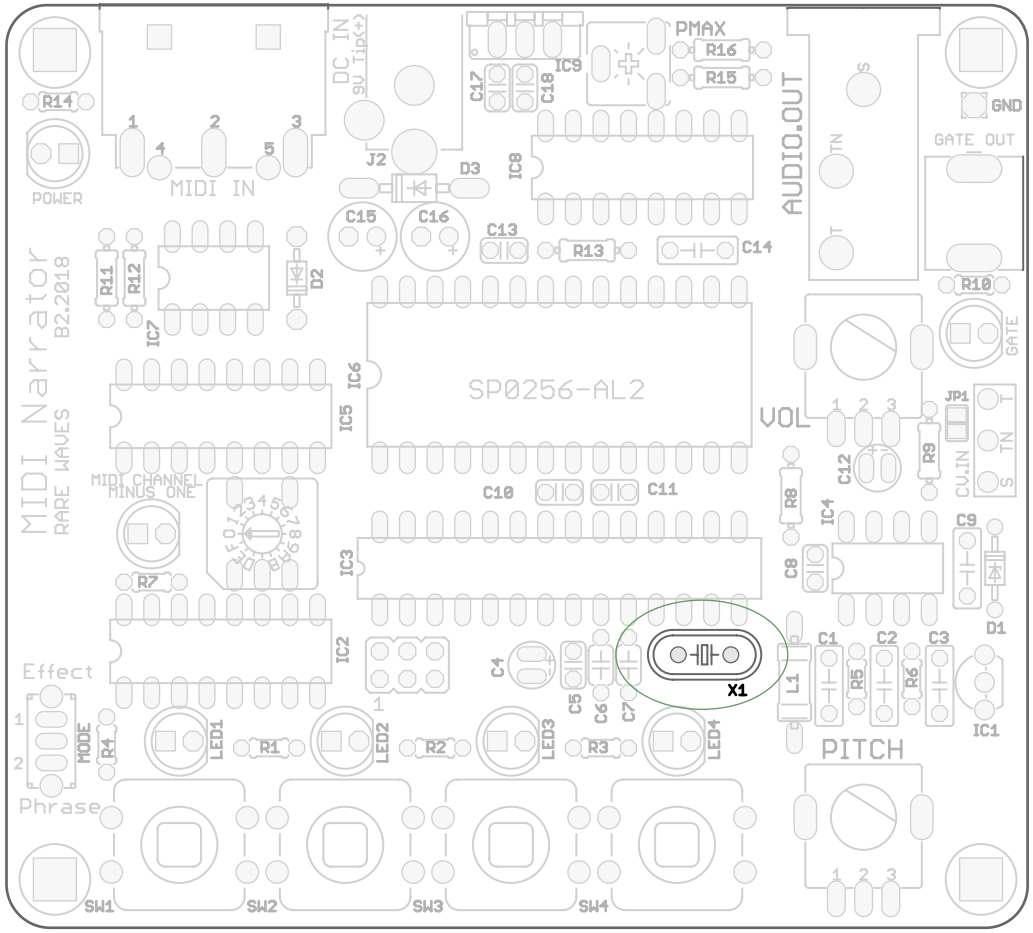
Component Type

Frequency control crystal HC49-U

Assembly Note

Metal package

Non-polarized

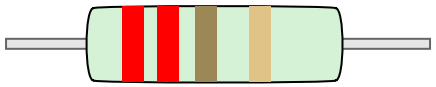


## Reference

L1

## Value

220 µH



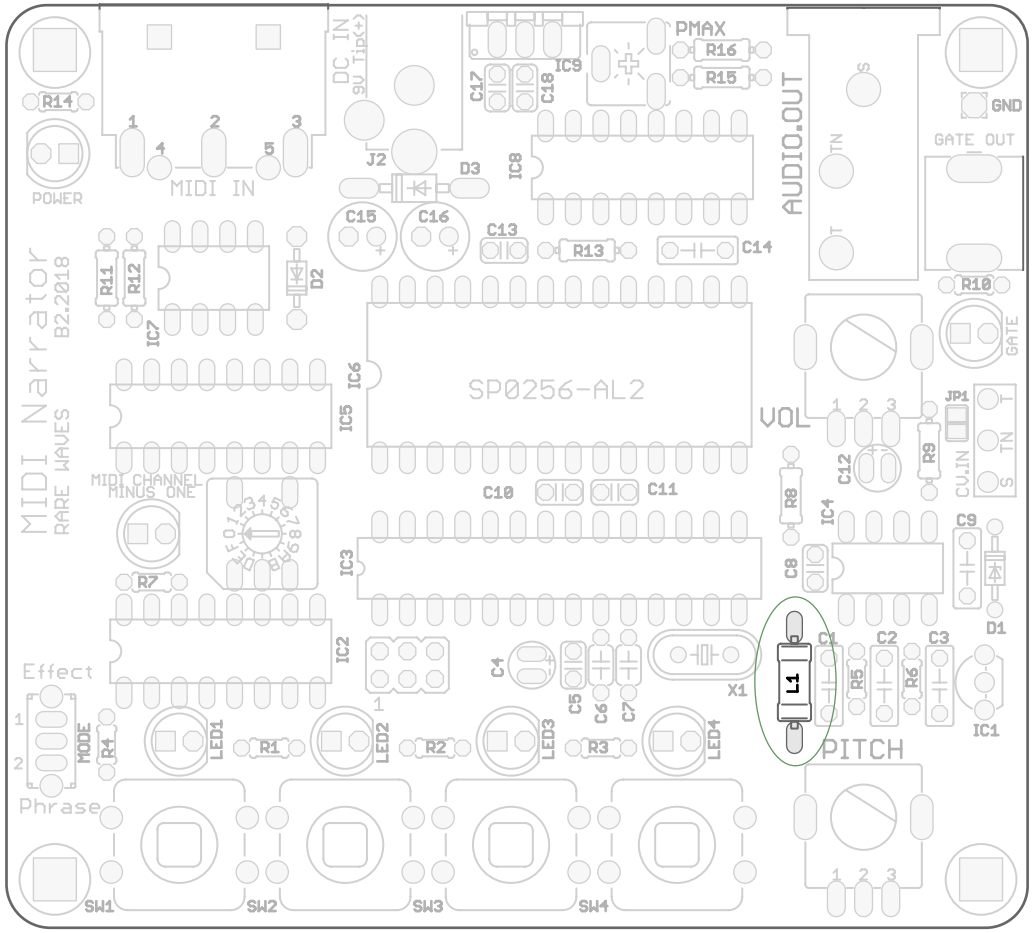
## Component Type

Ferrite core inductor, axial leads

## Assembly Note

Bend leads at right angle to body.
Hold leads with needle nose pliers while making the bends.

Non-polarized

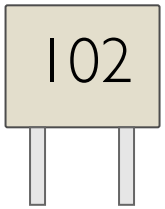


Reference

C14

Value

1 nF

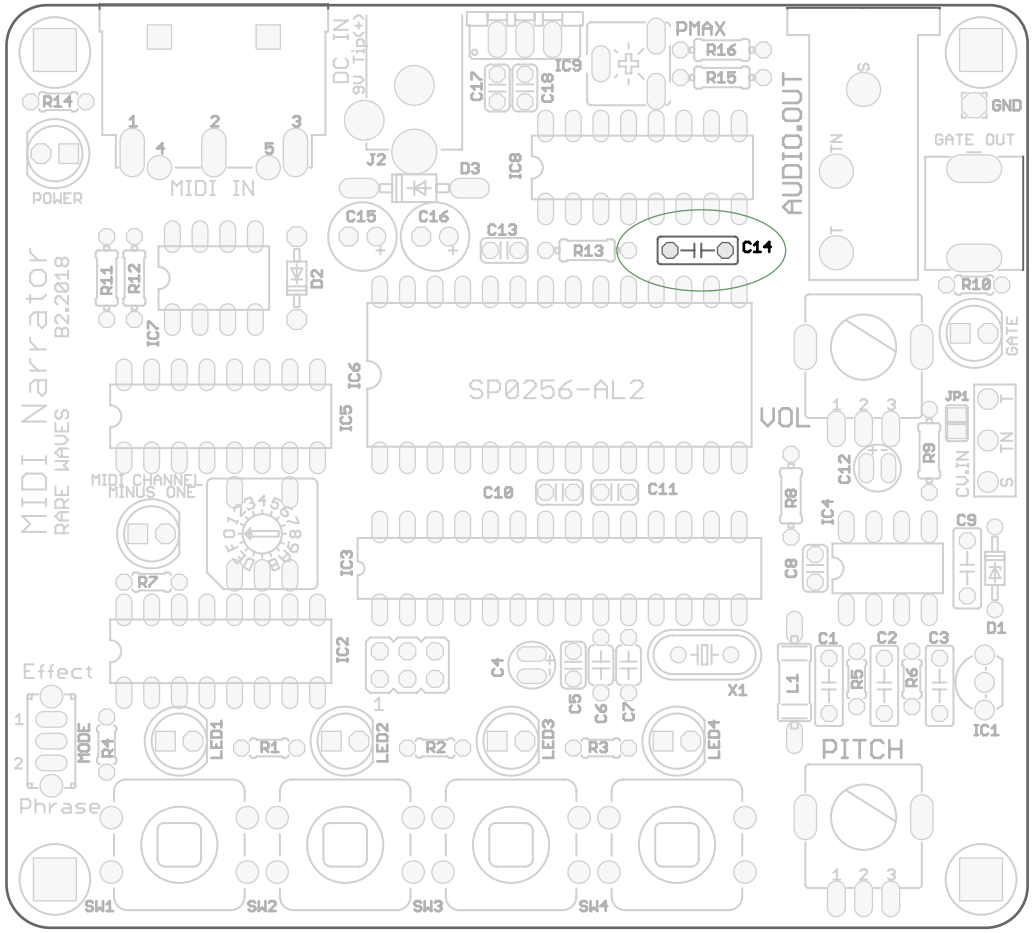



Component Type

Ceramic capacitor, C0G 5%

Assembly Note

Non-polarized



Reference

LED1,LED2,LED3,LED4,MIDI,GATE,POWER

Value

5mm red LED

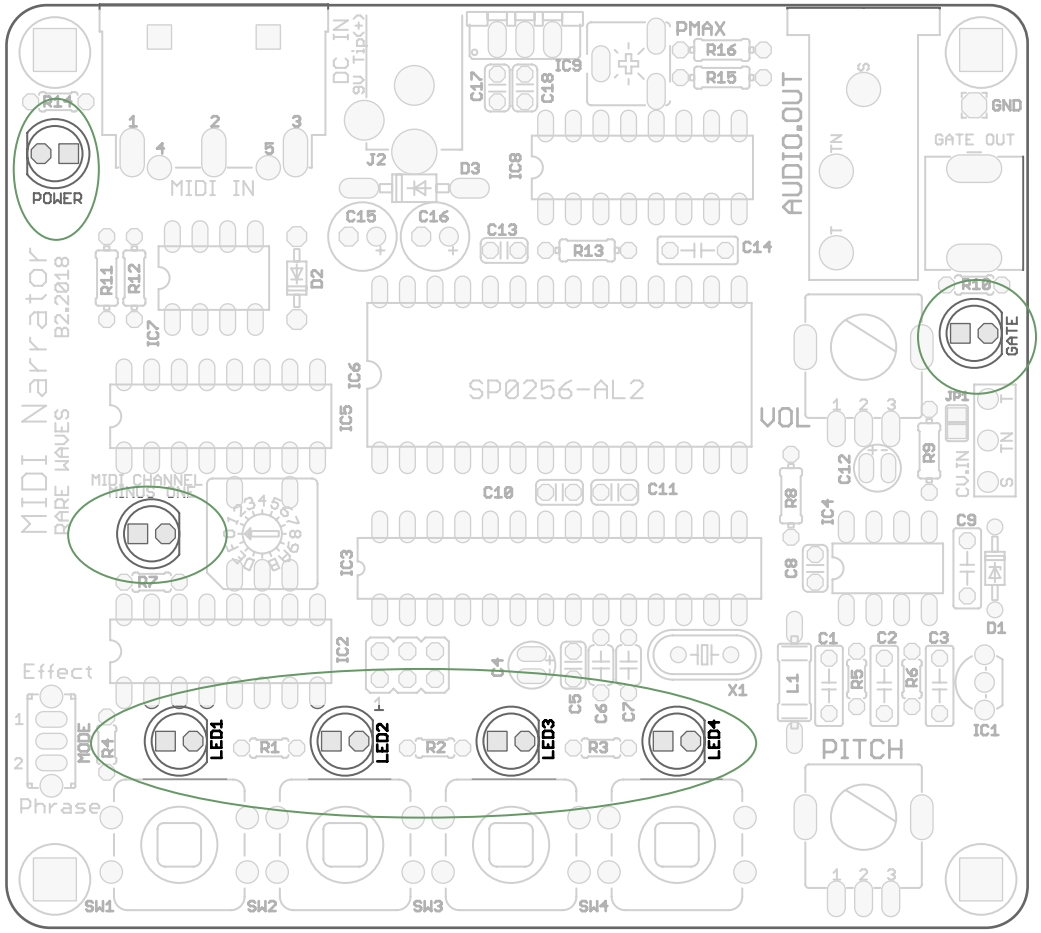
Component Type

High efficiency (5,000 mcd)

Assembly Note

Insert longer lead of the LED into the square-shaped pad.

Flat edge of LED is indicated by the outline on the silkscreen



Reference

IC2,IC5

Value

74HC595N

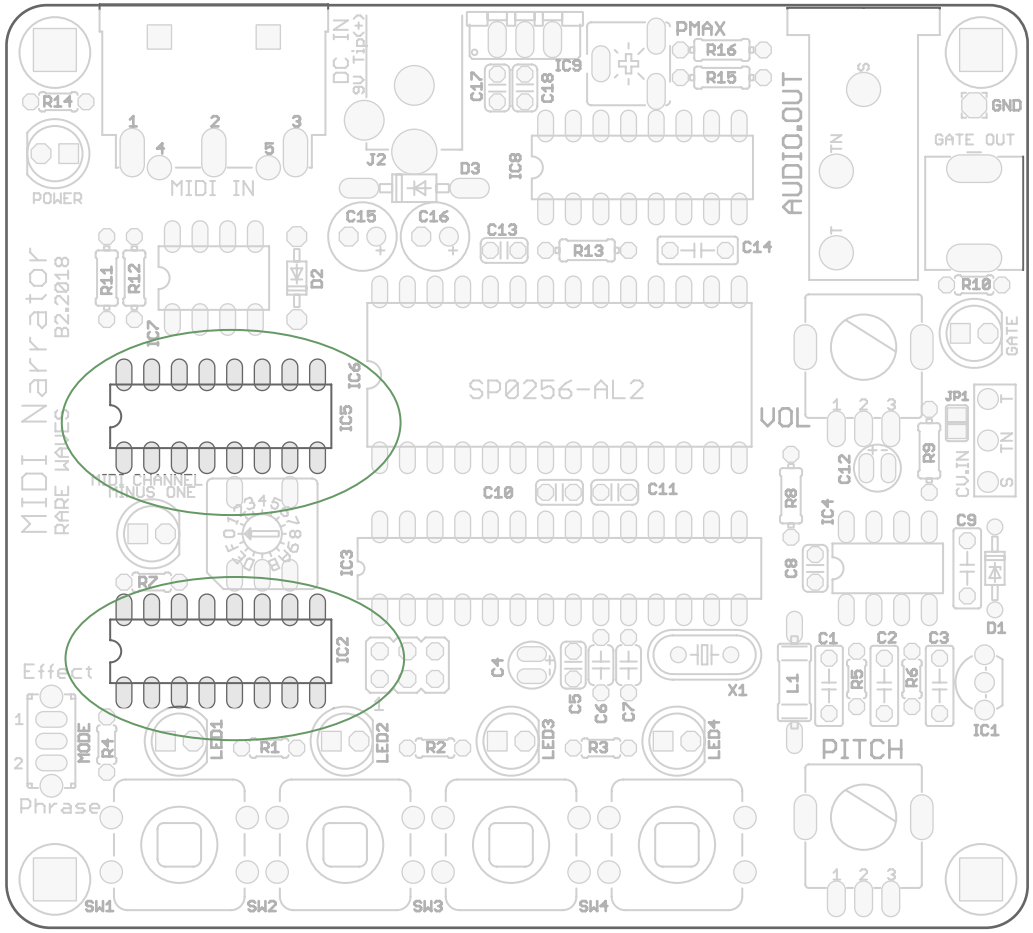
Component Type

Shift register

Assembly Note

Sockets are not used.

Align IC with the notch on the silkscreen




Reference

IC 8

Value

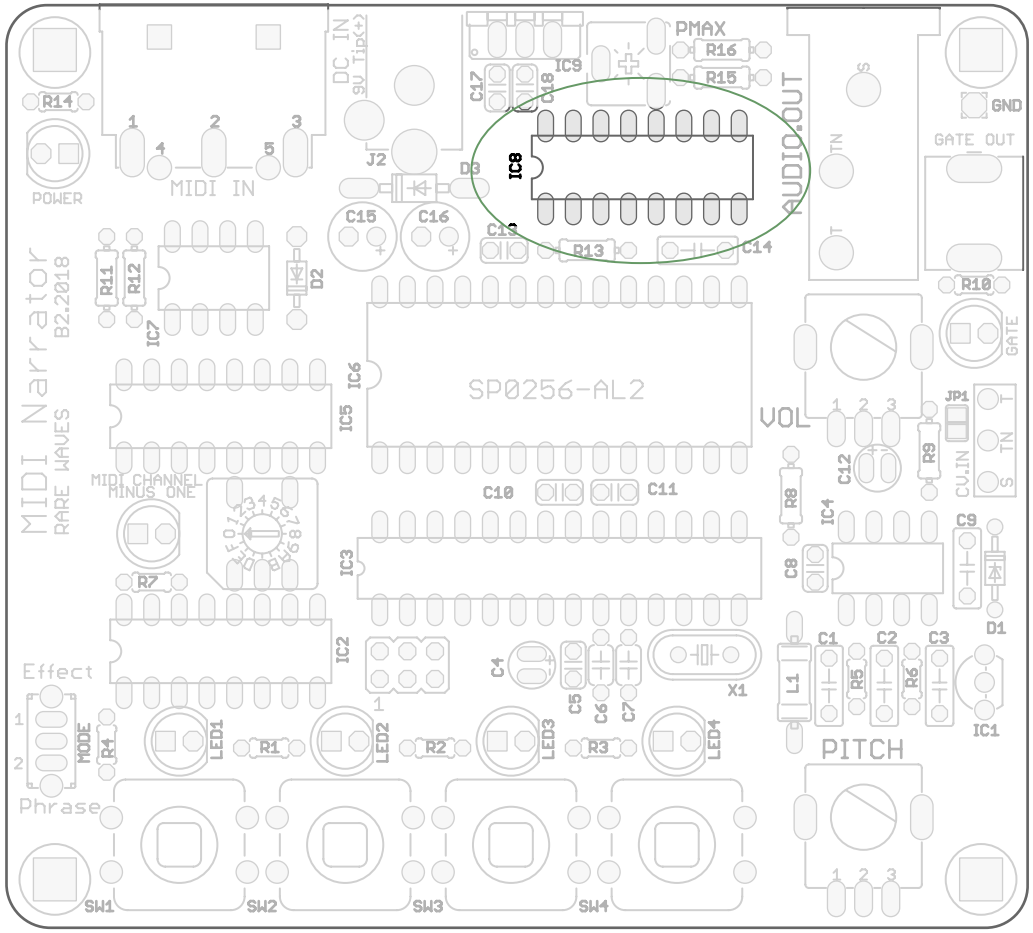
74HC4046AE

Component Type

Phase Locked Loop and VCO

Assembly Note

Socket is not used
Align IC with the notch on the silkscreen



Reference

IC 7

Value

6N138

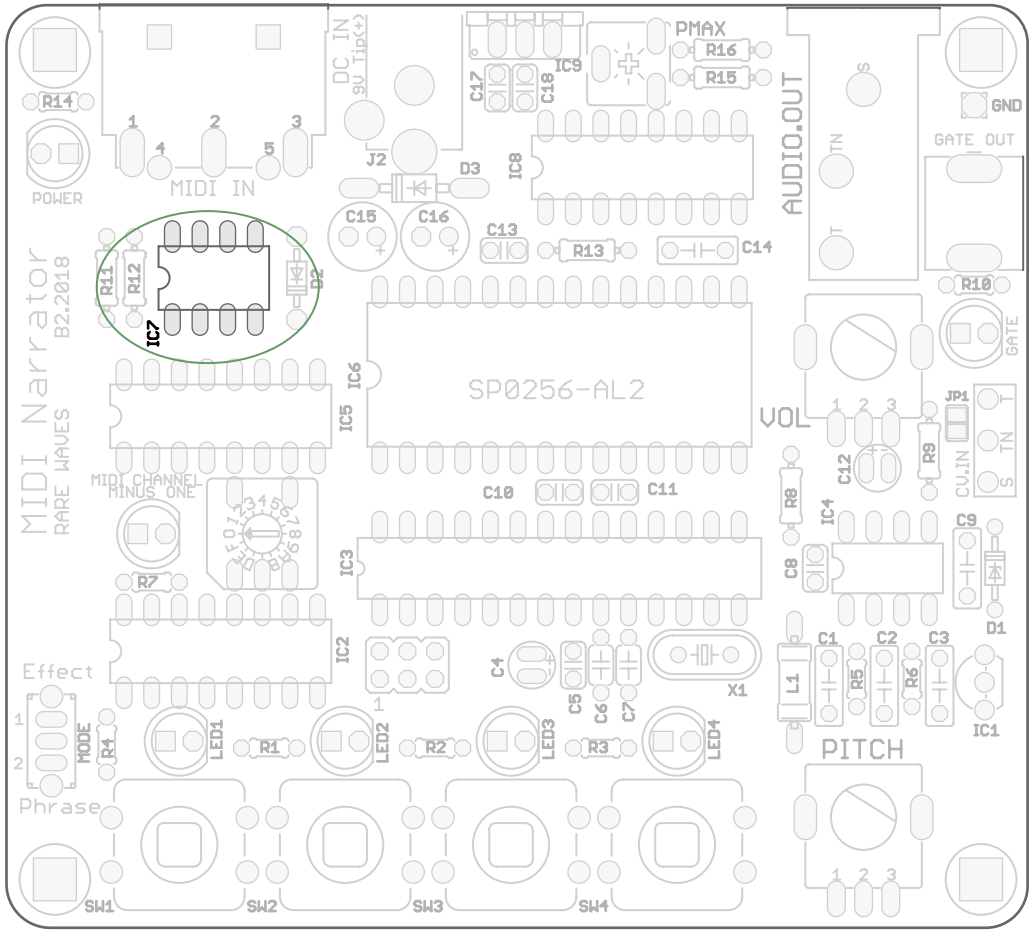
Component Type

Optocoupler

Assembly Note

Socket is not used

Align IC with the notch on the silkscreen




*Step 21*

Reference

IC 4

Value

LM 358

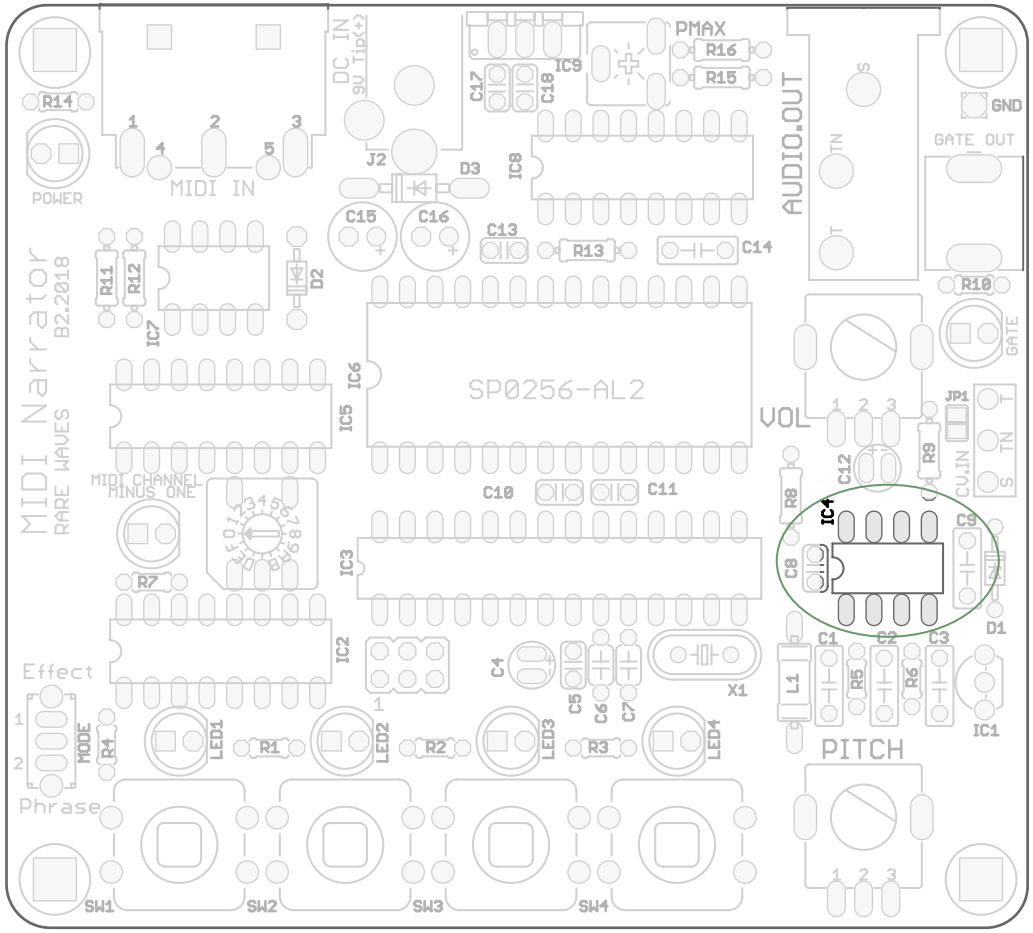
Component Type

Dual op amp

Assembly Note

Socket is not used

Align IC with the notch on the silkscreen



Reference

C4,C12

Value

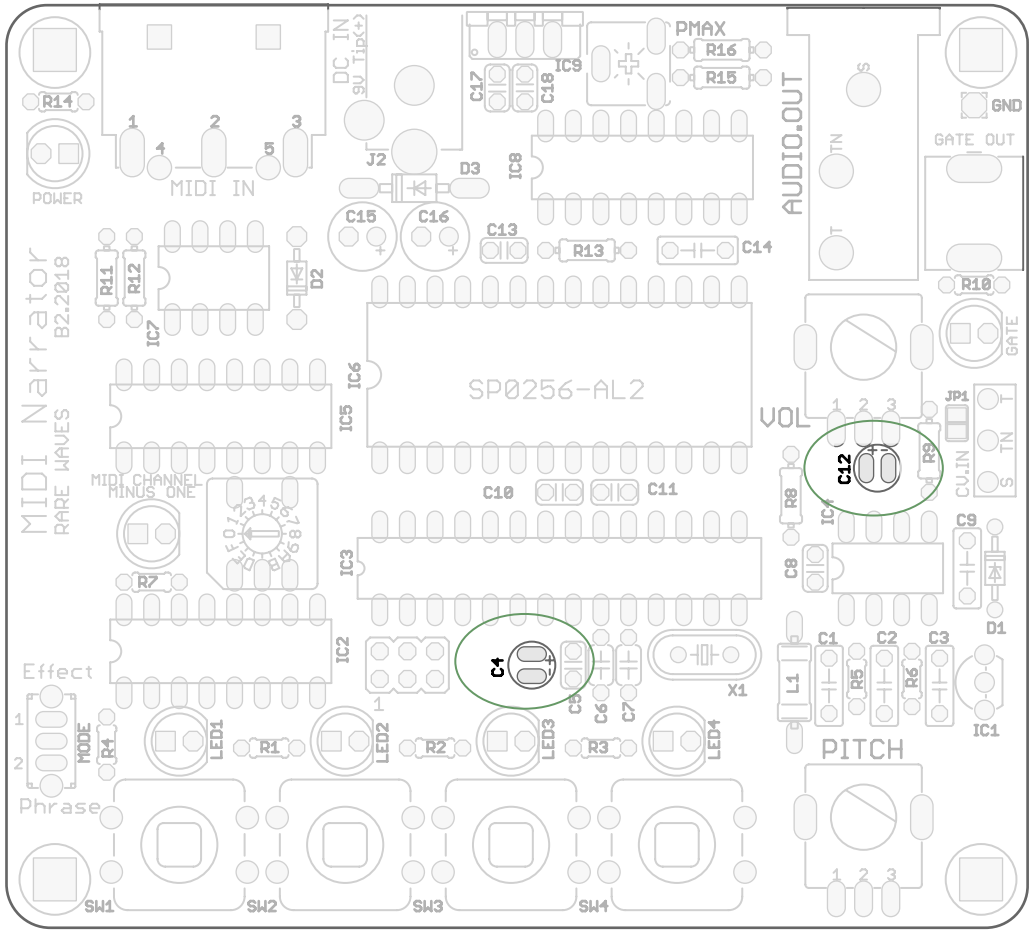
22 µF

Component Type

Electrolytic capacitor 16V

Assembly Note

Long lead goes in the hole marked with plus (+) sign

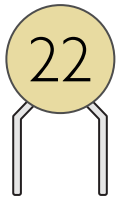


Reference

C6,C7

Value

22 pF

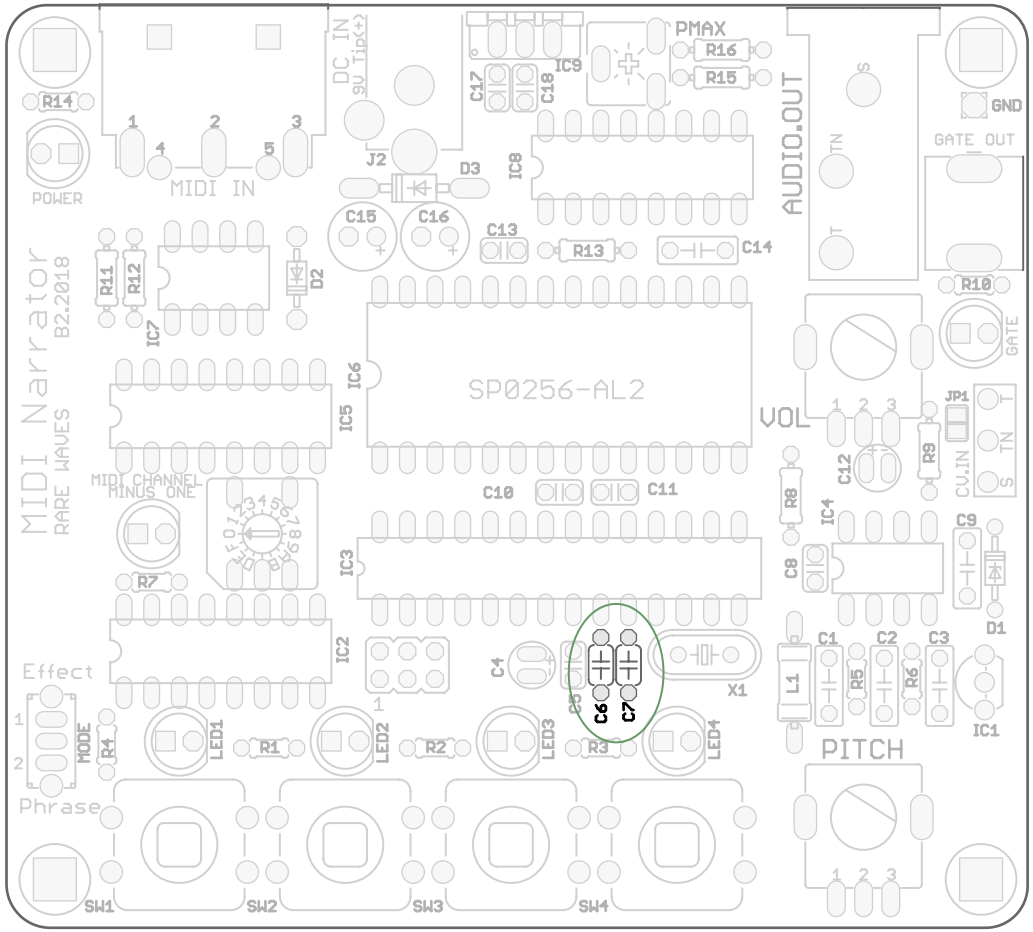



Component Type

Ceramic disc capacitor C0G 10%

Assembly Note

Non-polarized



Reference

MODE switch

Value

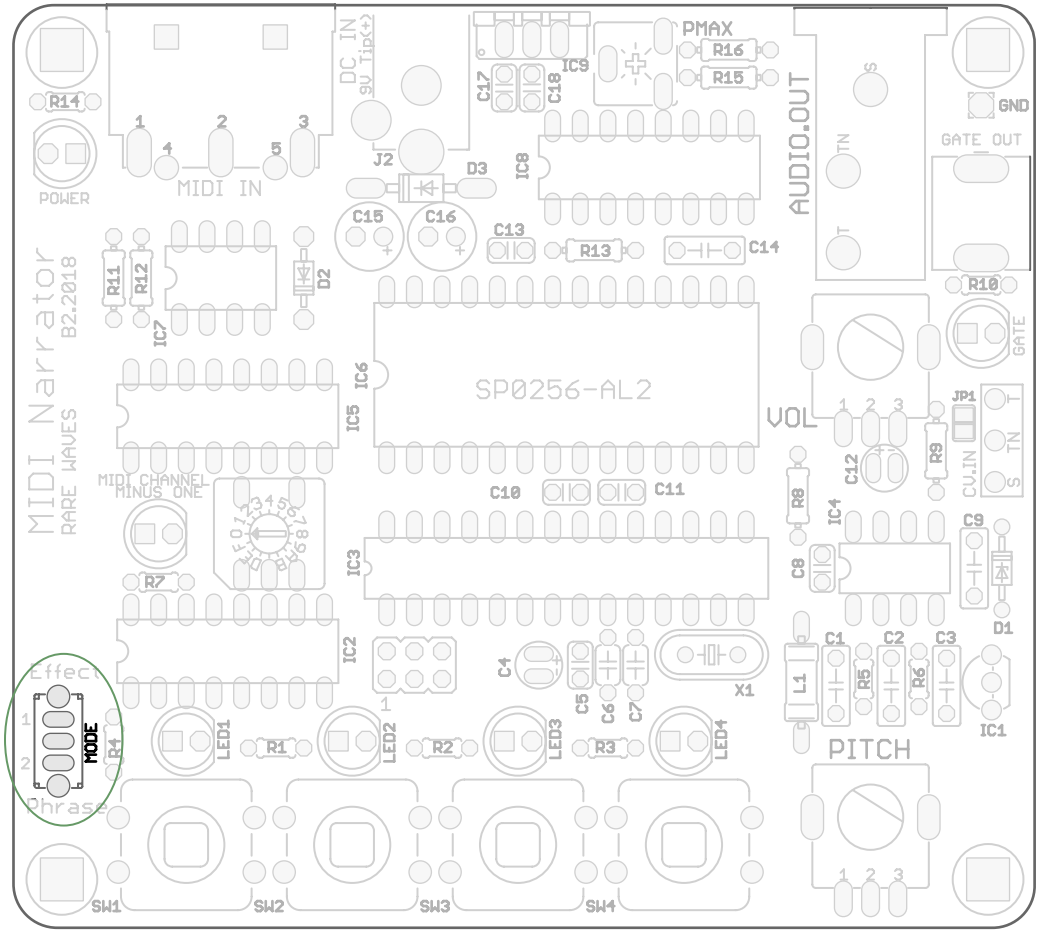
SPDT

Component Type

Slide switch

Assembly Note

Non-polarized



Reference

SW1,SW2,SW3,SW4

Value

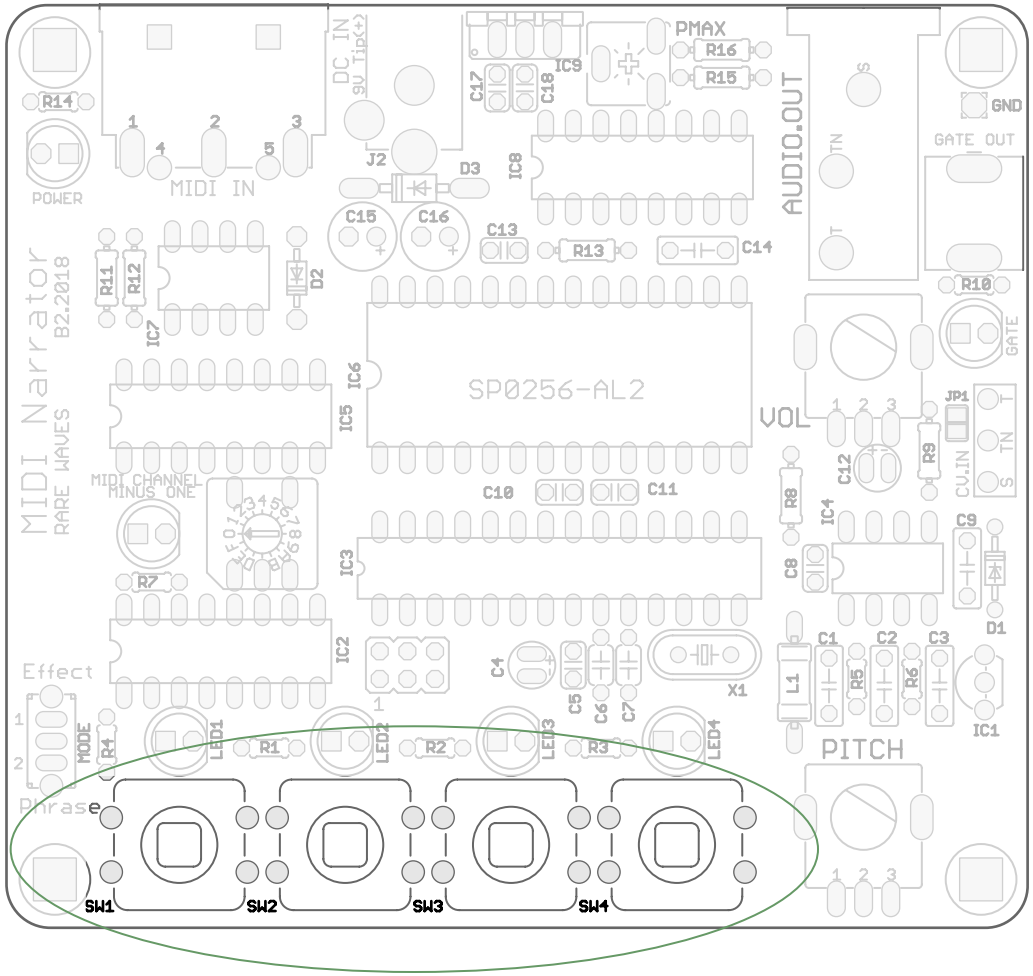
SPST

Component Type

Tactile pushbutton, N.O.

Assembly Note

Non-polarized



Reference

J2

Value

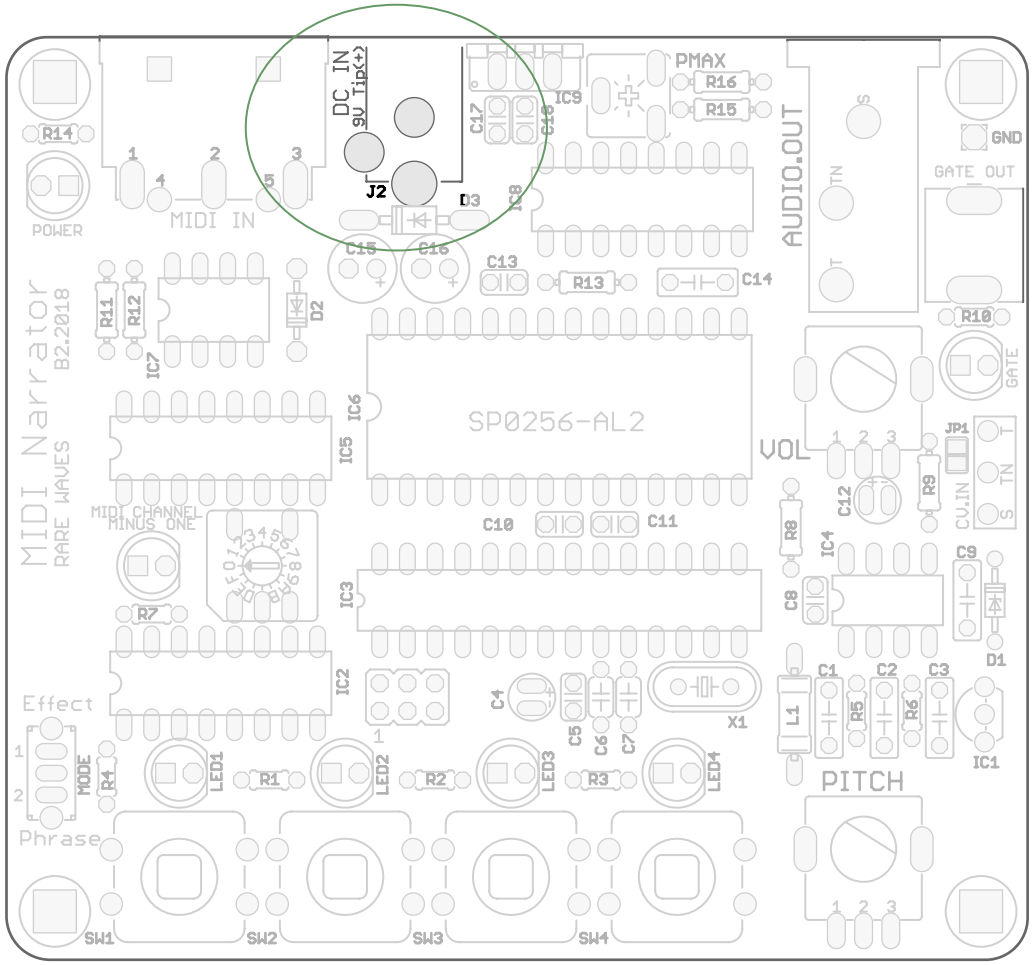
DC Input

Component Type

2.1mm round connector, tip positive

Assembly Note

N/A



Reference

PMAX

Value

1 kΩ

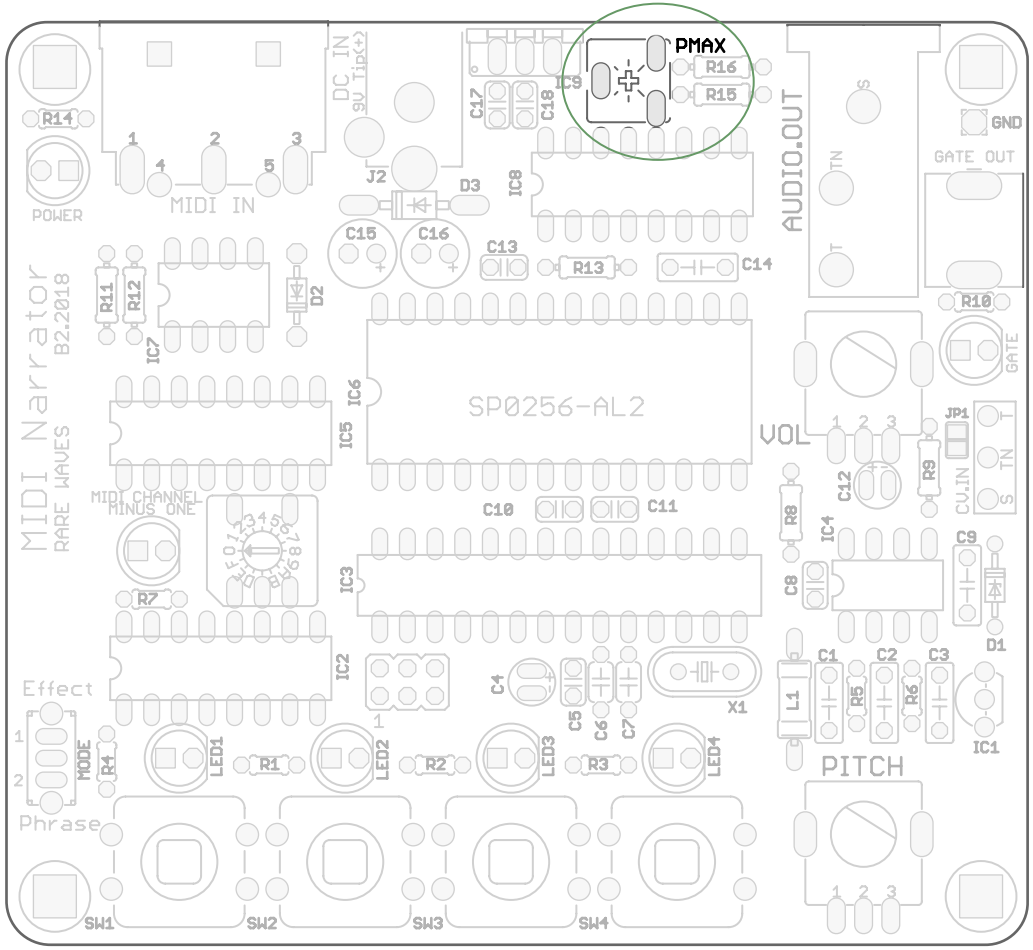
Component Type

Trim pot, screwdriver adjust

Assembly Note

The PMAX trimmer sets the high pitch limit of the tuning range. As a default, set it to the midpoint of its rotation.

If the speech chip malfunctions when the PITCH knob is turned up all the way, you must power down MIDI Narrator, reduce PMAX, then restart.



Reference

S1

Value

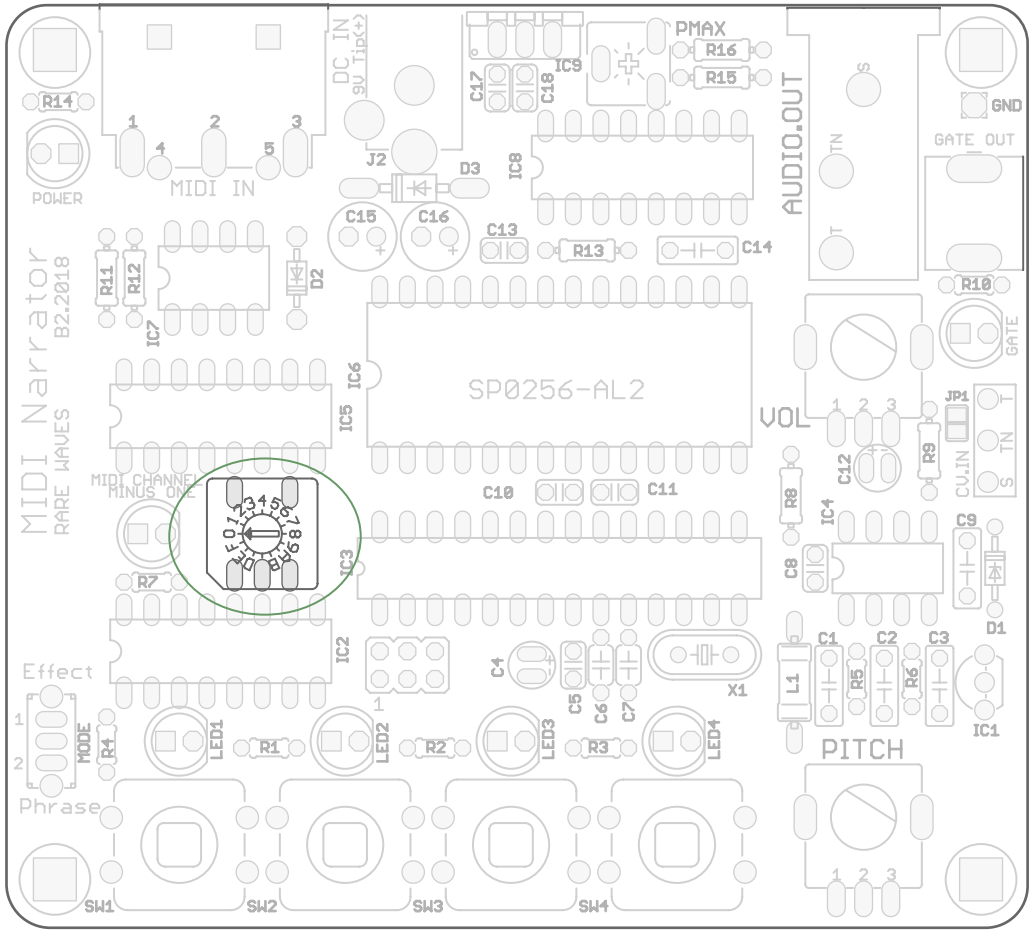
Rotary switch

Component Type

16-position binary coded rotary switch

Assembly Note

Orient the switch so the printing on its body matches the silkscreen



Reference

C15,C16

Value

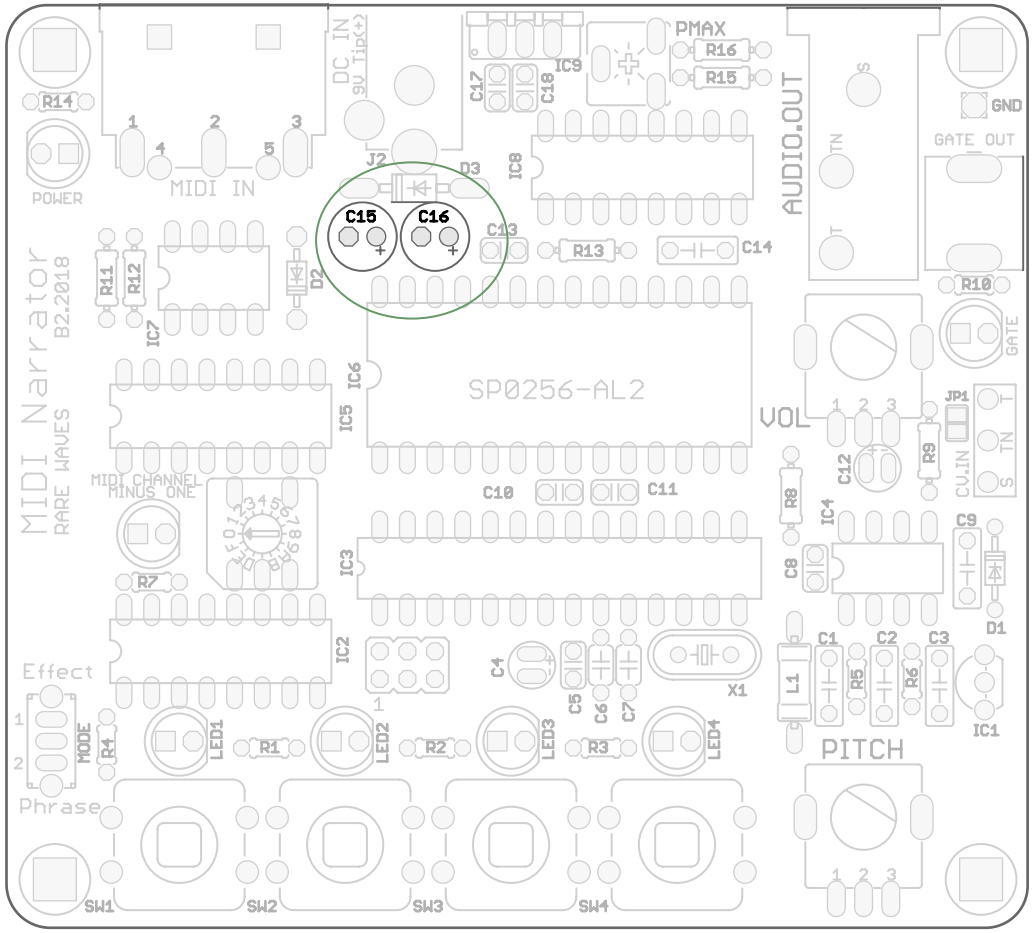
220 µF

Component Type

Electrolytic capacitor 16V

Assembly Note

The longer lead goes in the hole marked with a plus (+) sign



Reference

IC 1

Value

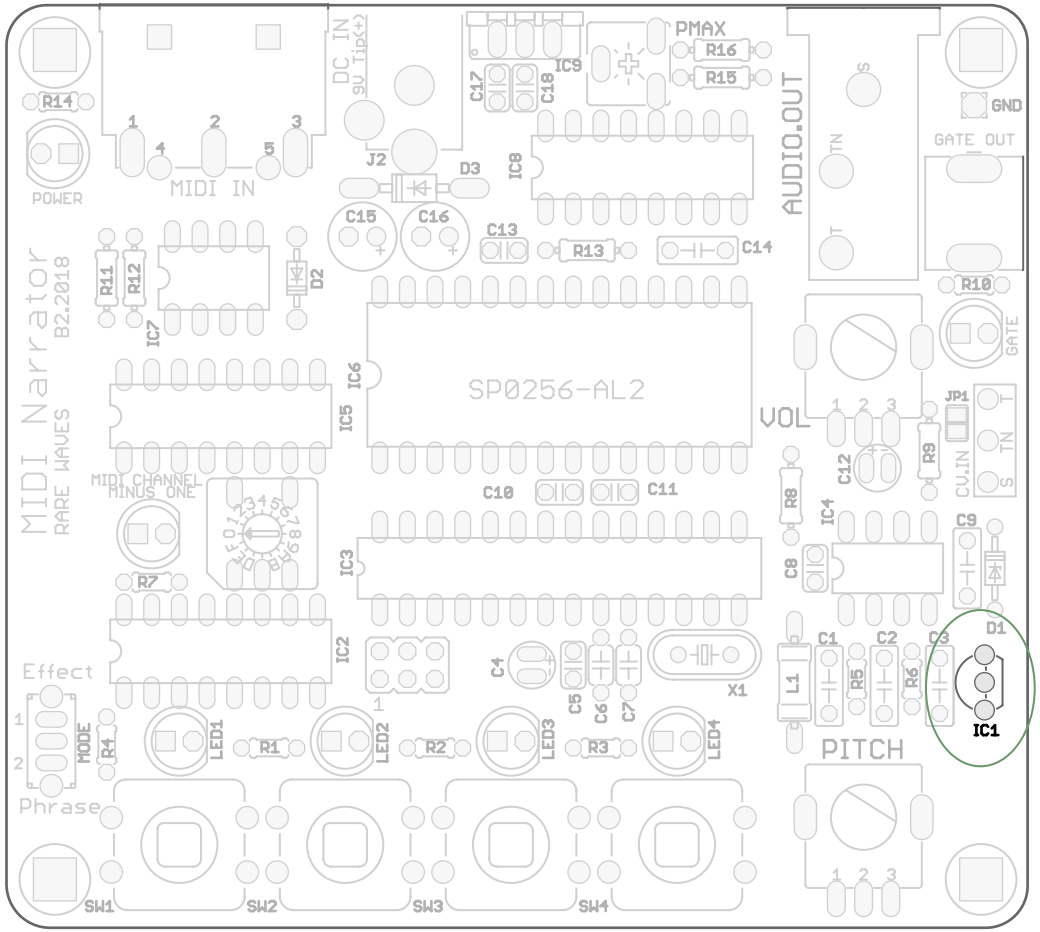
78L05

Component Type

5 volt regulator, TO-92 package

Assembly Note

Orient the flat face of the body to match the outline on the silkscreen



Reference

IC 9

Value

7805

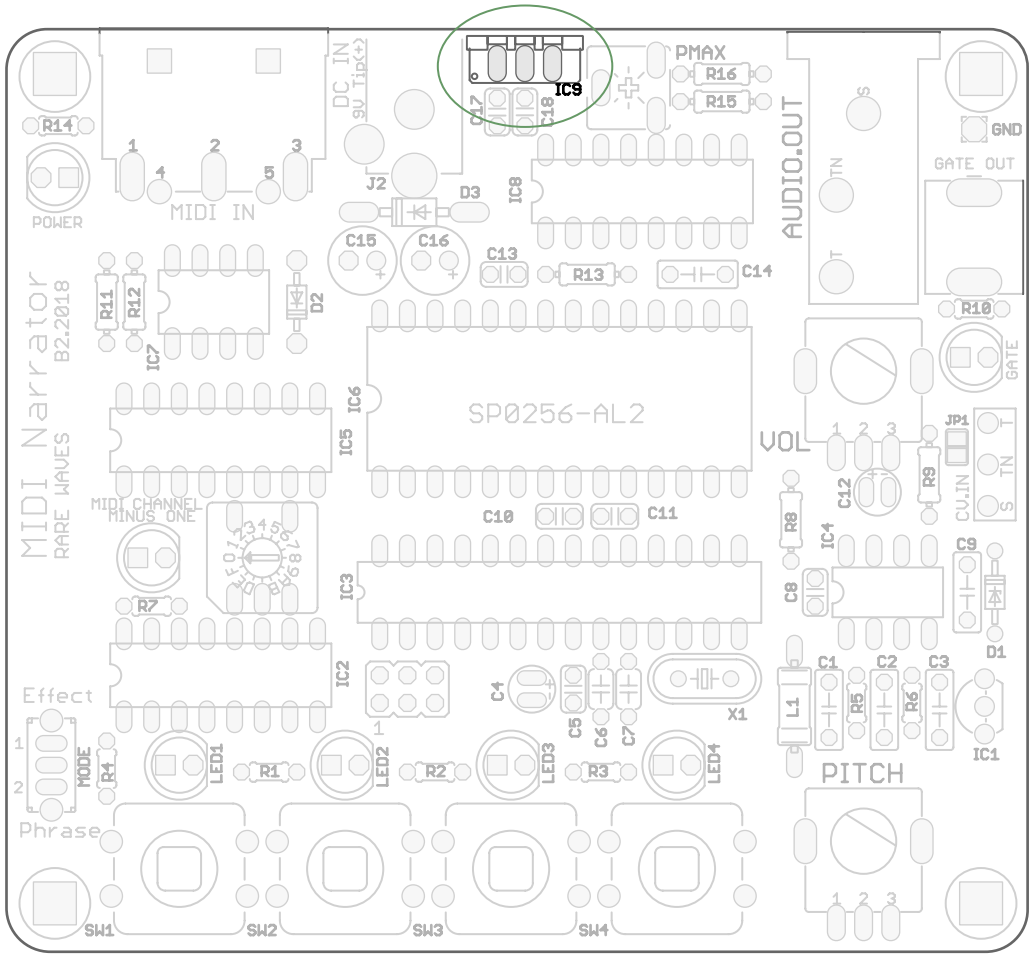
Component Type

5 volt regulator, TO-220 package

Assembly Note

Orient the part so its printed side faces the center of the PCB.

IMPORTANT - if you are building your kit into a custom case enclosure, this part should be mounted to the case with a machine screw and nut. Therefore, don't solder this part until you've planned the location of the drill hole.



Reference

AUDIO.OUT

Value

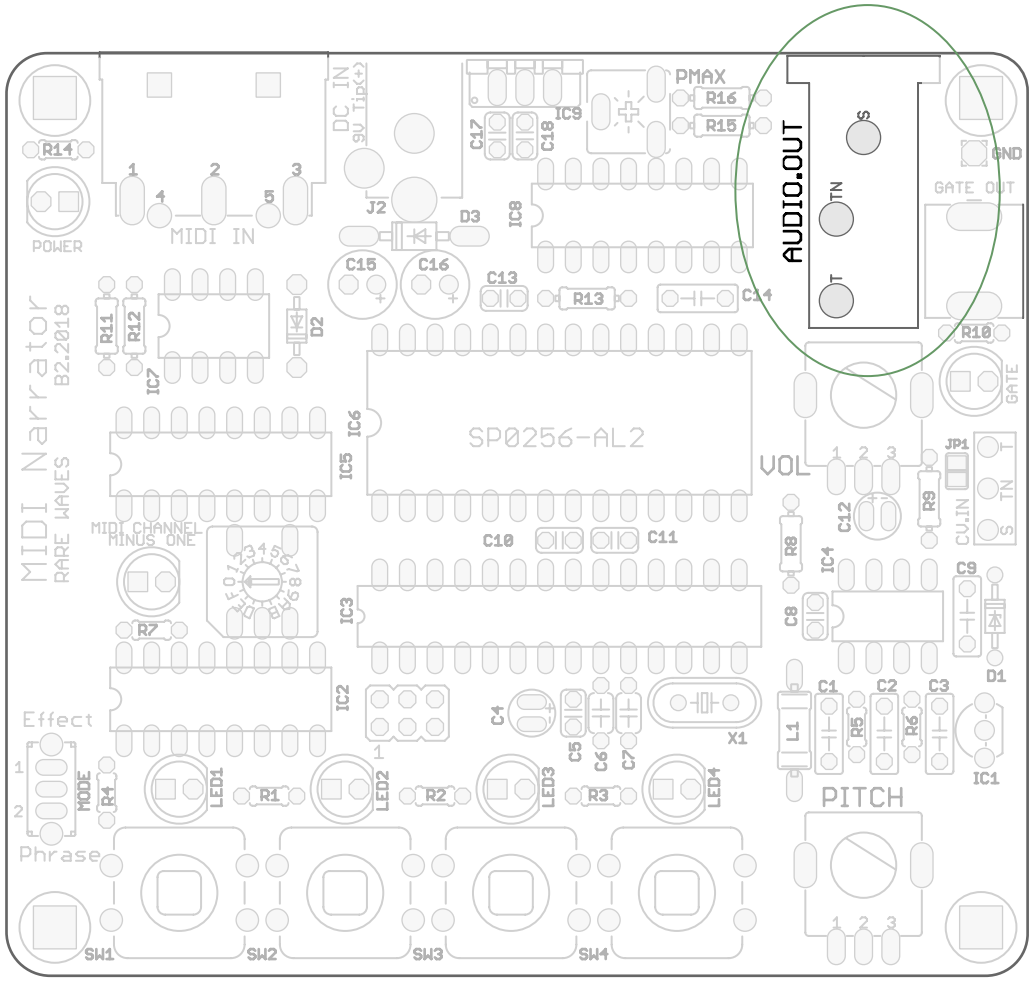
1/4” phone jack

Component Type

PC-mount horizontal 1/4” phone jack

Assembly Note

The tip normal (TN) terminal is unused



Reference

MIDI.IN

Value

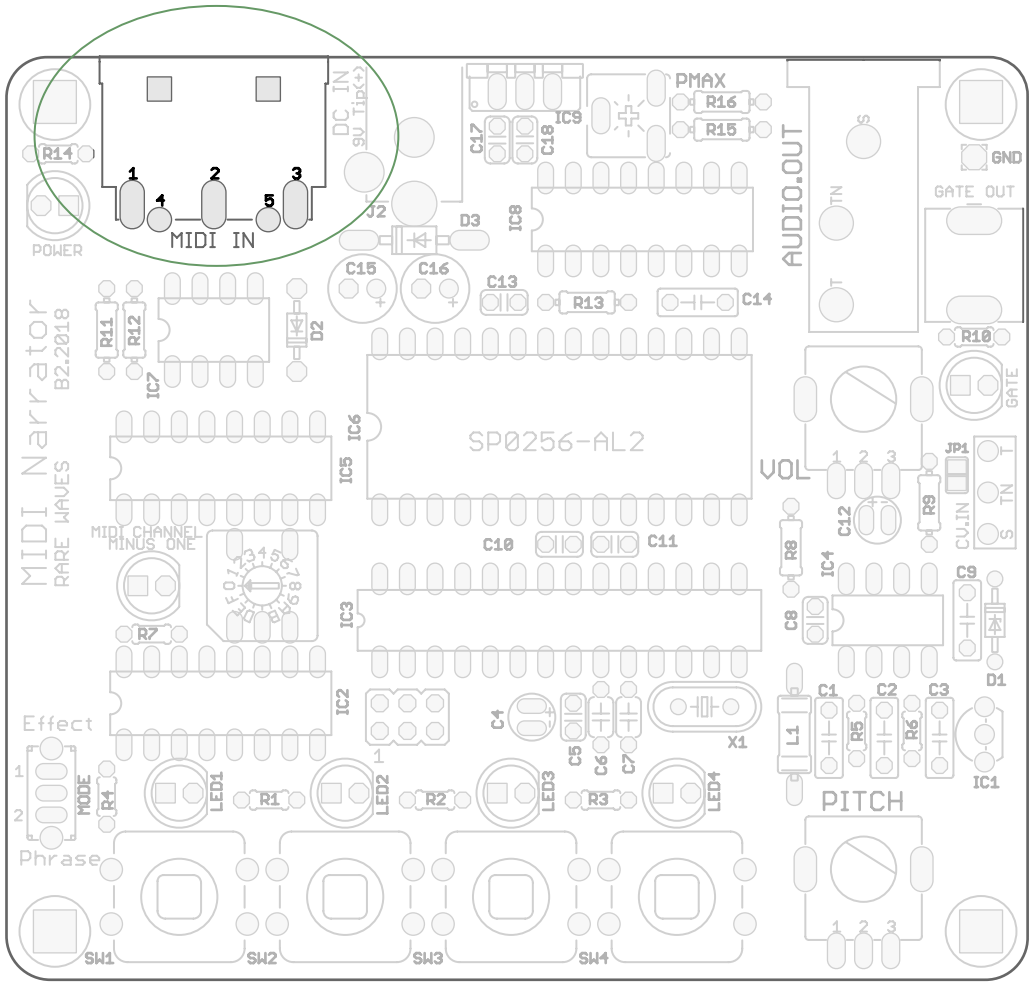
DIN-5 socket

Component Type

PC-mount DIN-5 connector

Assembly Note

Only pins 4 and 5 are used.



Reference

GATE.OUT

Value

3.5mm phone jack

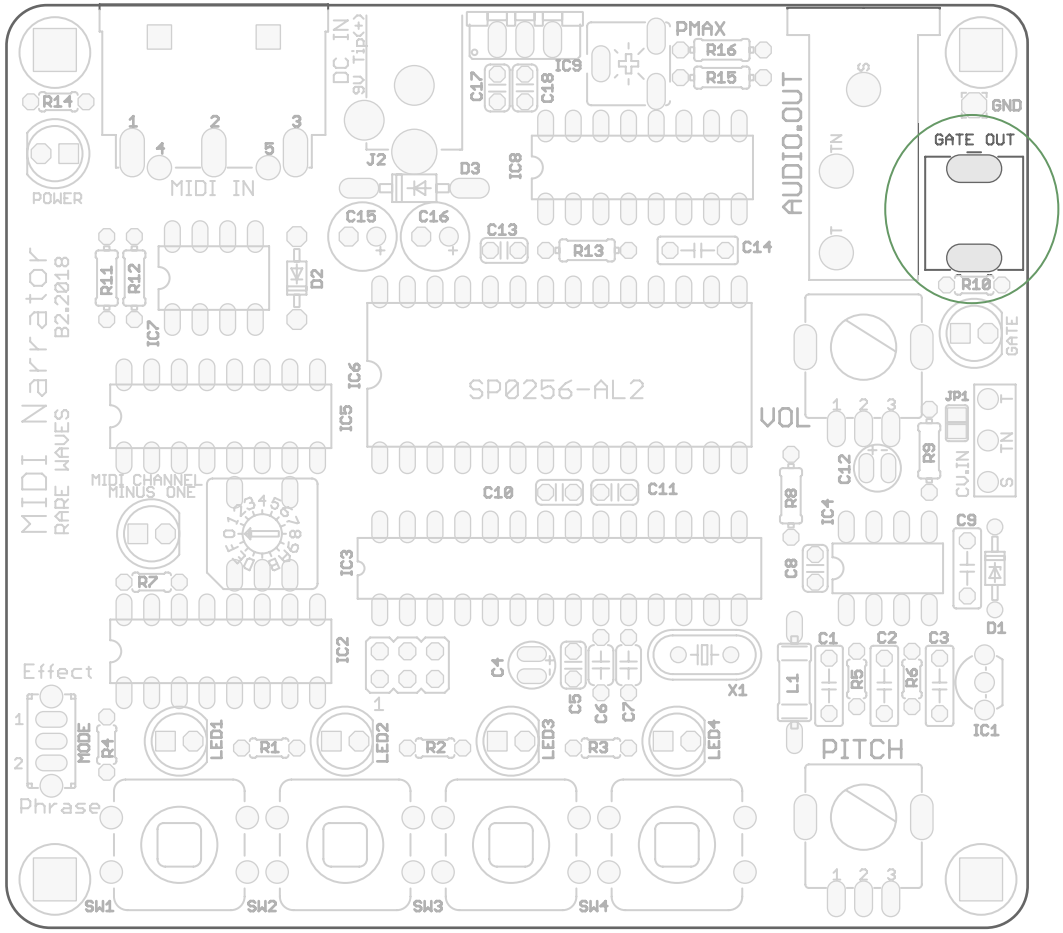
Component Type

PC-mount 3.5mm mono phone jack

Assembly Note

** PLEASE READ **

Use a piece of scrap wire to make a soldered connection between the jack's side terminal and the GND pad beneath it.



Reference

PITCH, VOL

Value

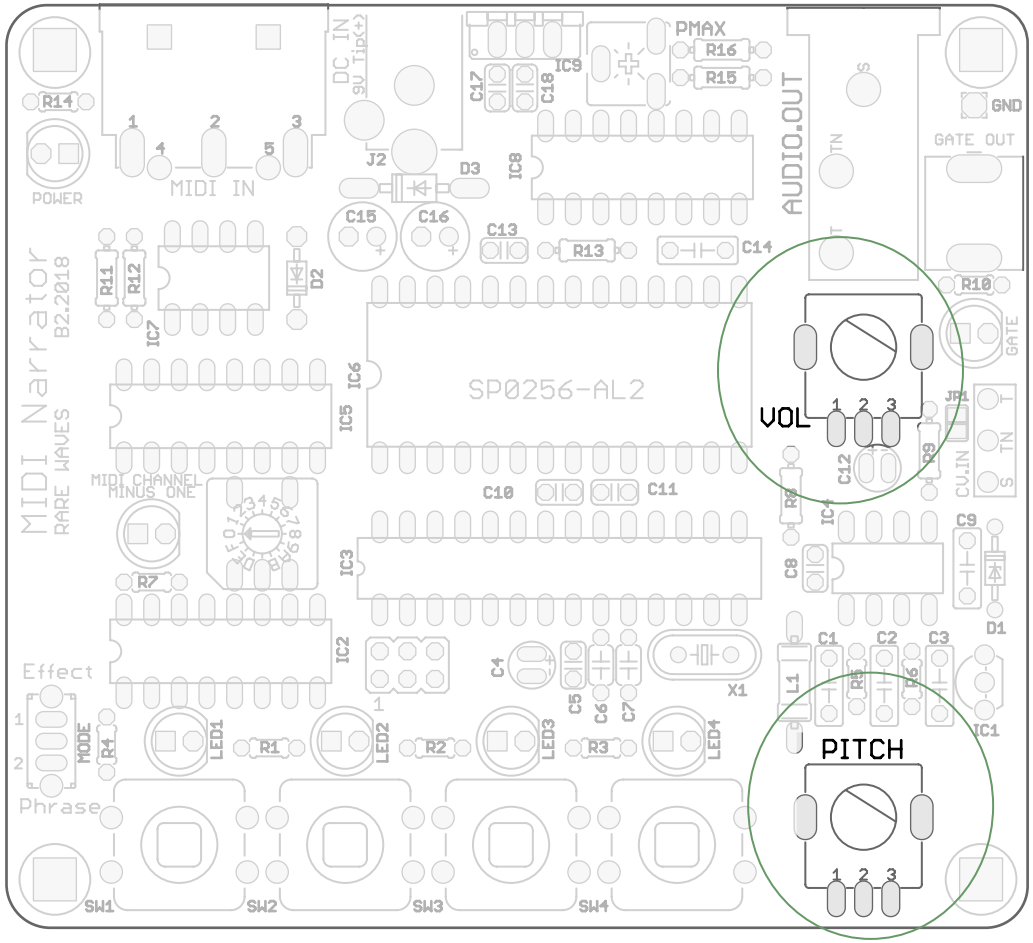
10k linear

Component Type

9mm snap-in potentiometer

Assembly Note

Knobs are provided



Reference

IC 3

Value

ATmega328P

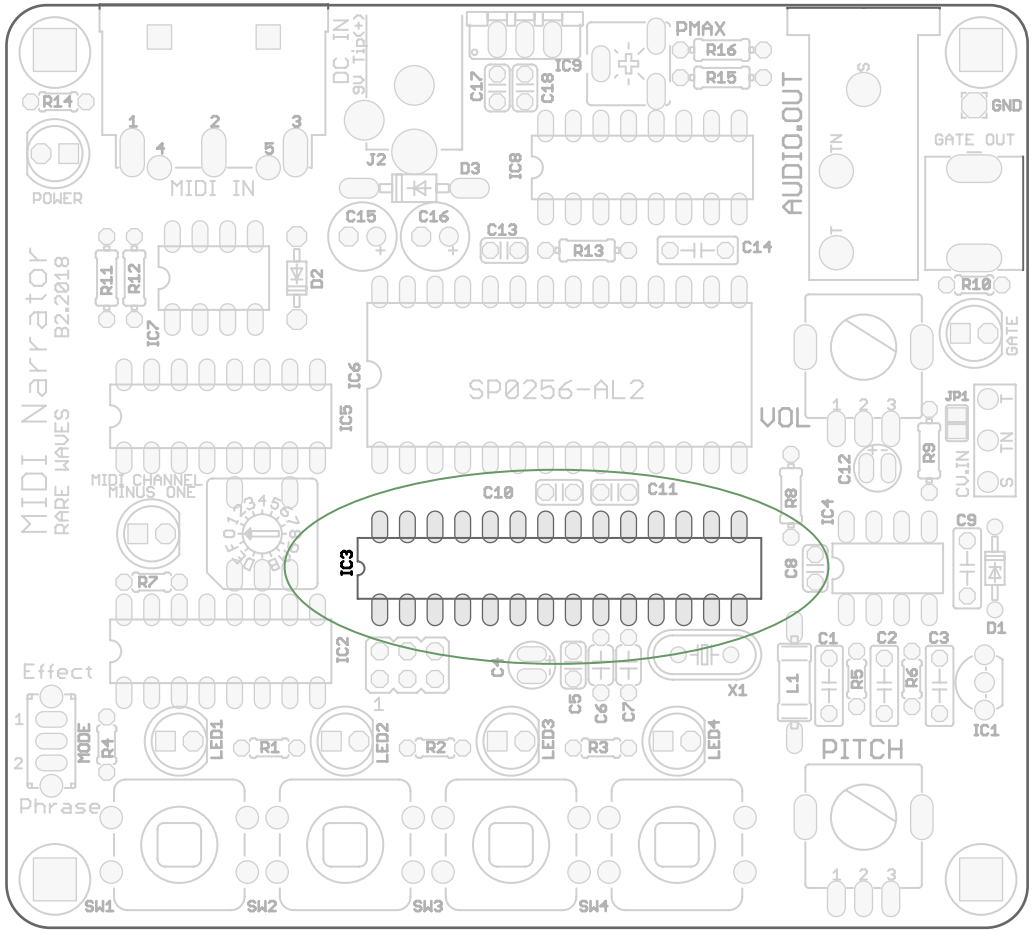
*pre-programmed with MIDI Narrator firmware*

Component Type

8-bit microcontroller, DIP-28

Assembly Note

The leads may require straightening before inserting in the socket. Hold the chip by its narrow ends and press the row of pins firmly against an anti-static work surface. Bend the pins so they are at a 90 degree angle to the body of the chip. It may be difficult to fully insert the chip in the socket. It is OK if the chip isn't sitting perfectly flat in the socket. Be sure none of the pins deflects sideways when you insert the chip.



Reference

IC 6

Value

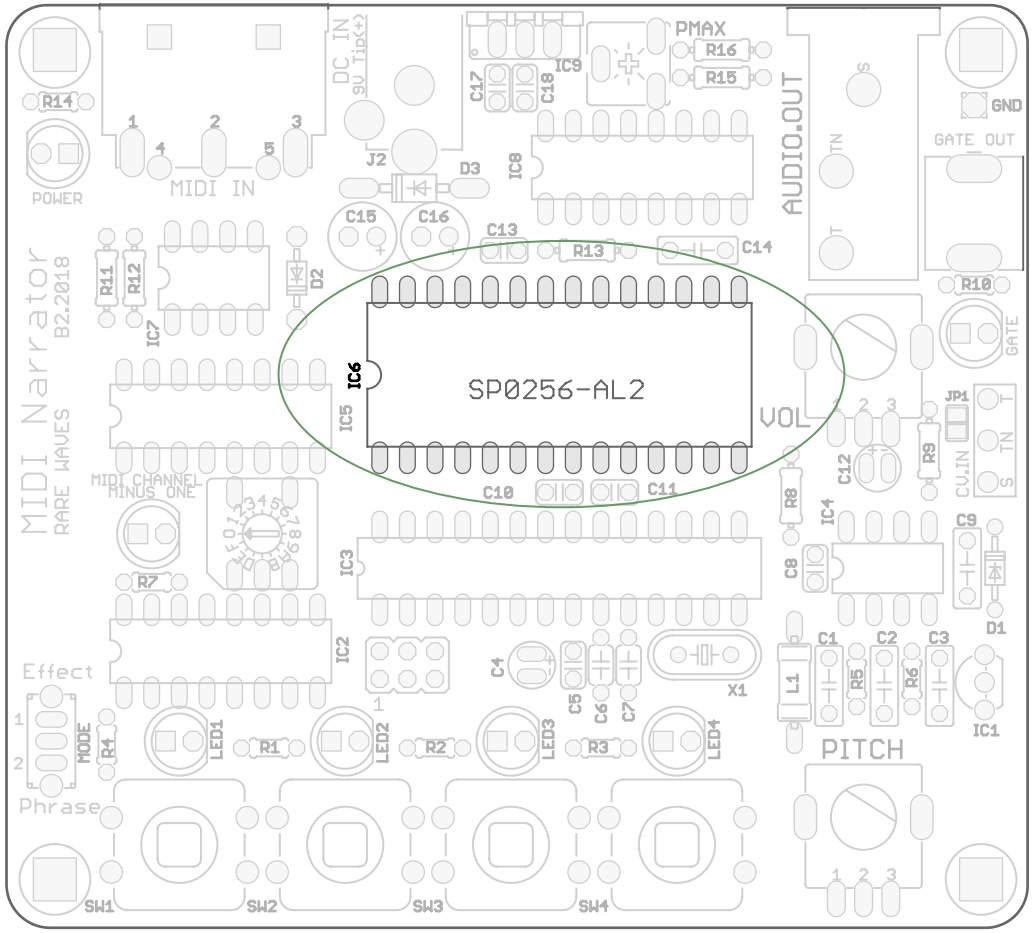
SP0256-AL2

Component Type

Vintage speech synthesizer IC, DIP-28

Assembly Note

The leads must be straightened before inserting the chip in the socket. Hold the chip by its narrow ends and press the row of pins firmly against an anti-static work surface. Bend the pins so they are at a 90 degree angle to the body of the chip. Be sure none of the pins deflects sideways when inserting.

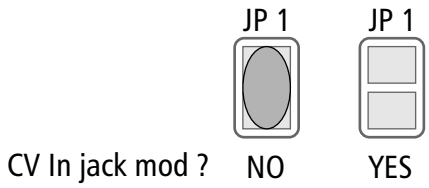


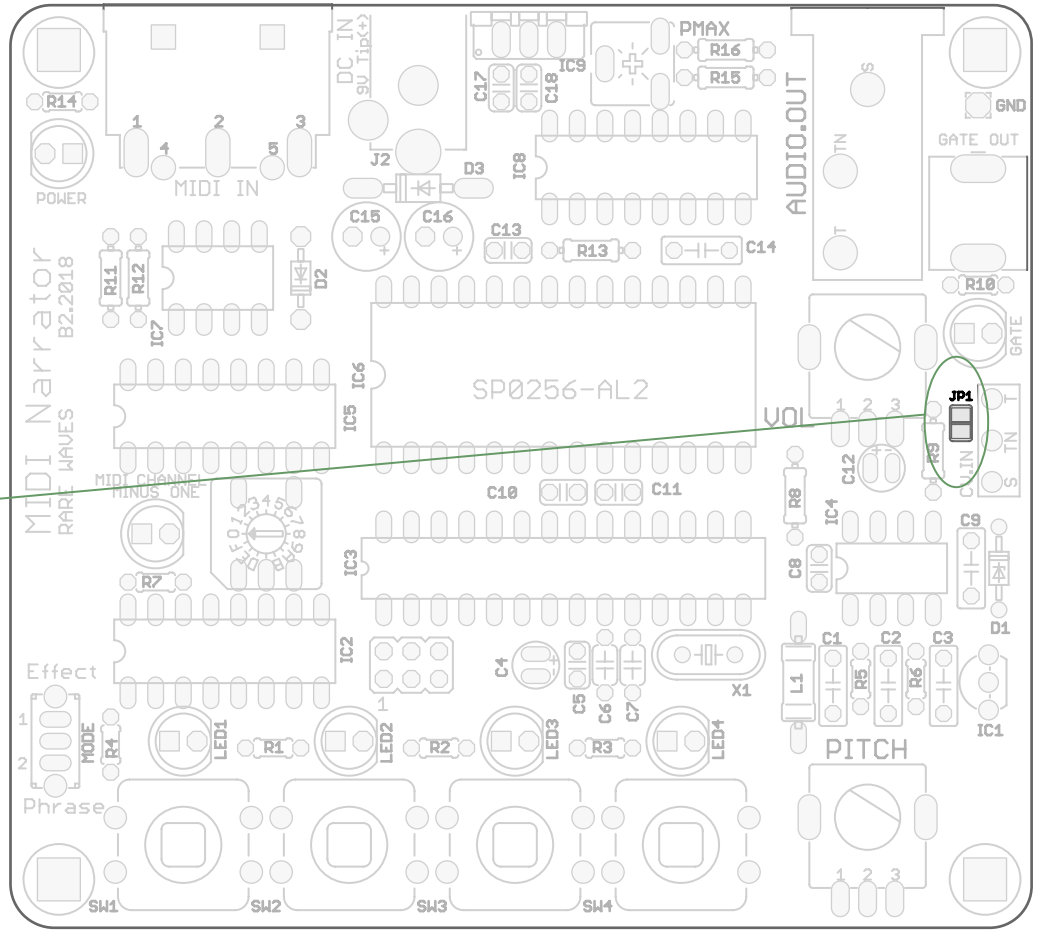
# Final Steps

## Jumper Configuration

The solder jumper JP1 must be enabled if you don't have an off-board CV Input jack connected. Use a blob of solder to connect the two halves of the jumper.

... or else the pitch control won't work




## Put the Legs On

The kit comes with four plastic standoffs that are used as legs to hold up the PCB for tabletop use.

Mount the standoffs to the four holes in the corners of the PCB using the screws provided (4-40 thread)

## Extra Instructions

If your kit came with additional printed instructions, refer to them now for important assembly details, before applying power to the device.

## CV Input Jack Modification

You can connect an optional jack for analog CV input. (Not 1v/octave compatible). The CV Input terminals are next to JP1. Connect them to a phone jack with Tip, Tip Normal, and Sleeve terminals using 3 conductor wire. JP1 must be disabled (remove the solder blob) when this modification is done.

# CONGRATULATIONS!

Your MIDI Narrator requires a power source of 9 volts DC with tip=positive polarity. (AC adapter is included)

** The first time you power up the unit, you should restore its default phrases by holding any button during the first 5 seconds after applying power.

As a quick test, put the slide switch in Phrase position, turn up the VOL knob, and press any button.  You should hear synthetic speech.

Please refer to the MIDI Narrator User Guide for more details on how to use it.

If the speech chip malfunctions by making a loud burst of noise when the PITCH knob is turned up all the way, you must reduce the PMAX trimmer.  Power off the unit, reduce PMAX, then restart.

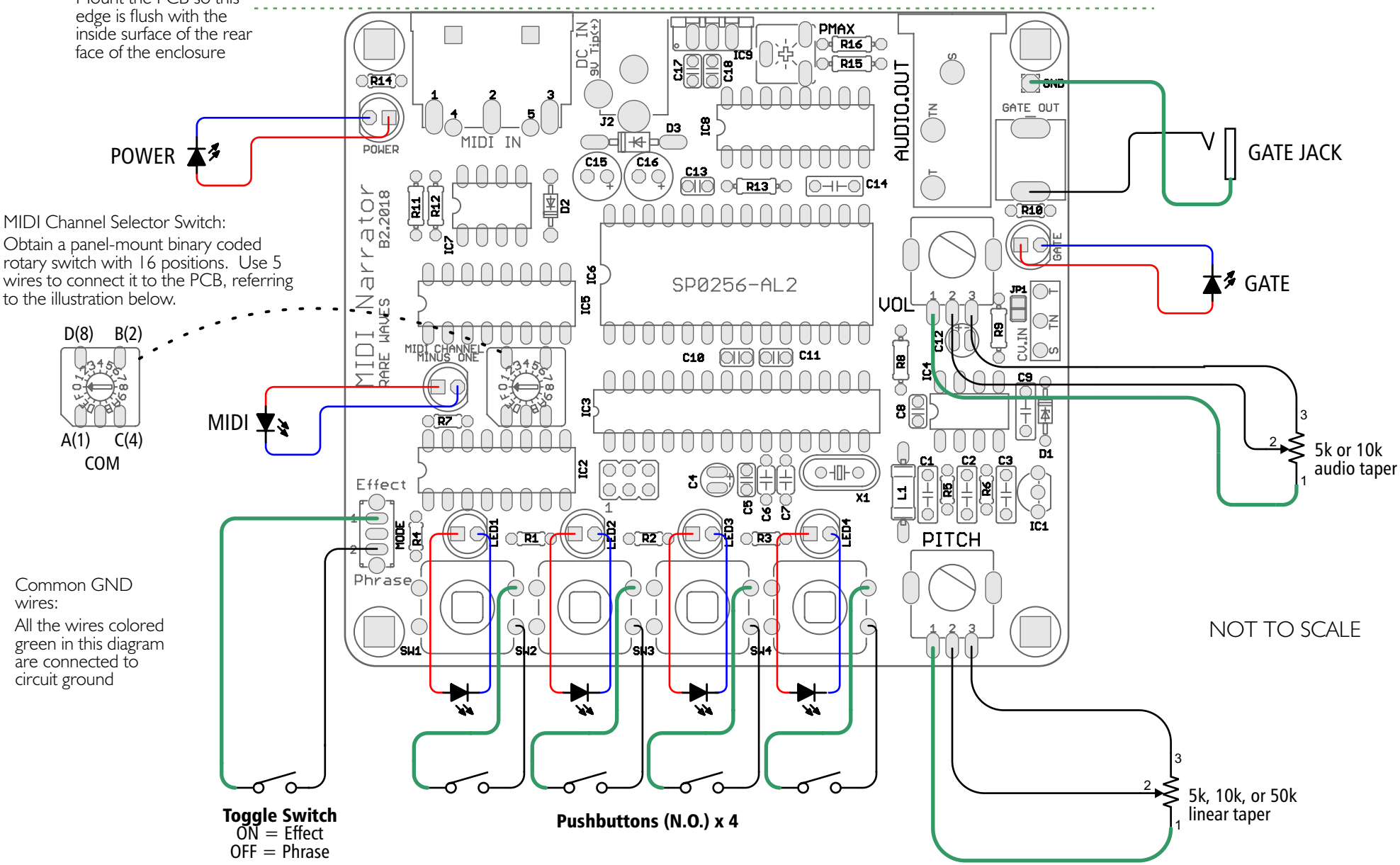
# MIDI Narrator

## *Offboard wiring guide for custom enclosure*

Note: This is an advanced project. Previous experience with DIY electronics construction is recommended.

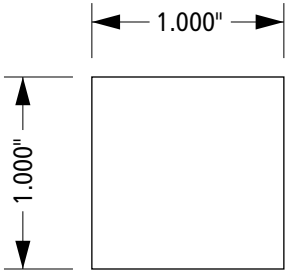
Use the drill template on following page to locate the rear panel holes for MIDI IN, DC IN, AUDIO OUT, and the voltage regulator (IC9) mounting screw.

Mount the PCB so this edge is flush with the inside surface of the rear face of the enclosure

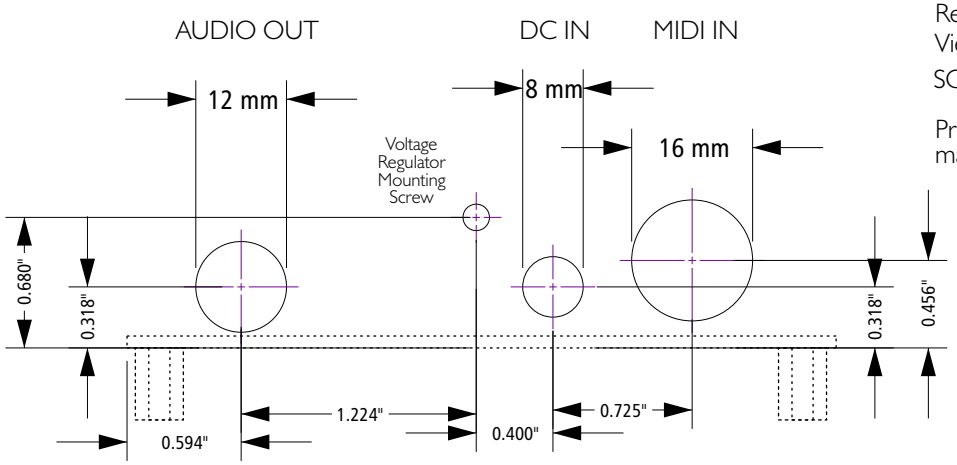


# MIDI Narrator

## *Drill templates for custom enclosure*



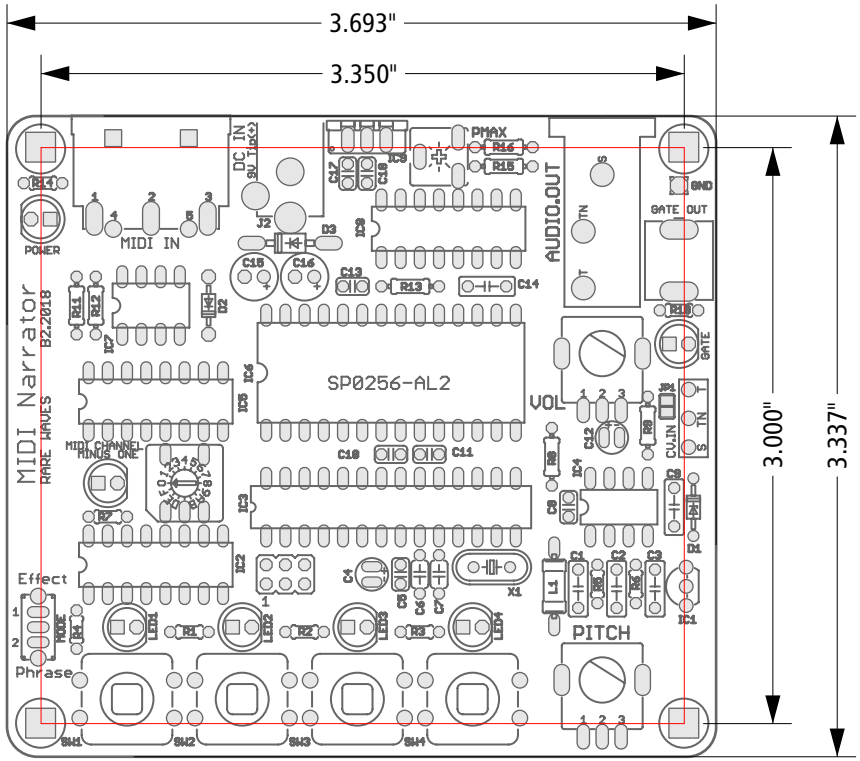

*Verify your printer's scale factor with this reference square*




Rear panel drill template
View from rear of enclosure
SCALE 1:1

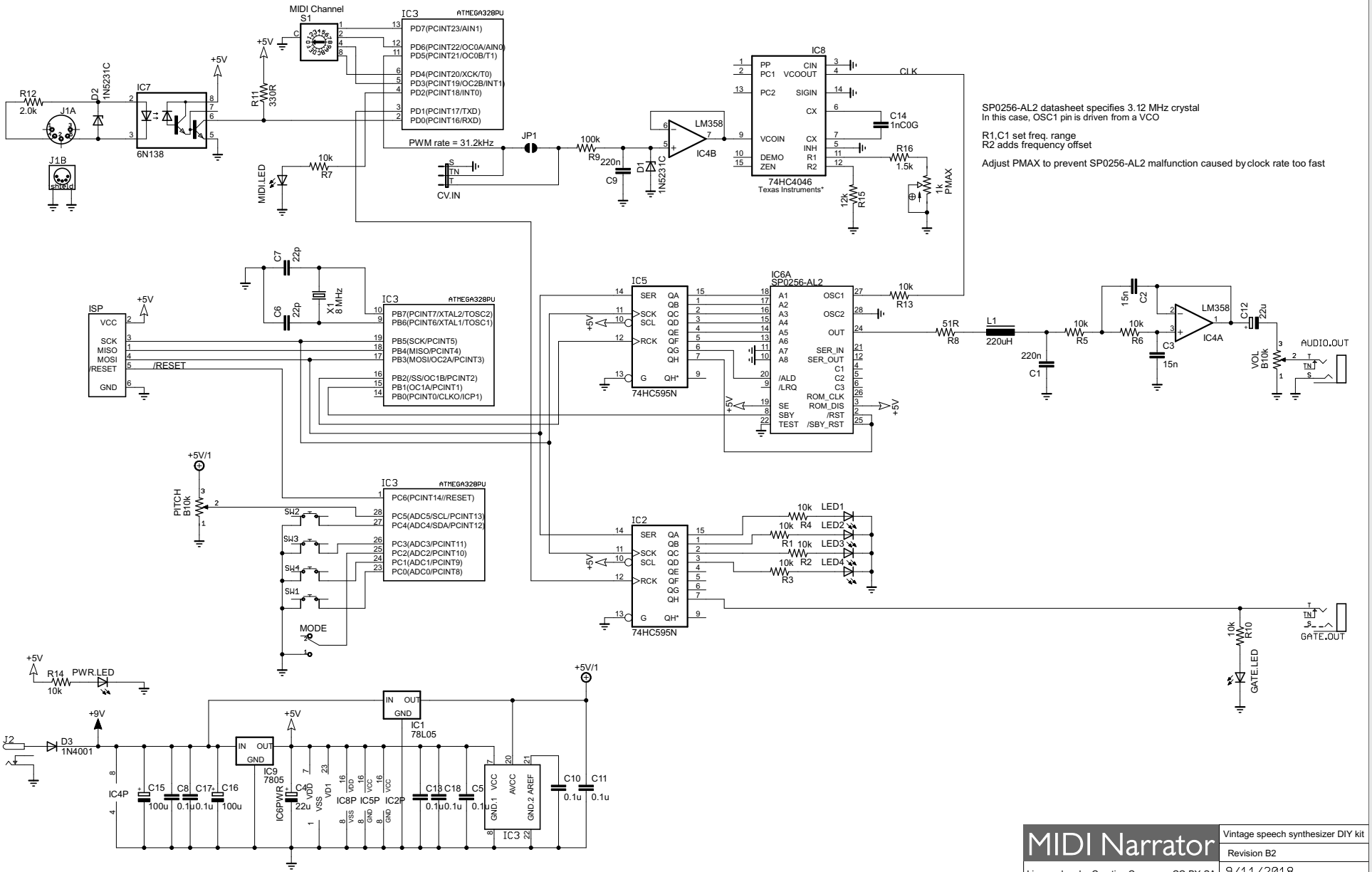
Print the template, cut to size, tape to enclosure, mark holes with center punch, then drill.

*Standoffs 0.375" height shown for reference*




PCB mounting holes drill template
View from top of PCB
SCALE 1:1

FRONT


MIDI Narrator
Vintage speech synthesizer DIY kit
Revision B2
9/11/2018
RAREWAVES.NET
1 of 1
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SP0256-AL2 datasheet specifies 3.12 MHz crystal
In this case, OSC1 pin is driven from a VCO
R1,C1 set freq. range
R2 adds frequency offset
Adjust PMAX to prevent SP0256-AL2 malfunction caused by clock rate too fast
MIDI Channel
S1
IC3
ATMEGA328PU
PD7(PCINT23/AIN1)
PD6(PCINT22/OC0A/AIN0)
PD5(PCINT21/OC0B/T1)
PD4(PCINT20/XCK/T0)
PD3(PCINT19/OC2B/INT1)
PD2(PCINT18/INT0)
PD1(PCINT17/TXD)
PD0(PCINT16/RXD)
PWM rate = 31.2kHz
CV.IN
IC7
6N138
J1A
J1B
shield
MIDI.LED
IC8
74HC4046
Texas Instruments*
CLK
C14
1nC0G
R16
1.5k
PMAX
LM358
IC4B
JP1
R9
100k
C9
220n
D1
1N5231C
R12
2.0k
D2
1N5231C
R11
330R
R7
10k
R15
12k
ISP
VCC
SCK
MISO
MOSI
/RESET
GND
C7
22p
C6
22p
X1
8 MHz
PB7(PCINT7/XTAL2/TOSC2)
PB6(PCINT6/XTAL1/TOSC1)
PB5(SCK/PCINT5)
PB4(MISO/PCINT4)
PB3(MOSI/OC2A/PCINT3)
PB2(/SS/OC1B/PCINT2)
PB1(OC1A/PCINT1)
PB0(PCINT0/CLKO/ICP1)
IC5
74HC595N
IC6A
SP0256-AL2
R13
10k
R8
51R
L1
220uH
C1
220n
R5
10k
R6
10k
C2
15n
C3
15n
LM358
IC4A
C12
22u
VOL
B10k
AUDIO.OUT
PITCH
B10k
PC6(PCINT14//RESET)
PC5(ADC5/SCL/PCINT13)
PC4(ADC4/SDA/PCINT12)
PC3(ADC3/PCINT11)
PC2(ADC2/PCINT10)
PC1(ADC1/PCINT9)
PC0(ADC0/PCINT8)
SW1
SW2
SW3
SW4
MODE
IC2
74HC595N
LED1
LED2
LED3
LED4
R4
R1
R2
R3
GATE.OUT
R10
GATE.LED
R14
10k
PWR.LED
J2
D3
1N4001
IC1
78L05
IC9
7805
IC6PWR
C15
100u
C8
0.1u
C17
0.1u
C16
100u
C4
22u
IC4P
IC8P
IC5P
IC2P
C13
0.1u
C18
0.1u
C5
0.1u
C10
0.1u
C11
0.1u
IC3