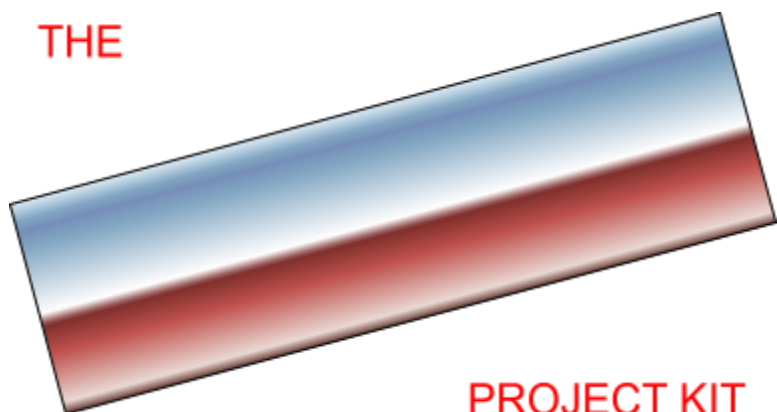


THE



PROJECT KIT



www.awesomecube.com

AWESOME USA

INTRODUCTION

Awesome USA is an electronics project kit with through hole and surface mount soldering. There is “practice” soldering components on the board that are used for beginners or to refresh the skills of an experienced solderer. The circuit is based on a 555 timer and 4017 counter. These are very common ICs used in electronics.

1) PARTS INVENTORY – check the following parts in your kit.

___ 1	“AWESOME USA” circuit board	___ 20	1k Ω SMT resistors (“102” or “1001”)
___ 1	555 timer IC	___ 14	2k Ω SMT resistors (“202” or “2001”)
___ 1	4017 decade counter IC	___ 14	330 Ω SMT resistors (“331” or “3300”)
___ 1	8 pin IC socket	___ 1	10k Ω SMT resistor (“103” or “1002”)
___ 1	16 pin IC socket	___ 15	4148 SMT switching diode
___ 75	various resistors for Alaska, Hawaii, and US outline	___ 6	SMT 3904 transistors
___ 11	330 Ω resistors (orange-orange-brown)	___ 1	22 μ F SMT electrolytic capacitor
___ 11	1k Ω resistors (brown-black-red)	___ 25	red LEDs
___ 11	2k Ω resistors (red-black-red)	___ 25	white LEDs
___ 1	three position slide switch	___ 25	blue LEDs
___ 1	100k Ω potentiometer	___ 1	AA battery holder
___ 3	through hole 3904 transistors	___ 1	USB-A Male to Male cable
___ 1	USB-A female connector		

- 2) Install resistors for Alaska and Hawaii (some kits may also have Guam and Puerto Rico) The resistors for these are not connected to the circuit and are a good place to hone your soldering skills. If you are new to soldering here is a link to a good soldering tutorial <http://www.youtube.com/playlist?list=PL926EC0F1F93C1837>. Use the extra resistors available (there are extra resistors in the kit) to build Alaska and Hawaii. Put the resistors in with the color code reading left to right. Do NOT use 330 Ω , 1k Ω , or the 2k Ω resistors for Alaska, Hawaii, Guam or Puerto Rico.



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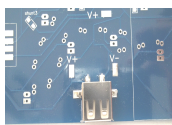
3) US Outline unmarked resistors

- a) Some resistors are marked “r”, “w”, or “b”. These are for the red, white, and blue LEDs. Start with the unmarked resistors and use the extra resistors (not 1k Ω , 2k Ω or 330 Ω) to build the outline of the US.
- b) Important – make sure that you do not bridge the solder joints to the r, w, or b resistor pads. This would effect the brightness of the LEDs! (see picture above).

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4) USB-A female connector

- a) decide if you will display the project hanging or standing. Select either USB location on the circuit board.
- b) bend the two outer leads of the USB connector 90° as shown
- c) using a cutter, remove the two inner leads of the USB connector. These leads are used to transmit and receive data. We are only using the USB connector to get 5 volts to our board.
- d) using a pliers, straighten the mounting leads of the connector as shown
- e) solder the connector to the Awesome USA PCB board.



need help? watch video “Awesome USA – USB” in the Awesome USA folder:

<https://drive.google.com/folderview?id=0B2XvzmWYqNzQZ1hhYkF0MktOUek&usp=sharing>

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5) SP3T switch

- a) tin one pad on the pcb. Then hold the switch in place, reheat the tinned pad and let the lead of the switch solder to the pad. solder the remaining three leads to the pads.



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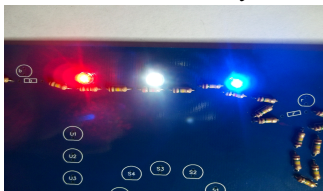
6) shunt 3

- a) Next to the switch, you will see shunt 3. This is just a wire (use a lead that you cut off of a resistor) soldered to the two pads. If provided, you can also use a 0 Ω SMT resistor.

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- 7) One Red, White, and Blue resistor and LED
- At the top of the board, above the big letter "S", solder
 - one 330Ω resistor for the "r" resistor
 - one $2k\Omega$ resistor for the "w" resistor
 - one $1k\Omega$ resistor for the "b" resistor
 - Now solder one RED LED by the 330Ω resistor. Remember, the rounded side of the silkscreen is "+" and is the longer lead of the LED.
 - solder one WHITE LED by the $2k\Omega$ resistor.
 - solder one BLUE LED by the $1k\Omega$ resistor.



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- 8) Connect the USB-A to USB-A cable to the AWESOME USA and a USB port or a USB/AC adapter. Turn the switch UP and verify that the RED WHITE and BLUE LEDs are lit.
- IF all three are **not** lit
 - look for a bridge across one of the LEDs
 - make sure the switch is soldered well
 - make sure the USB connector is soldered well
 - make sure the computer is ON (If you connected the cable to a USB port)
 - IF one LED is not lit
 - make sure it is not backwards!!
 - make sure that it is connected to the resistor

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- 9) USA outline - RED LEDs
- solder the remaining 330Ω resistors. Reminder: do not bridge the pads to the adjacent resistor pads.
 - solder the remaining RED LEDs.
 - Connect the USB cable, and power ON.
 - Verify that all 11 RED LEDs are lit.

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- 10) USA outline - WHITE LEDs
- solder the remaining $2k\Omega$ resistors. Reminder: do not bridge the pads to the adjacent resistor pads.
 - solder the remaining WHITE LEDs.
 - Connect the USB cable, and power ON.
 - Verify that all 11 WHITE LEDs are lit.

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11) USA outline - BLUE LEDs

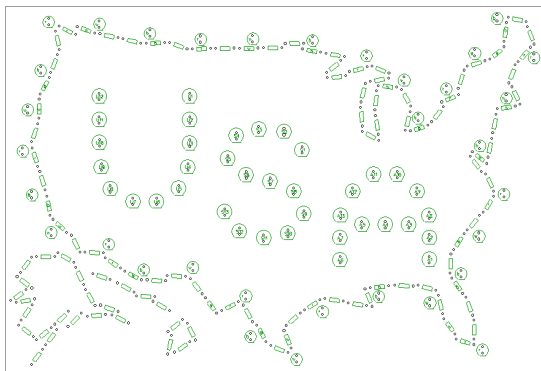
- solder the remaining $1k\Omega$ resistors. Reminder: do not bridge the pads to the adjacent resistor pads.
- solder the remaining BLUE LEDs.
- Connect the USB cable, and power ON.
- Verify that all 11 BLUE LEDs are lit.

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12) U-S-A LEDs

- On the top view of the Awesome USA pcb, design the letters with the remaining (14 each) red, white, and blue LEDs. You can put any color anywhere on the three letters, but you must keep track of what color goes where. Note the name (S11 or U3 for example) of each LED on the silkscreen. There is a matching (same name) resistor on the bottom that will be installed.
- some ideas –
 - U – all red; S- all white; A – all blue
 - the tops of the letters –red; the middle of the letters – white; the bottom of the letters – blue
 - left side –red, middle – white, right side-blue
 - be creative!!
- Use the picture to design your project. After writing down the color for every LED, solder the LEDs in place for U-S-A.

Student initial _____ Instructor initial _____



13) SMT resistor practice.

- Watch our video on SMT resistor soldering in the Awesome USA folder <https://drive.google.com/folderview?id=0B2XvzmWYqNzQZ1hhYkF0MktOUek&usp=sharing>
- Near the top of the pcb, note R1, R2 and R3. These pads are for practice. Use the $1k\Omega$ SMT resistors and solder in place.
- Use a multimeter to measure resistance on the circular pads just above R1, R2, R3. Verify that the $1k\Omega$ resistor is in place.

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14) U-S-A resistors

- a) Solder 330 Ω SMT resistors in place for all RED LEDs.
- b) Solder 2k Ω SMT resistors in place for all WHITE LEDs.
- c) Solder 1k Ω SMT resistors in place for all BLUE LEDs.

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15) SHUNTS

- a) solder shunts 1,2 and 4 (you already soldered shunt 3). Use a wire lead from a resistor or a 0 Ω SMT resistor.

16) TESTING U-S-A

- a) you can test each letter as follows. Secure a jumper wire between V- and the “c” pad of the e-b-c- transistor pads closest to the letter you want to test. Power ON, and all LEDs should be lit for the letter you are testing.

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17) IC sockets

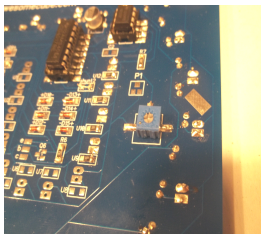
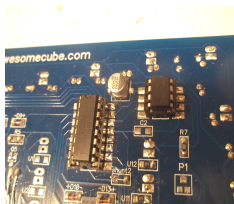
- a) take the two IC sockets and “flatten” the leads so that they can be soldered into place. Match the notch in the IC socket to the notch on the silkscreen and solder into place. Hint: you can tin a corner pin pad, then put the IC over it in position and reheat. Then solder the rest of the pads.
- b) Note: AWESOME USA could have been designed with SMT ICs. We used standard ICs and sockets because the socket can be soldered and the IC placed into it.

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18) 555 timer circuit components

- a) solder the following components to the board. (do not insert the actual 555 timer chip into the socket. If it is, it can be heated and damaged while you solder the following components).
 - i) C1=22 μ F
 - ii) C2=.001 μ F (this capacitor is not necessary for the project and may be omitted)
 - iii) R7=10k Ω
 - iv) P1 = 50k -100k Ω There are two places to solder P1. Select either the standard size (larger) P1 or the SMT P1 (may not be provided in your kit). The standard P1 will need the leads flattened like you did for the IC sockets.



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b) Optional – Testing the 555 timer circuit.

- i) If you have a logic probe you can test the 555 timer circuit. Insert the 555 timer IC into the socket. (make sure the notch in the IC matches the notch on the silkscreen).
- ii) Connect the logic probe to + and – voltage.
- iii) Turn the circuit ON, and put the tip of the probe on pin 3. You should see the HIGH and LOW of the probe lighting.

Student initial _____

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19) R4, R5, R6 SMT resistors

- a) Install 1k Ω SMT resistor for R4, R5, and R6.

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20) Diodes D1 through D15

- a) You can now install all diodes D1 through D15. They are soldered in place with the same technique as the SMT resistors. These diodes may be cylindrical and tend to roll around. Just use the tweezers to hold in place as you did the resistors.
NOTE: the black stripe on the diode is the NEGATIVE (-) side. Make sure that the diodes are installed with the correct +/- orientation.

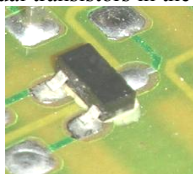


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21) Transistors

- a) First, let's practice soldering the SMT transistor. There is three practice SMT transistors Q1, Q2, and Q3 to be soldered by the three practice resistors. Use the following technique: Tin one pad first. Then use the tweezers to hold the transistor in place, reheat the pad, slide the transistor in place and let the solder harden. Wait a little (so that the transistor cools down) and solder one other lead. Again, wait for cooling, and solder the last lead. After soldering the three practice transistors, you should be ready for the actual transistors in the circuit.



- b) Solder in Q4, Q5, and Q6.

SMT transistor soldered in place

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22) JUST IN CASE- -

- a) If you accidentally destroy an SMT transistor or the pads - we have it covered!
- b) We have designed the circuit with an SMT transistor and three pads for a “backup” transistor in parallel. Use one of the through hole 3904 transistors provided and solder in place as shown. (you can use a heat sink for protection). Make sure the e-b-c-leads are soldered to the correct pads. Do not install both transistors on the same circuit!

flat side up. e - b - c through hole transistor

23) TEST the AWESOME USA project

- a) With the USB cable installed, turn on the switch (up) and verify that the USA is lighting as follows (after it is running):
 - i) U only, all off, U-S, all off, U-S-A, all off, U-S-A, all off, U-S-A, all off. (then repeats over and over)
 - ii) test if the potentiometer adjusts the speed of the display and set where desired.

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24) Battery pack.

- a) solder the leads of the battery pack to the pcb as follows. First, tin the pads on the pcb. Then, shorten and strip (if necessary) the leads from the battery pack and tin the ends. Then, solder the leads to the board. Red is (+); black is (-).
- b) We prefer to use 4 AA *rechargeable* batteries. Regular AA batteries are 1.5 volts, and 4 batteries in series gives us 6 volts. It is slightly more than the 5 volts from the USB. Rechargeable batteries usually only charge to 1.25 to 1.3 volts, and the 4 series batteries are then very close to the 5 volts from the USB.
- c) Verify that the switch works for both USB and battery operation.
- d) Use 2- way tape or hot glue to affix the battery pack to the pcb (there is an outline).

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25) Frame and/or hanging wire (Optional)

- a) The AWESOME USA fits into a standard 8 x 10 picture frame for display.

- b) there are two large pads on the pcb near the side edges. You can solder a wire to these pads to use for hanging your project.
- 26) Desktop (if not using a picture frame)
- a) If you wish to display AWESOME USA on a table or desktop and still use the USB cable for power, you can cut the connector off the end of the cable and solder the red and black leads to the V+ and V- pads directly. This way, the pcb will balance on the battery pack and sit evenly on the surface!
- 27) Please visit our website www.awesomecube.com for more projects and videos! If you have any questions, please contact us at jeff@awesomecube.com.