

# KIT 126. WOOFER STOPPER

Barking dogs drive many people crazy and there is usually nothing you can do about it. That is up until now.

The Woofer Stopper emits a blast of high intensity sound. The frequency is just out of the range of human hearing but dogs will hear it easily. Usually a few blasts is all it will take before most dogs learn that barking means punishment and stop. How effective the Woofer Stopper is will depend on the dog. Note that some dogs are deaf or so stupid that they will continue to bark anyway. However, provided that the dog is within 30 metres, the Woofer Stopper will deter most dogs from barking.

The kit is constructed on a single-sided printed circuit board (PCB) measuring 122 x 56mm. The kit requires a 10-to-16V DC power supply rated at **1/2 amp** minimum. So a usual 300mA powerpack **will not be able to drive it**.

## WARNING

**The output from this kit is at a very high level. Even though you may not hear the noise, take care to keep away from the front of the tweeters when the kit is operating. Ear damage may occur.**

## ASSEMBLY INSTRUCTIONS

Check the components against the Component listing on the next page. Follow the component overlay on the PCB, starting with the resistors then inductors and IC socket. Use the wire offcuts from the resistor leads to fit the **two** wire links. Next fit the monobloc capacitors, followed by the electrolytic capacitors. Electrolytic capacitors are polarised, the positive lead is marked on the overlay, the negative is marked on the body of the capacitor.

Secure the heatsinks onto the power transistors, TIP41C, using the 3mm screws and nuts. Make sure the heatsinks are “straight” before soldering the transistors into place. The heatsinks must **not** be touching. Add the transformer last.

You have to supply your own twin cable wire for the TRIGGER push-on switch. The switch may be located some distance away from the PCB. Also you must supply your own wire to connect the TWEETER to the pcb. The position for the first tweeter is on the bottom right of the PCB. Pads are available to connect three more inductor / tweeter combinations which the circuit can drive.

For just off/on use the 1/2W 120R resistors are OK. But if you are going to leave this kit on continuously then they should be replaced by 1W rated resistors

## CIRCUIT DESCRIPTION

The circuit is based around the TL494 Pulse Width Modulation Control chip. For the data sheet go to the Texas Instrument website at **www.ti.com**. The output is configured for push-pull operation by connecting the “Output Control” (pin 13) to Vref (pin 14). The outputs are current boosted by transistors Q3 and Q4 and drive the primary of transformer T1.

The transformer steps up the voltage and drives the piezo tweeter(s). Piezo tweeters are basically a capacitor. Adding an inductor in series with the tweeter forms a resonant circuit, providing maximum power transfer to the tweeter and therefore a higher output level. An internal oscillator in the TL494 sets the output frequency. Capacitor C3 is charged with a constant current – the value of which is determined by resistor R7 in series with trimpot VR1. This produces a sawtooth waveform across C3. When the voltage across C3 reaches 3V, it is discharged by the internal oscillator and the charging cycle starts over again.

For push-pull operation, the oscillator frequency is:

$$f_{osc} = \frac{1}{2R_x C_3} \quad (\text{where } R_x = R7 + VR1)$$

Resistors R1-4, capacitor C1 and the PUT form a “relaxation” oscillator. Capacitor C1 is charged via resistor R3. When the voltage across C3 reaches the breakover voltage of the PUT it fires and C1 is discharged via R4. This forms a sawtooth waveform across C1 with a frequency of approximately 4Hz. Transistor Q2 is a unity gain buffer used to minimise any loading on the capacitor.

This sawtooth waveform appears at the  $R_T$  input (pin 6) of the TL494 and causes the charging rate of C3 to vary. This has the effect of “modulating” the TL494 oscillator frequency and therefore the output frequency.

At one extreme setting of VR1 the sweep range is approx. 20-23KHz. On the other extreme setting of VR1 the sweep range is approx. 28-31kHz. Modulating (sweeping) the output frequency provides a high effective output by overcoming any peaks and dips in the frequency response of the tweeters.

Internally, the TL494 compares the sawtooth voltage across C3 with the voltage level at the “Dead Time” input, pin 4. The output pulses are enabled when the sawtooth voltage is greater than the “Dead Time” voltage. Normally the Dead Time input is held at about 5V. When the pushbutton is pressed the voltage level on pin 4 falls to almost zero volts and the output is enabled. The RC combination of R8, R9 & C4 prevent harsh turn-on/turn-off of the output signal. The 5V comes from a voltage regulator inside the TL494 & is output on pin 14.

## IF IT DOES NOT WORK

Poor soldering (“dry joints”) is the most common reason for the circuit not working. Check all soldered joints carefully under a good light. Re-solder any that look suspicious.

- Are all the components in their correct position on the PCB.
- Are the electrolytic capacitors the right way round?
- Is the IC the right way around?
- Are the transistors and PUT the right way around?
- Are any IC leads bent up under the IC body?

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- Have you put in the 2 wire links?

COMPONENTS		
Resistors, 5% carbon		
47R yellow violet black	R11 R13	2
120R 1/2W brown red brown	R10 R12	2
1K brown black red	R4	1
10K brown black orange	R5	1
12K brown red orange	R7	1
22K red red orange	R9	1
47K yellow violet orange	R6	1
68K blue grey orange	R1	1
100K brown black yellow	R2	1
470K yellow violet yellow	R3 R8	2
5K 502 Koa trimpot	VR1	1
Electrolytic capacitors;		
1u/50V ecap	C2	1
100uF	C5	1
470u/25V	C6	1
2n2 mylar capacitor	C3	1
.47u, 474 MPE cap	C1 C4	2
2N6028 PUT	Q1	1
BA159 diode	D1 D2	2
BC548 transistor	Q2	1
TIP41C	Q3 Q4	2
TL494	IC1	1
16 pin IC socket		1
Transformer		1
Inductors 400uH		2
Piezo tweeter		1
HS103 heatsink		2
3x8mm nut & bolt set		2
Push-on switch		1
K126 PCB		1

## CONTACTING US

You can email us at [peter@kitsrus.com](mailto:peter@kitsrus.com) if you have any problems or requests. Information on other kits in the range is available from our Web page at:

<http://kitsrus.com>

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