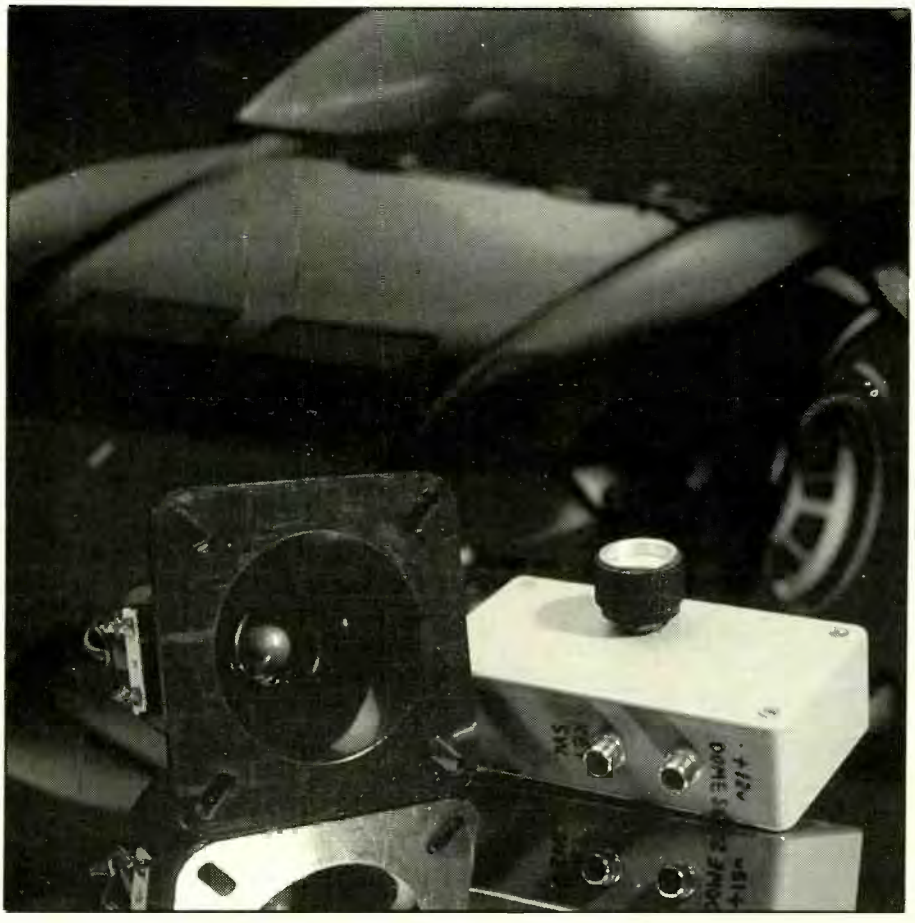
The (Car) Thief Chaser

System emits painfully loud high-pitched sound that drives off thieves before they can steal anything of value

By Desi Stelling



With the high cost of cars and high insurance premiums for them, installing a theft alarm system in them is a necessity nowadays. Unfortunately even a high-priced deluxe alarm system won't always prevent your car or anything in it from being stolen with today's savvy thieves. Even if a thief does trip an ordinary alarm, passers-by are likely to ignore it. If the foregoing makes you feel helpless, you're just one of millions of worried car owners in the same predicament. A solution to this problem is installing the (Car) Thief Chaser described here. This simple device actually drives thieves away before they can rip you off.

It does this by pumping out 40 watts of raw 10-15-kHz sound that's likely to drive away any but a deaf thief when he's inside the car. It's the combination of high-power, high-frequency sound and the car's small interior that does the trick, even if one plugs up his ears. (Only ten feet away outside the car the sound becomes bearable.)

About the Circuit

As shown in Fig. 1, a state-of-the-art power MOSFET, *Q1*, is switched on and off to deliver a large amount of power to the supertweeter connected to terminals A and B. The choice for the particular power MOSFET for *Q1* was dictated by the need for the source-to-drain resistance to switch a 4-ohm load consisting of two 8-ohm supertweeters. If only one supertweeter is used, 20 watts of 15-kHz sound power is generated by the circuit, which is adequate to protect an average-size car. The ability of the circuit to deliver 40 watts to two supertweeters adds a wide margin of safety to the system.

Timer *IC1* is operated at 15 kHz, with a 50% duty cycle. The frequency controlling RC network for the 555 timer IC is comprised of *R1*, *R2*, *R3* and *C2*, with *R2* used as a trimmer control that fine tunes the circuit for the most effective sound.

Zener diode *D4* prevents transients at the gate of *Q1* that exceed approximately 14 volts from appearing at the pin 1 output of *IC1*. (These transients occur as a result of the drain-to-gate capacitance of the MOSFET.) Diode *D3* clamps *Q1*'s drain to prevent the MOSFET from exceeding its maximum drain-to-source voltage. The need for *D3* is dictated by the inductive nature of the supertweeter(s). Switching an inductor tends to build current that must be discharged back to the battery. The discharge path that pro-

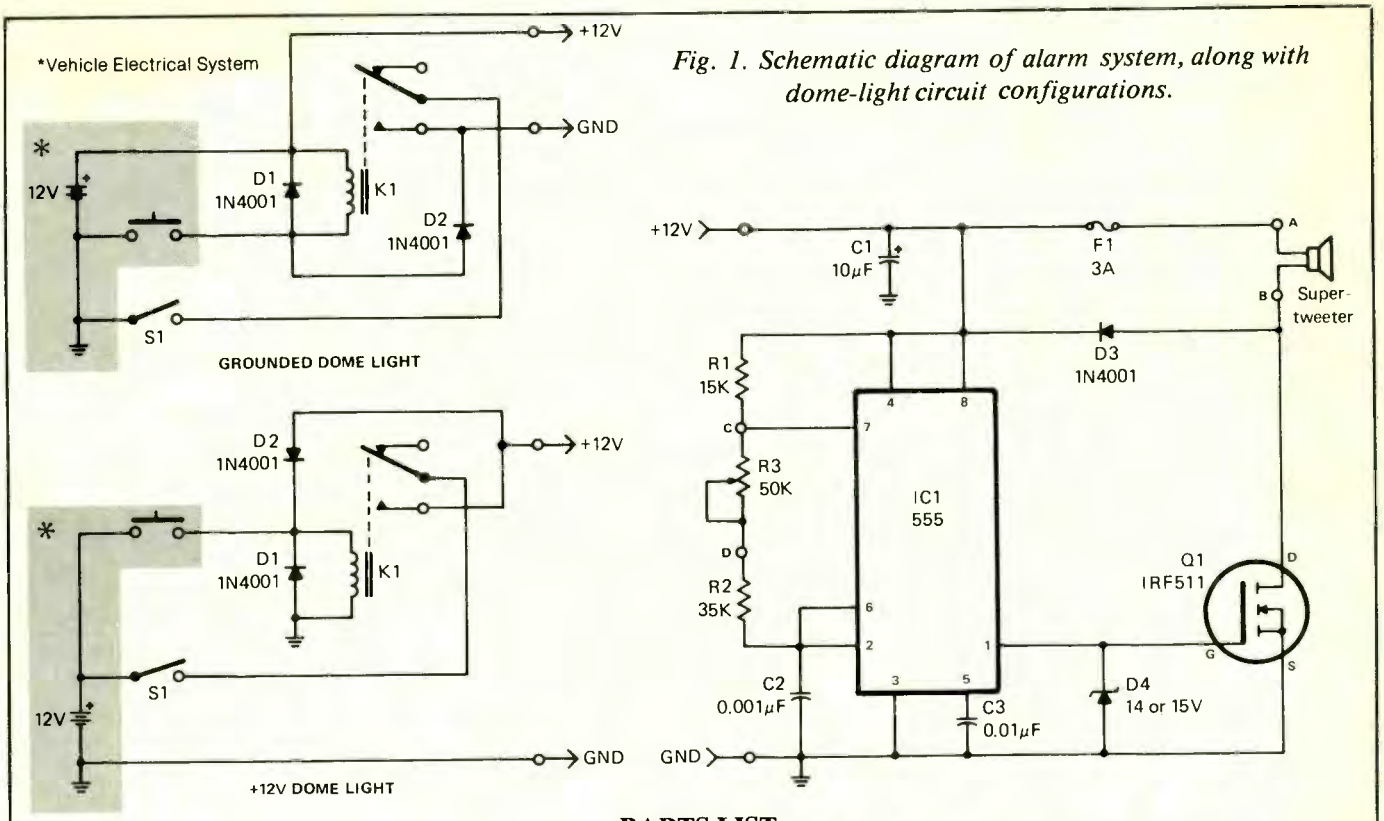


Fig. 1. Schematic diagram of alarm system, along with dome-light circuit configurations.

PARTS LIST

C1—10-μF, 50-volt electrolytic capacitor
C2—0.001-μF disc capacitor
C3—0.01-μF disc capacitor
D1,D2,D3—1N4001 rectifier diode
D4—14- or 15-volt zener diode
F1—3-ampere fuse
IC1—555 timer
K1—Dpdt 12-volt dc relay
Q1—IFR511 power MOSFET
R1—15,000-ohm, ¼-watt, 5% tolerance resistor
R2—35,000-ohm, ¼-watt, 5% tolerance resistor
R3—50,000-ohm linear-taper potentiometer
S1—Spst keyswitch

Misc.—8-ohm supertweeter (see text); printed-circuit board or perforated board and soldering hardware; 4.5" × 2.5" × 1.125" plastic project box; phono jacks and plugs (3 sets); control knob for R3; pc-mount fuse holder; two-conductor cable (see text); machine hardware and plastic cement or double-sided foam tape; stranded hookup wire; solder; etc.

Note: The following items are available from DDS Systems, P.O. Box 5715, Glendale, AZ 85312: Complete kit (less enclosure, supertweeter and keyswitch) for $19.95; pc board for $4.95; warning decal for $1.50 plus $3.50 P&H. Arizona residents, please add 6% sales tax.

tects *Q1* from being damaged by excessive current is provided by *D3*.

Power for the system is provided by your car's electrical system. It's taken from the dome-light circuit as shown in the drawings at the left in Fig. 1. Note that there are two different wiring arrangements for the dome-light circuit in modern cars.

The circuit is armed by closing keyswitch *S1*. It is tripped by closing the unlabeled switch, which is the pin switch that normally turns on the car's dome light when a door is opened. With *S1* closed, if a door is opened and the other switch is closed even momentarily, current from the car's 12-volt battery energizes *K1*.

With *K1* energized, its armature is pulled down to the lower contact. This simultaneously latches *K1* in the closed position by current flowing back to its coil through *D2* and delivers 12 volts dc to the Chaser's circuit. Diode *D1* protects the circuit from voltage spikes generated by the collapsing magnetic field when *K1* deenergizes. As long as keyswitch *S1* is closed and the circuit has been triggered, *K1* will be latched and the supertweeter will sound until *S1* is opened with a key.

Construction

The best way to assemble the circuit is on a printed-circuit board and housing it in a small plastic or metal project box. You can fabricate your own pc board using the actual-size etching-and-drilling guide shown in Fig. 2, or you can purchase a ready-to-wire board from the source given

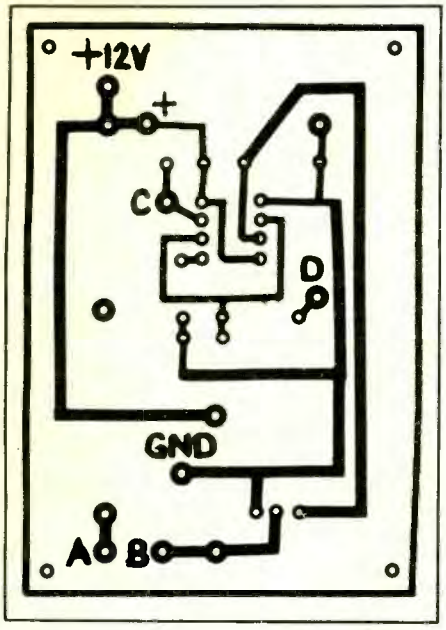


Fig. 2. Actual-size etching-and-drilling guide for pc board.

in the Note at the end of the Parts List. Wiring of the board is simple and straightforward, as shown in Fig. 3. Just be sure to properly orient *C1*, *D3*, *D4* and *IC1* before soldering their leads and pins to the copper pads on the board. Do not forget to solder short wires from the lugs on the fuse holder to the *F1* holes in the board. Use of a socket is not recommended in this project because road vibration might work the IC loose.

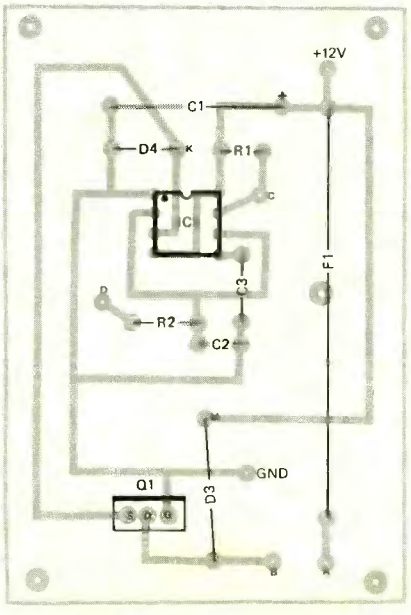
After the circuit board is wired as shown in Fig. 3, solder 2″ lengths of hookup wire to points A and B. Similarly, solder 5″ lengths of wire in the holes labeled C, D, +12V and GND. Use only *stranded* hookup wire throughout to wire the project.

Components that do not mount on the board include *D1*, *D2*, *K1*, *R3* and *S1*. Diodes *D1* and *D2* wire directly across the appropriate lugs on the relay. These diodes must be wired to the relay lugs according to the type of dome-light circuit in your car. For cars with grounded dome-light circuit, as in circuit A in Fig. 1, wire the diodes anode to anode. Those with +12-volt dome-light circuits, as in circuit B, wire cathode to cathode. Then connect and solder 2″ lengths of stranded hookup wire to the lug to which both diodes are connected and the lug that goes to the relay's armature contact.

Because ordinary phono jacks are used for the dc power input, connection of the *S1* keyswitch and the output to the supertweeter, it is important that you use a plastic—*not* metal—project box to house the project. Drill holes in the box to accommodate control *R3* and the jacks. Then mount the jacks and control in their respective locations. Label the jacks according to function) TWEETER, KEYSWITCH and +12V DOME LIGHT SWITCH).

Strip an extra ½″ of insulation from the wire coming from hole D on the pc board. Twist together the fine wires and lightly tin them with solder. Now loop this wire from the left to the center lugs (viewed from the rear) of the potentiometer and solder both connections. Then connect and solder the free end of the wire coming from hole C to the potentiometer's right lug.

Fig. 3. Wiring guide for pc board.



Connect and solder the wires coming from the pc board to the appropriate points in the circuit. Refer to Fig. 1 for details for your particular dome-light circuit configuration.

You can mount the relay and pc board assembly with plastic cement and machine hardware, respectively. Alternatively, you can use double-sided foam tape to secure the two into place. Then mount the jacks in their respective holes. Connect and solder the free ends of the wires coming from the holes labeled A and B on the circuit board to the TWEETER jack. Locate the wire coming from the armature contact of the relay and connect and solder its free end to one lug on the KEYSWITCH jack. Wire the other lug of this jack to the point in the system that corresponds to your type of dome-light circuit.

Assemble the project's case.

Installation

Mount the keyswitch in an external front-end location where it will be relatively well hidden from view and protected from the elements. Route a two-conductor cable from inside your car through the firewall to the keyswitch. Dress the cable neatly around the engine compartment, and use plastic cable ties to hold it in place. Connect the cable's conductors to the switch's lugs.

Select a location for mounting the project box where it will be invisible and relatively difficult to get at inside the passenger compartment. Once you have selected an appropriate location for the project box, determine how long the cable from the keyswitch must be, cut to length, and terminate with a phono plug.

Now find a suitable location in which to mount the supertweeter(s). Keep in mind that high-frequency sound energy tends to be quite directional. Therefore, select a mounting location that beams the sound energy to cover the front seat, particularly

the driver's area. Under the dashboard is a good location. If your car is a compact sport model, one supertweeter may be enough to assure adequate coverage. However, if your car is a full-size model, it may be better to use two supertweeters, mounted on opposite sides of the passenger compartment and angled inward to cover the front-seat area.

Select unobtrusive mounting locations for the supertweeters. Then connect and solder two-conductor cable to the lugs of each. If you are using two supertweeters, wire them in parallel with each other, properly phased. That is, tie together the cable conductors that go to the "hot" (may be identified with a + sign or a painted dot or both). Similarly, tie together the conductors that go to the "neutral" (identified with a − sign). Then run a two-conductor from the junction to the project box. Terminate the other end of the cable in a phono plug.

Connect another cable into your car's dome-light circuit (see Fig. 1) and terminate it with a phono plug at the project box end.

As you route the cables inside the passenger compartment, hide them from view as much as possible.

Once the system is completely installed, arm it by closing the keyswitch and trigger it by opening a door. If everything is okay, you should immediately hear a painfully high-pitched sound. Closing the door should not silence the sound. Disarm the system with the keyswitch. Repeat the procedure to make sure everything is okay. Then trigger the system once again and adjust the setting of the control for the most unpleasant sound. Disarm the system and mount the project box in its final location.

To use the (Car) Thief Chaser, all you do is get out of your car, lock the doors and arm it with your keyswitch. When you return, disarm it with your keyswitch—before opening any doors! ME

LETTER

Erratum

• The projects in *Modern Electronics* and other electronics magazines have helped my fellow students and me win prizes in our industrial arts shows. But out of all the magazines dealing with electronics, I find yours to be the *best*! Thank you. Incidentally, I spotted a slight error in the schematic of "The (Car) Thief Chaser" in the October 1986 issue. Pins 1 and 3 of the 555 timer should be transposed.

John Hiett
Flagstaff, AZ

Connections to pins 1 and 3 should indeed be transposed.—Ed