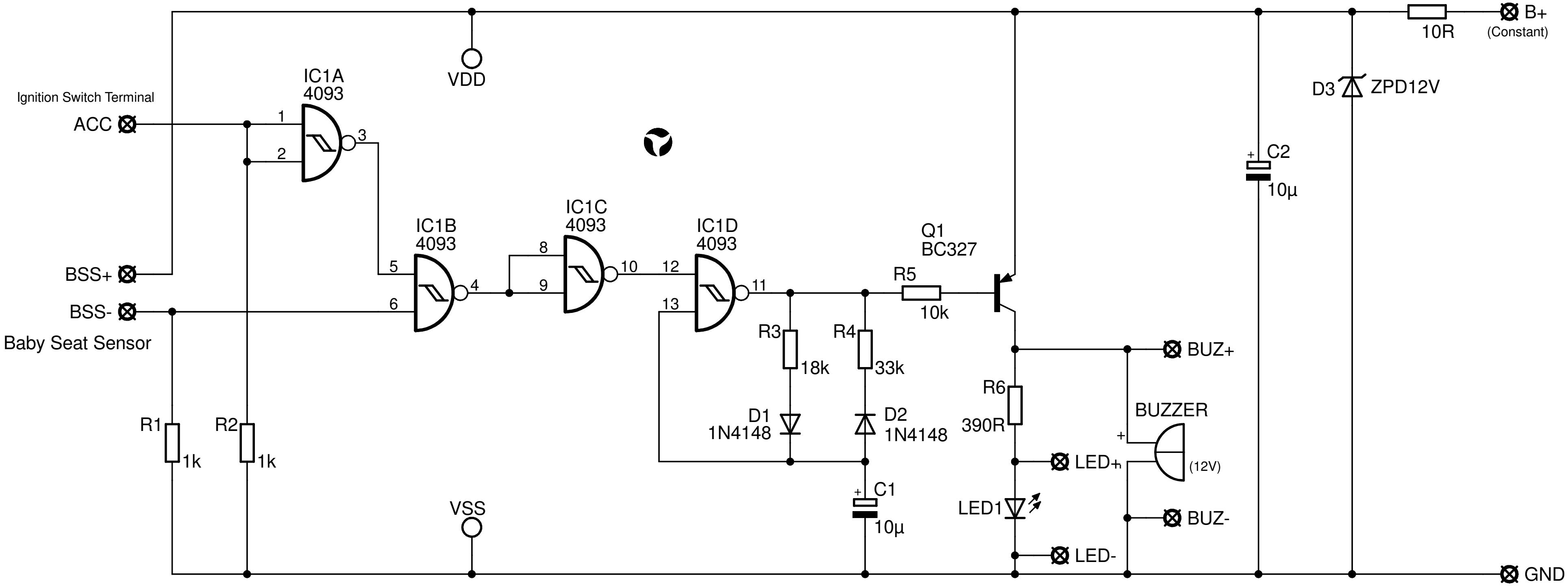
"Hot-Car Death" Alarm



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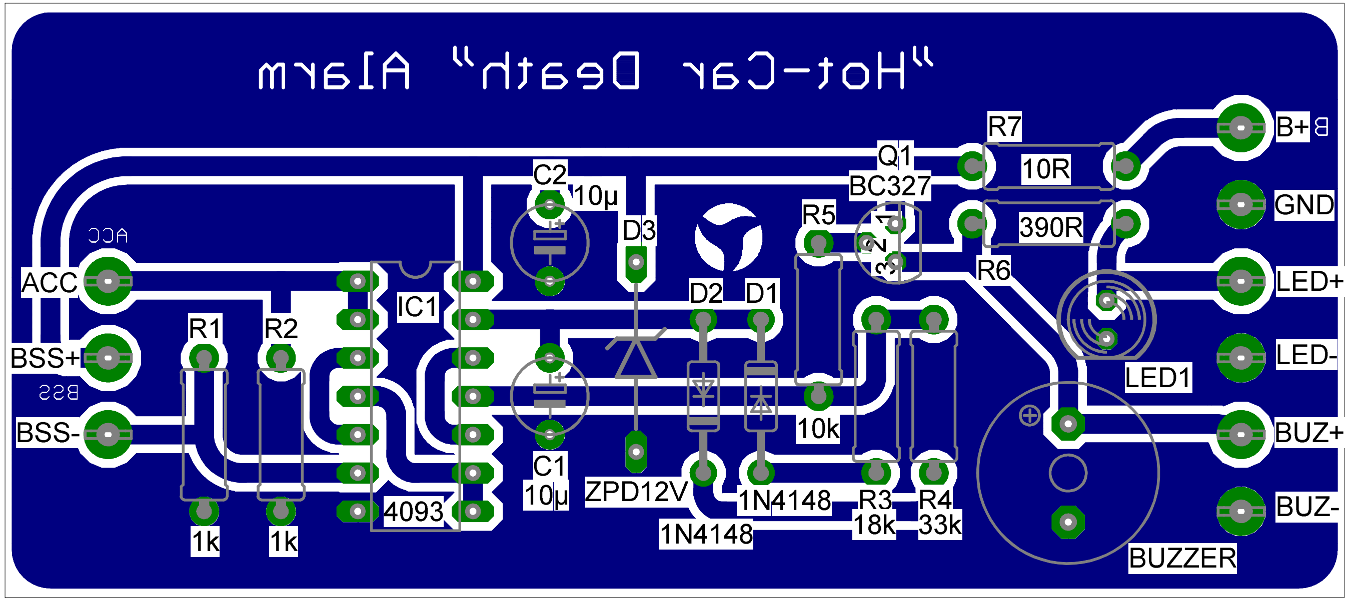

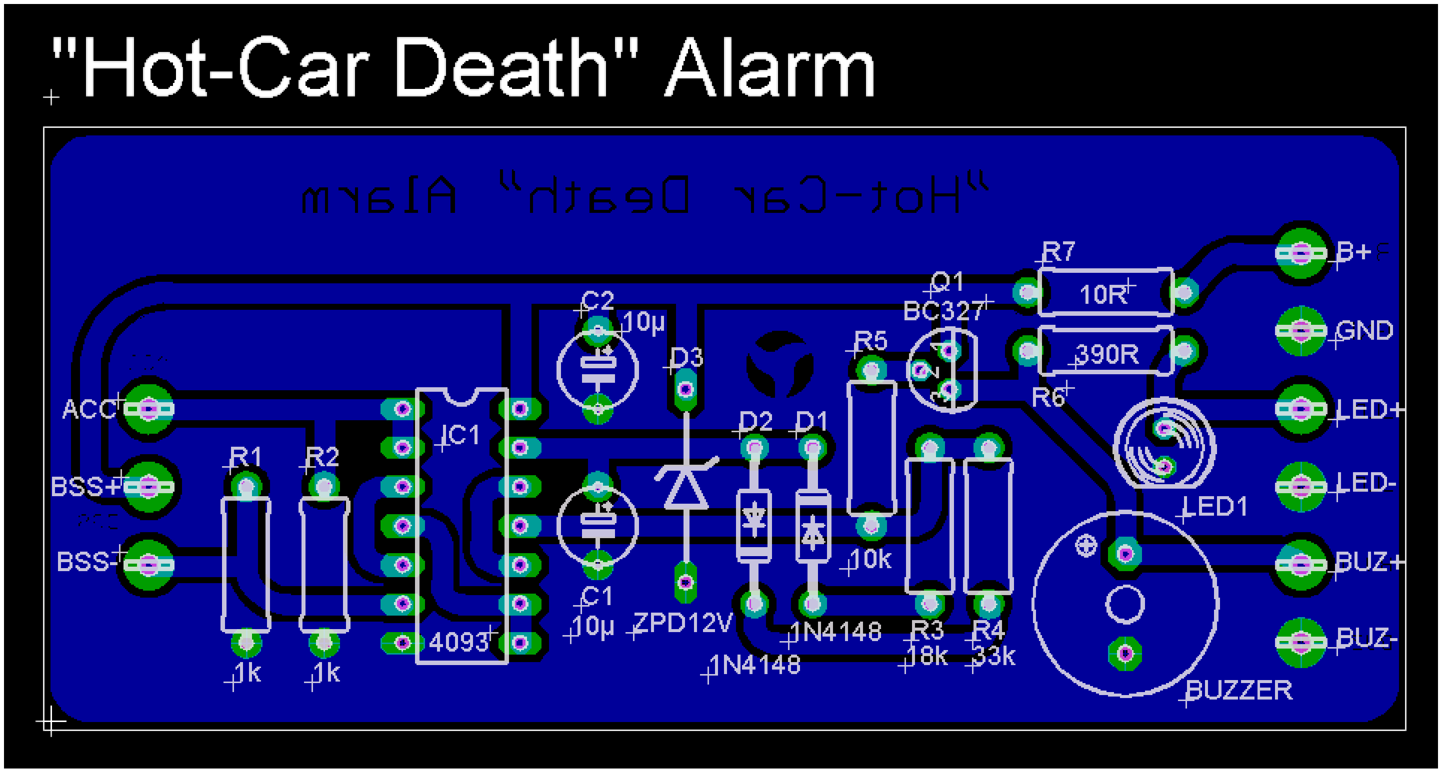

"Hot-Car Death" Alarm
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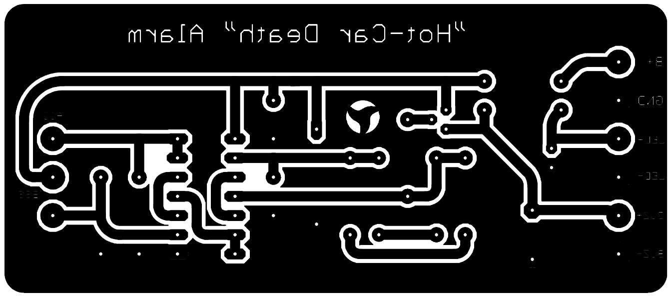
R7
10R
390R
R6
B+
GND
LED+
LED-
BUZ+
BUZ-
Q1
BC327
R5
10k
C2
10µ
D3
ZPD12V
D2
D1
1N4148
1N4148
R3
18k
R4
33k
LED1
BUZZER
ACC
BSS+
BSS-
R1
1k
R2
1k
IC1
4093
C1
10µ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IC1A and IC1C are both used as inverters i.e. a logic "0" on the input, gives a logic "1" on the output and v.v. A logic "0" is 0V and a logic "1", depends on the supply voltage, here it's 12V.

IC1A is connected to the ACCessories switch on the ignition lock switch, and goes to 12V at the first position of the ignition switch and is kept there, until the key is removed, whether the motor is started/running or not. This line can also be tapped from e.g. the supply to the car stereo.

R2, which pulls the input to IC1A low is probably not needed, as the load from car stereo and other accessories will most likely be quite enough to hold it low, but if testing out of the car, it's needed and as it has no negative impact...

Next gate is IC1B, which (N)ANDs the input from IC1A and the Baby Seat Sensor (BSS). R1 is needed to pull pin 6 low, when the baby is absent. A baby in the seat makes this output go high ("1") and when ACC goes low ("0"), pin 5 goes high as well, making the output of the gate (pin 4) goes low, saying "Remember The Rug Rat".

This signal is inverted in IC1C , as we need a high ("1") gating signal to IC1D.

IC1D is the core of an oscillator that oscillates (swings back and forth) between "0" and "1".
Only when both inputs (pins 12 and 13) of this gate is high, its output (pin 11) can go low, so it will be high until an alarm signal is issued. With a high output on pin 11, Q1 (the PNP transistor) will be "off" i.e. not conducting.

When pin 12 goe high (assuming that pin 13 is already high), the output of IC1D (pin 11) goes low and two things happen: Q1 conducts turning on the LED/buzzer combo and C1 (which was at "high" potential) starts to discharge through D2 and R4 into pin 11.

When the voltage on C1 reaches the lower threshold voltage of IC1D (very roughly 4V here) and pin 13 sees this as a "low", shifting pin 11 high once more, shutting off Q1 and C1 now charges through D1 and R3 from pin 11 until the voltage on C1 reaches the upper threshold voltage (very roughly 8V here), which again makes pin 11 low and this back and forth goes on as long as pin 12 is high (i.e. alarm signal issued).

Q1 is thus driven on/off/on/off/etc. with a timing for the off-periods determined by R3 and C1 and the on-periods determined by R4 and C1. Both R3 and R4 could be variable resistors, but in an automotive environment, one should never use trimmers unless absolutely necessary – much better to determine the value of the resistors and be done with it. Suitably timing would be from 1 to maybe 5 flashes/beeps a second.

With the values chosen (33k and 18k) T_{ON} is ~230ms and T_{OFF} is 125ms~, giving a period of ~355ms, which equates to ~2.8 flashes/s
Approximate formula for T_{ON} = 0.7 x R4 x C1 and T_{OFF} = 0.7 x R3 x C1

Example: 47k chosen from R4
T_{ON} = 0.7 x 47000 Ohm x 0.00001 Farad = 329 ms