Luggage Security Alarm using IC UM3561

Aman Chadha, and Abhijeet Ballani, TE, EXTC

Abstract—When we travel by train we are always skeptical about the theft of our luggage and find ways and means to secure our luggage, many a times unsuccessfully. We were looking at a simple and more efficient way of doing the same. We made a luggage security alarm with the help of musical tones IC 3561 which is powered with 1.5x2 V batteries and hence is very portable. The moment the lock is broken, the IC generates an alarm either a police siren, fire engine siren, machine gun sound or an ambulance alarm thus notifying the owner about the theft of his luggage, hence alarming the owner about the theft.

I. INTRODUCTION

Often, while travelling by train or bus, generally our luggage is locked using a typical chain-and-lock arrangement. However, someone may cut the chain and steal our luggage. Here, is a simple circuit to alarm you when somebody tries to cut the chain.

II. INTERNAL DESCRIPTION

A. A brief overview of the UM3561 IC

UM3561 is an excellent ROM IC that can generate Multi siren tones simulating Police siren, Ambulance siren, Fire brigade siren and Machine gun sound. This 8 pin low power IC can work down to 2.4 volts.

UM3561 is a low-cost, low-power CMOS LSI designed for use in alarm and toy applications. Since the integrated circuit includes oscillator and selector circuits, a compact sound module can be constructed with only a few additional components. The M3561 contains a programmed mask ROM to simulate siren sound.

The UM 3561 is a low cost siren generator designed for use in toy applications. The IC has an inbuilt oscillator and tone selection pins. It is easy to make a siren generator with only a few external components. Only one external resistor and a speaker driver transistor are sufficient to make a simple siren generator.

B. Inside the UM3561

Inside the IC, there is an oscillator circuit and the frequency of oscillations is controlled by the external resistor connected to OSC 1 (Pin 7) and OSC2 (Pin 8). A 220 K resistor will give satisfactory results. The oscillations thus generated will be then transferred to a control circuit which function based on the tone selection through the connections of SEL 1 (Pin 6) and SEL2 (Pin 1). The control circuit passes the signal to an address counter and then to the ROM. The tone pulses thus generated will be available from the output pin 3. Since the sound is weak, an amplifier is necessary to get loud sound. A single NPN transistor will amplify the sound.

![Fig. 1. Figure showing internal structure of IC UM3561 with a block diagram](image)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tone Sel. 2</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>4</td>
<td>NC*</td>
</tr>
<tr>
<td>5</td>
<td>+3V</td>
</tr>
<tr>
<td>6</td>
<td>Tone Sel .1</td>
</tr>
<tr>
<td>7</td>
<td>Osc 1</td>
</tr>
<tr>
<td>8</td>
<td>Osc 2</td>
</tr>
</tbody>
</table>

*Used for testing purpose

C. IC Specifications: Absolute Maximum Ratings

- DC Supply Voltage: Min 2.4V Typ 3V Max 5.0V
- Input Voltage Range: VSS -0.3V to VDD +0.3V
- Operating Ambient Temperature: -10°C to +60°C
- Storage Temperature: -55°C to +125°C
- Operating current: Min 180 uA
D. IC Specifications: Features

- Four sounds can be selected
- Power on reset.
- Typical 3V operating voltage
- A magnetic speaker can be driven by connecting
- 8-pin DIP package form an NPN transistor

E. Schematic Description

As shown in the schematic, Transistor T1 enables supply to the sound generator chip when the base current starts flowing through it. When the wire (thin enameled copper wire of 30 to 40 SWG (Standard Wire Gauge), used for winding transformers) loop around the chain is broken by somebody, the base of transistor T1, which was earlier tied to positive rail, gets opened. As a result, transistor T1 gets forward biased to extend the positive supply to the alarm circuit.

In idle mode, the power consumption of the circuit is at its minimum and thus it can be used for hundreds of travel hours. The IC produces all the sound effects, the output at Pin 3 being amplified by the Darlington arrangement. A 64 Ω loudspeaker can be substituted (to gain better sound clarity) in place of 8 Ω loudspeaker (250 mW Power Rating). To enable generation of different alarm sounds, connections to pin 1 and 6 may be made as per the table.

<table>
<thead>
<tr>
<th>Select 1 (Pin 6)</th>
<th>Select 2 (Pin 1)</th>
<th>Sound Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>×</td>
<td>×</td>
<td>Police siren</td>
</tr>
<tr>
<td>V_DD</td>
<td>×</td>
<td>Fire-engine siren</td>
</tr>
<tr>
<td>V_SS</td>
<td>×</td>
<td>Ambulance siren</td>
</tr>
<tr>
<td>&quot;-&quot;</td>
<td>V_DD</td>
<td>Machine-gun sound</td>
</tr>
</tbody>
</table>

Note: × = no connection; "-" = do not care

III. SCHEMATIC

![Schematic of the Luggage Security Alarm using IC UM3561](image)

Fig. 3. Schematic of the Luggage Security Alarm using IC UM3561. In the above schematic, R1=10kΩ, R2=220kΩ, R3=560Ω, T2=BC548, T1=BC548, G1=3V, DC T3=BC548, SG1=Speaker 8Ω 250mW

IV. PHYSICAL CONNECTION ARRANGEMENT

![Figure showing physical connection arrangement between the points A and B on the Luggage Alarm Circuit attached to the chain which is anchored on to a surface](image)

Fig. 4. Figure showing physical connection arrangement between the points A and B on the Luggage Alarm Circuit attached to the chain which is anchored on to a surface.

V. PCB MAKING PROCESS

A. Requirements
- Laser printer
- Suitable glossy paper
- Copper PCB boards
- An iron
- Etchant
- Protective clothing

B. Overview
Print up the PCB traces on suitable paper and transfer the toner to the copper. Etch the board, remove the toner and drill. The PCB is ready.

C. Printing PCBs
Use a transparency of good quality. To save time, effort and expenses it's a good idea to combine multiple images to try and fill the entire 8.5x11 page with PCBs. Remember that these must be printed as mirror images of the final PCB in order to be correct after transferring them to the copper board.
E. Transferring the Image
To proceed you will need a cutout of a single PCB image from the glossy paper, a very clean copper board and a clothes iron. Place the PCB mirror image face down on the copper, ensuring it is correctly positioned. You can use a few pieces of tape to secure the glossy paper to the board but I find that, if you are careful when you begin to iron, the paper sticks and stays in place on its own. Preheat your trusty clothes iron, using the hottest setting it’s got (cotton, linen or above). Iron the entire area of paper, pressing firmly and staying long enough to ensure the toner melts a bit and binds to the copper. Carefully remove the paper. If certain areas seem particularly difficult to peel off, you can try soaking a bit more.

![Printed Layout and the Copper Clad PCB Surface](image)

F. Etching the Board
When creating a PCB using a chemical etchant, you want to protect certain areas of copper from the chemical reaction (to form the pads and signal lines) and let the ferric chloride remove all the metal that remains exposed. The next step consists in removing unwanted copper from the board. You can use the classic, ferric chloride or other chemical solutions. You won't need a ton of etchant for a regular sized PCB. Start with a bit, enough to cover the board. You can always add more if the reaction stops. Just how much etchant you need and how long the process takes will depend on many things: the size of the PCB, the amount of copper on the board (both in terms of area and thickness). Somewhat hotter etchant will react faster than a cold solution but we like the ease and control that using room temperature etchant affords us. Regularly stir the solution, every couple of minutes, to ensure the board is in contact with fresh etchant. After a while, you will be able to see that the reaction has begun. The etchant solution will get filled with dark colored particles and the copper will begin to disappear. Removing the PCB from the solution for a few seconds will reveal freshly etched spots. After something like 50-75% of the copper has been removed, gently stir the solution (never use metal) on sway the container and keep an eye on the state of your board. The process seems to accelerate in the final stages; this is only an impression but it can surprise you and lead to over-etching. Leaving the board in the solution too long will cause the etchant to eat at your signal traces from below, potentially causing breaks in your traces.

![Ferric Chloride, the etchant](image)

G. Finishing the PCB
Drill holes as appropriate, place your components and solder.

VI. PCB LAYOUT

![Final PCB](image)
VII. CONCLUSION

The security concerns raised by the typical chain-and-lock arrangement have been completely overcome by using our Luggage Security Alarm.

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REFERENCES
