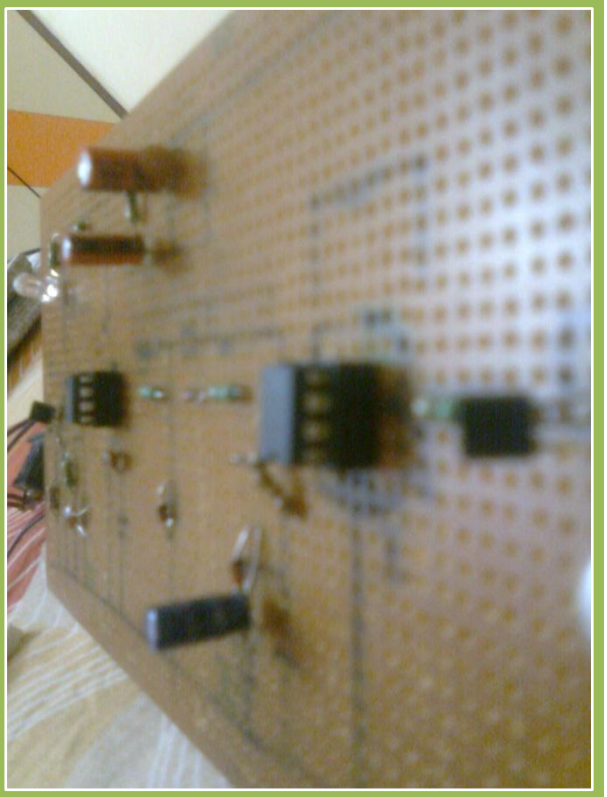
2011

Smart Vibration Sensor



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List of contains

Introduction

Introduction of circuit

This circuit senses the minimum effective vibration by peizo sensor and primary FET transistor amplify the signal and send to LM555 I.C. as trigger pulse.

The LM555 i.c. supply uniform d.c. voltage to sound i.c. UM3561 & this i.c. generate pulsating signal

What is Sensor?

It is a device for sensing a physical variable of a physical system or an environment.

Quantities measure by Sensors

- **Mechanical quantities:** displacement, rotation velocity, acceleration, pressure, force/torque.
- **Thermal quantities:** temperature, heat.
- **Electromagnetic quantities**: voltage, current, frequency, magnetism.
- **Chemical quantities:** moisture, pH value

What is the need of Smart Vibration Sensor?

- For the safety purpose
- As a earth quack detector
- For house security
- In heavy loading machine
- As a door bell(future application)

Introduction of Elements

PIEZO SENSOR

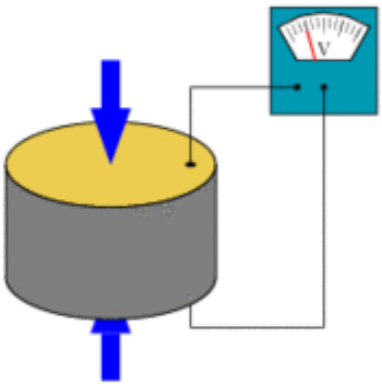
Two main groups of materials are used for piezoelectric sensors:

- piezoelectric ceramics
- Single crystal materials.

A Piezo sensor is sense the vibration and produces a specific amount of voltage.

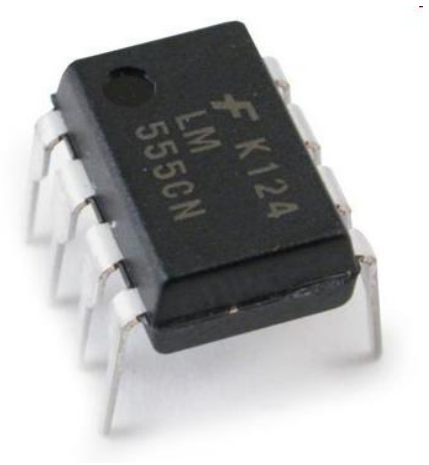
From shown in figure when distance between the two plates is change then it produce the voltage at their two terminals.

Then this voltage is given to the LM555 I.C. as a trigger pulse.



LM555 I.C

Description



The LM555 is a highly stable device for generating accurate time delays or oscillation.

Additional terminals are provided for triggering or resetting if desired.

In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor.

For a stable operation as an oscillator, the free running frequency and duty cycle are accurately controlled with two external resistors and one capacitor.

UM3561 I.C

Description

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.

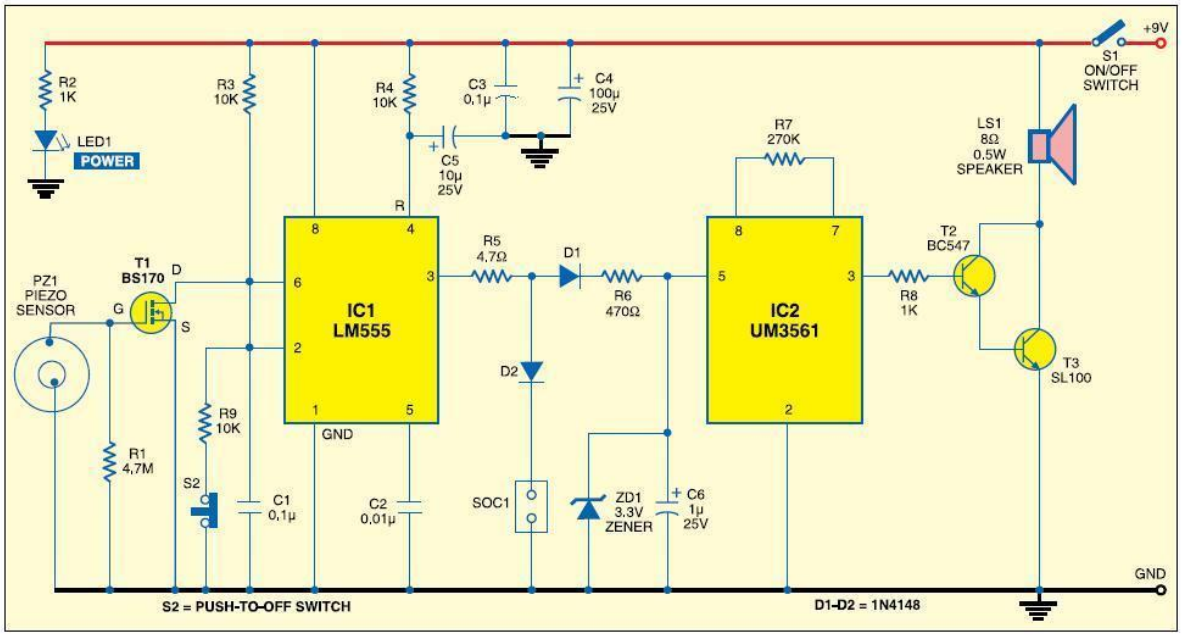
The M3561 contains a programmed mask ROM to simulate siren sound.

Circuit Diagram

This is the circuit diagram of Smart Vibration Sensor.

It divided in two parts as below:

- Vibration sensor
- Sound generator



1. Vibration sensor part

It includes piezo sensor which sense the vibration and produce triggering pulse this pulse is given to the LM555 I.C.

The LM555 is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired.

2. Sound generator part

It includes UM3561 I.C. which is Sound generator i.c. It is produce four different types of sounds like Police siren, Fire Engine Siren, Ambulance Siren, and Machine Gun.

Working

- The circuit works on 9V DC supply. In this vibration sensor alarm circuit initially, when power switch S1 is flipped to 'on' position, power indicator LED1 lights up immediately. As soon as vibration is detected, MOSFET-T1 is fired by the positive going pulse output from the vibration sensing mechanism built around piezo-ceramic wafer and associated components.
- Control input pins 2 and 6 of IC1 latch are grounded. As a result Output pin 3 of IC1 now goes high. The positive supply from output pin 3 of IC1 is extended to tone siren generator UM3561 (IC2) through R5, D1 and R6.
- Components R6 and ZD1 stabilize the input power supply of IC2 to around 3.3V.
- Output signals from IC2 are amplified by Darlington-pair transistors T2 and T3 to produce alert tone (police siren sound) via loudspeaker.
- Reset switch S1 can be used to switch off the alarm sound by resetting the circuit.
- A relay can also be connected at the output socket (SOC1) of the circuit to emergency sirens and Fence electrification units.

List of Component & Cost

No.	Name of components	Quantity	Price
1.	9v battery	1	10Rs.
2.	PCB	1	18 Rs.
3.	Piezo sensor	1	15 Rs.
4.	LM555 I.C.	1	5Rs.
5.	UM3561 I.C.	1	28 Rs.
6.	Register	13	6 Rs.
7.	BS170	1	10 Rs.
8.	BC547	1	2 Rs.
9.	SL100	1	7 Rs.
10.	1N4148 diode	2	2 Rs.
11.	Push to off switch	1	10 Rs.
12.	On/Off switch	1	5 Rs.
13.	0.5 w Speaker	1	12 Rs.
14.	I.C. Socket	2	4 Rs.
15.	1µ ,25 V capacitor	3	6 Rs.
16.	3.3v zenor diode	1	2 Rs.
17.	0.1µf capacitor	3	3 Rs.
Total			145 Rs.

Conclusion

- After creating this project we observe that this system is so sensitive that any minimum vibration due to air the piezo sensor detects the vibration and circuit is run and alarm is on.

- So if we want to get accurate value of vibration produce by the earth we have to build a proper air tight chamber and put vibration sensor in it thus we can get the reading of vibration.

Data Sheet of LM555 I.C.

LM555
Timer
General Description

The LM555 is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For astable operation as an oscillator, the free running frequency and duty cycle are accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output circuit can source or sink up to 200mA or drive TTL circuits.

Features

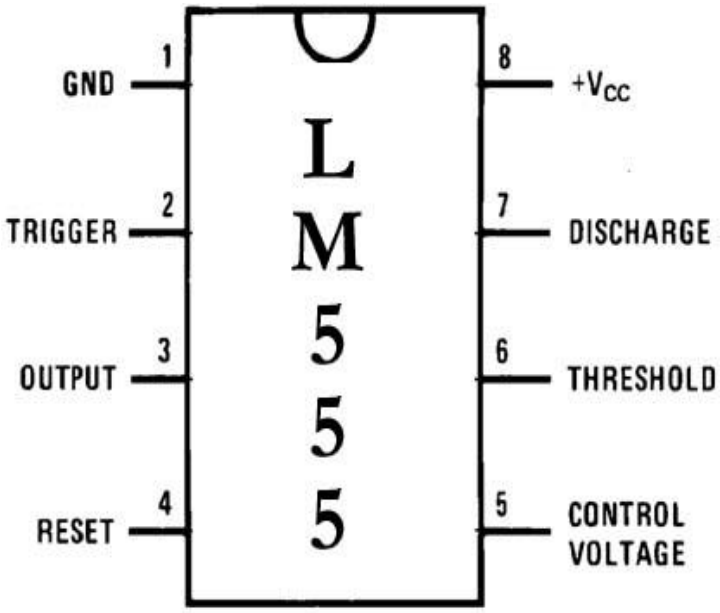
- Direct replacement for SE555/NE555
- Timing from microseconds through hours
- Operates in both astable and monostable modes
- Adjustable duty cycle
- Output can source or sink 200 mA
- Output and supply TTL compatible
- Temperature stability better than 0.005% per °C
- Normally on and normally off output
- Available in 8-pin MSOP package

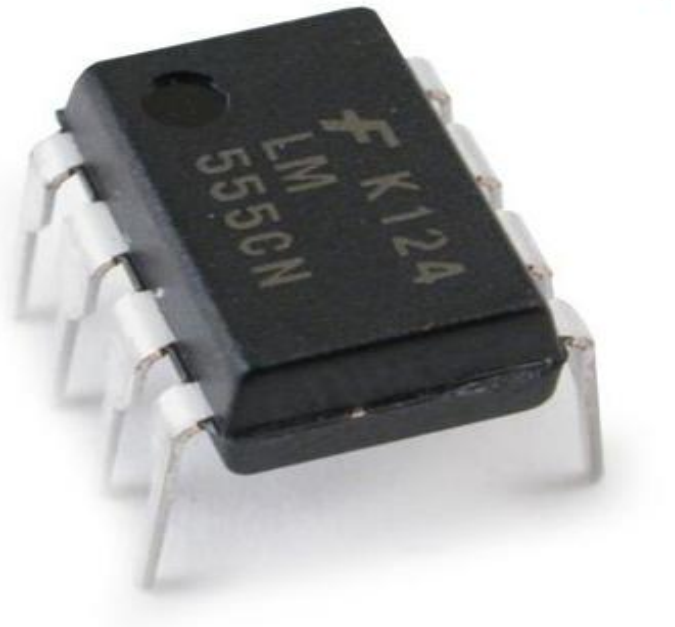
Applications

- Precision timing
- Pulse generation
- Sequential timing
- Time delay generation
- Pulse width modulation
- Pulse position modulation
- Linear ramp generator

Connection Diagram

Dual-In-Line, Small Outline
And Molded Mini Small Outline Packages





➢ **Electrical Characteristics** (Notes 1, 2)
(TA = 25°C, VCC = +5V to +15V, unless otherwise specified)

Parameter	Conditions	Limits			Units
		LM555C			
		Min	Typ	Max	
Supply Voltage		4.5		16	V
Supply Current	VCC = 5V, RL = ∞ VCC = 15V, RL = ∞ (Low State) (Note 4)		3 10	6 15	mA
Timing Error, Monostable Initial Accuracy Drift with Temperature Accuracy over Temperature Drift with Supply	RA = 1k to 100kΩ, C = 0.1µF, (Note 5)		1 50 1.5 0.1		% Ppm/°C % %/V
Timing Error, Astable Initial Accuracy Drift with Temperature Accuracy over Temperature Drift with Supply	RA, RB = 1k to 100kΩ, C = 0.1µF, (Note 5)		2.25 150 3.0 0.30		% Ppm/°C % %/V
Threshold Voltage			0.667		VCC
Trigger Voltage	VCC = 15V VCC = 5V		5 1.67		V V
Trigger Current			0.5	0.9	µA

Reset Voltage		0.4	0.5	1	V
Reset Current			0.1	0.4	mA
Threshold Current	(Note 6)		0.1	0.25	µA
Control Voltage Level	VCC = 15V VCC = 5V	9 2.6	10 3.33	11 4	V
Pin 7 Leakage Output High			1	100	nA
Pin 7 Sat (Note 7) Output Low Output Low	 VCC = 15V, I7 = 15mA VCC = 4.5V, I7 = 4.5mA		180 80	 200	mV mV
Output Voltage Drop (Low)	VCC = 15V ISINK = 10mA ISINK = 50mA ISINK = 100mA ISINK = 200mA VCC = 5V ISINK = 8mA ISINK = 5mA		 0.1 0.4 2 2.5 0.25	 0.25 0.75 2.5 0.35	 V V V V V V
Output Voltage Drop (High)	ISOURCE = 200mA, VCC = 15V ISOURCE = 100mA, VCC = 15V VCC = 5V	 12.75 2.75	12.5 13.3 3.3		V V V
Rise Time of Output			100		ns
Fall Time of Output			100		ns

Note 1: All voltages are measured with respect to the ground pin, unless otherwise specified.
Note 2: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings.

Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

Note 3: For operating at elevated temperatures the device must be rated above 25°C based on a +150°C maximum junction temperature and a thermal
resistance of 106°C/W (DIP), 170°C/W (S0-8), and 204°C/W (MSOP) junction to ambient.

Note 4: Supply current when output high typically 1 mA less at VCC = 5V.

Note 5: Tested at VCC = 5V and VCC = 15V.

Note 6: This will determine the maximum value of RA + RB for 15V operation. The maximum total (RA + RB) is 20MΩ.

Note 7: No protection against excessive pin 7 current is necessary providing the package dissipation rating will not be exceeded.

Note 8: Refer to RETS555X drawing of military LM555H and LM555J versions for specifications.

Data Sheet of UM3561 I.C.

UM3561
UM3561A Three Siren Sound Generator

Features

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

General Description

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.

Absolute Maximum Ratings

DC Supply Voltage ..... -0.3V to +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

Electrical Characteristics

(Vdd=3V, Vss=0V, Ta=25□C, Fosc=106496Hz unless otherwise specified.)

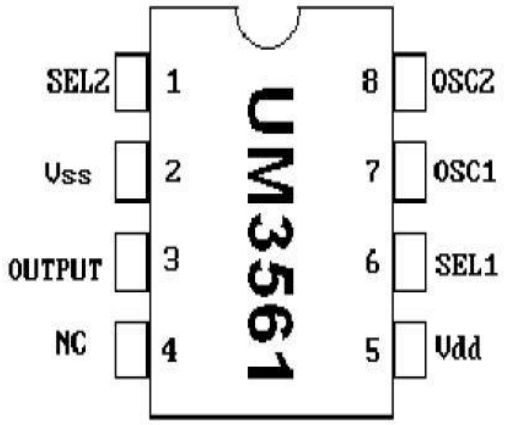
Parameter	Symbol	Min.	Typ.	Max.	Conditions
Operating voltage	Vdd	2.4V	3V	3.6V	-
Operating Current	Idd	-	-	150μA	-
”H” Input Voltage	Vih	Vdd-0.2	-	Vdd	-
“L” Input Voltage	Vil	Vss	-	Vss+0.2	-
Frequency Stability	ΔF/F	-	-	20%	$\frac{Fosc(3.3V)-Fosc(2.7V)}{Fosc(2.7V)}$
Output Current	Io/p	3mA	-	-	-
Frequency Deviation	ΔF/F	-10%	-	+10%	-

Playing modes

SEL1	SEL2	Sound Effect
NC	NC	Police Siren
Vdd	NC	Fire Engine Siren
Vss	NC	Ambulance Siren
X	Vdd	Machine Gun

NC: No Connection
X: Don't Care

Pin Configuration



Pin Configuration

Pin no.	Symbol	Description
1	SEL2	Sound effect selection pin no. 2
2	Vss	Negative power supply
3	OUTPUT	Mono-tone output
4	NC	Internal testing pin : Leave open for normal operation
5	Vdd	Positive power supply
6	SEL1	Sound effect selection pin no. 1
7	OSC1	External oscillator terminal 1
8	OSC2	External oscillator terminal 2

Reference

- The circuit of smart vibration sensor is tested by Prof. T.K. Hareendran and Prof. S.C. Dwivedi

➢ The circuit idea get from the electronics for you web site

- www.EFYMAG.com
- www.electronicsminiproject.com