Timers

Mati Chessin

10/07/04
Contents

• Intro to Timers
• General Uses
• 555 Timer
Introduction

What is a timer?

• A timer is a device that oscillates at an exact, programmable frequency

• In an electronic device, the timer will be used to coordinate actions and keep components working at the same rate
Introduction

• 1880 - Piezoelectric effect discovered by Jacques and Pierre Curie
• 1905 - First hydrothermal growth of quartz in a laboratory by G. Spezia
• 1918 - First use of piezoelectric crystal in an oscillator
• 1927 - First quartz crystal clock built
• 1934 - First practical temp. compensated cut, the AT-cut, developed
• 1956 - First commercially grown cultured quartz available
• 1971 - Introduction of 555 timer by Signetics (later acquired by Philips)
Introduction

How do timers work?

• Timers are regulated by an oscillating device, usually a crystal
• The crystal is made of a piezoelectric material, such as quartz
• As crystal vibrates, it produces voltage when compressed and the opposite voltage when expanded
• By vibrating the crystal at its natural frequency, a circuit can be created to produce a very regular timing signal
• Higher oscillation frequencies yield lower output voltages

• A purely electronic timer can be made by utilizing a capacitor and resistor to regularly store and discharge voltage
General Uses

- Timers are used in many electronic devices:
  - Examples: Clocks, radar, computers, microwaves, robots, HC11, etc…
  - Used to measure the time between inputs (leading or falling edge of signal)
  - Used for pulse width measurement
  - Used to create a time delay
General Uses

A Single device can have multiple timers. These could be both built-in or external. For example:

HC11 could regulate a 555 timer that controls an LED
General Uses

Common Applications:

- **Monostable Multivibrator**
  - Holds a state ("high" or "low") until triggered
  - Once triggered, keeps other state for a determined amount of time
General Uses

Common Applications:

• Bistable Multivibrator
  – Can hold either the high or low state
  – When triggered, it switches state
General Uses

Common Applications:
- **Astable Multivibrator**
  - Automatically switches between high and low states
  - Becomes a rectangular wave generator
The 555 Timer

- Most common timer
- Costs about $0.50
- A single pulse lasts 1.1 ms
- 15,400 seconds is the longest time it can be set to
The 555 Timer

Astable 555

- pin 2
- pin 7
- control F/F
- pin 3
- +Vcc
- RESET

Fig. 3

(c) Tine van Rooij
The 555 Timer

555 Schematic

(c) Tony van Roon

Fig. 4–2

The George W. Woodruff School of Mechanical Engineering
References

- http://www.me.gatech.edu/mechatronics_lab/LabMaterials/EExercise2.pdf
- http://www.me.gatech.edu/charles.ume/me6405Fall01/ClassNotes/Timer_fall_01.ppt
- http://www.madsci.org/posts/archives/may98/895289339.Eg.r.html