Lecture 9

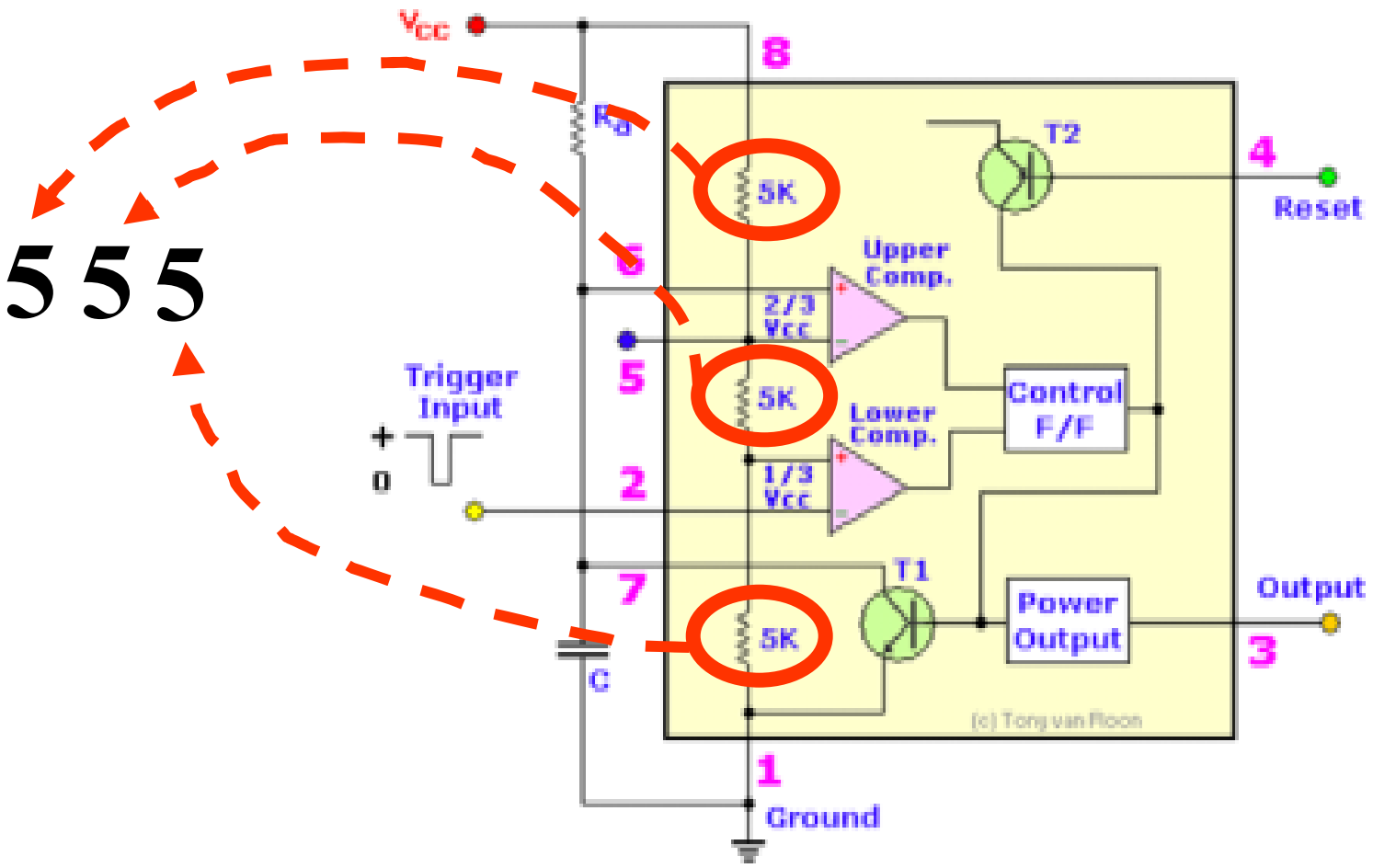
Pulse Generation

- Pulsout
  - Software version of pulse generation
  - Pulsout pin, Period
    - Pin: specified I/O pin from 0 to 15
    - Period: 2 μsec per each unit
- 555 Timer
  - Hardware version of pulse generation
  - BS2 can do other works
  - Microcontroller is not necessary

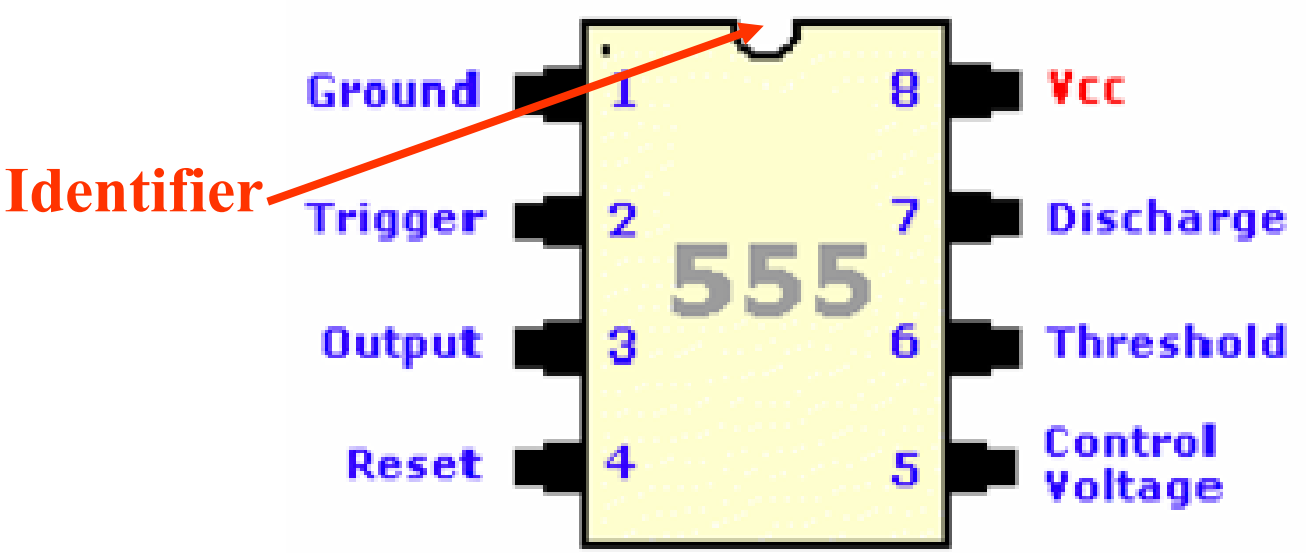
555 Timer

- Highly stable devices for generating accurate time delay or oscillation
- Not programmable
- Controlled by resistors and capacitors
- Applications
  - Pulse generation
  - PWM
  - Time delay generation

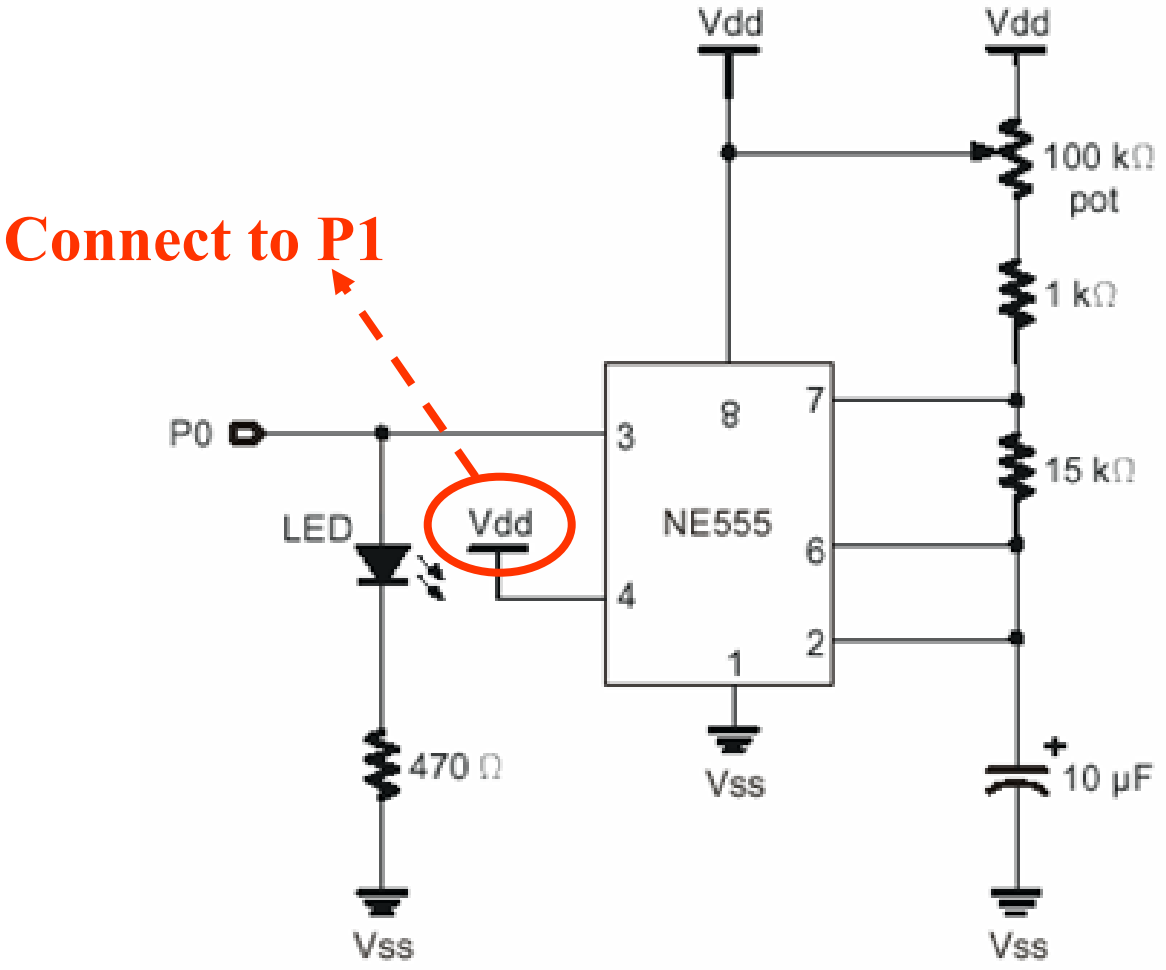
555 Timer Block Diagram



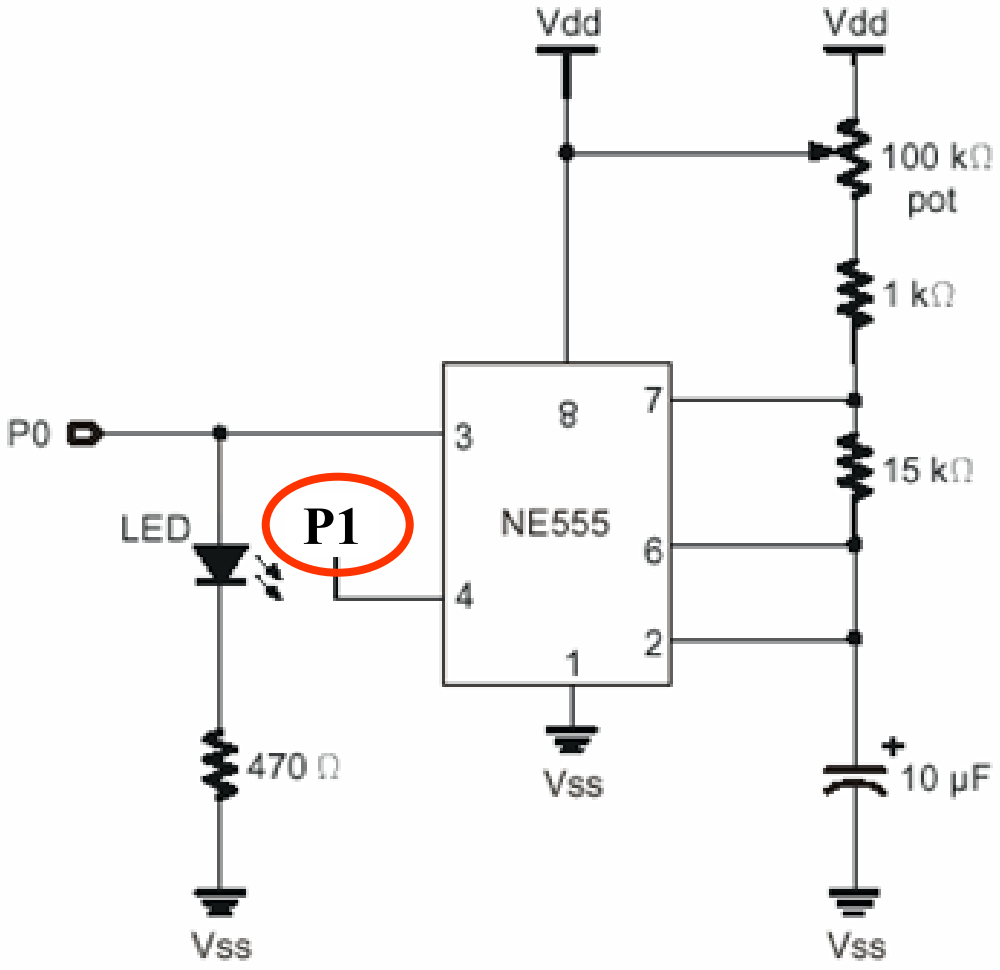
Connection Diagram



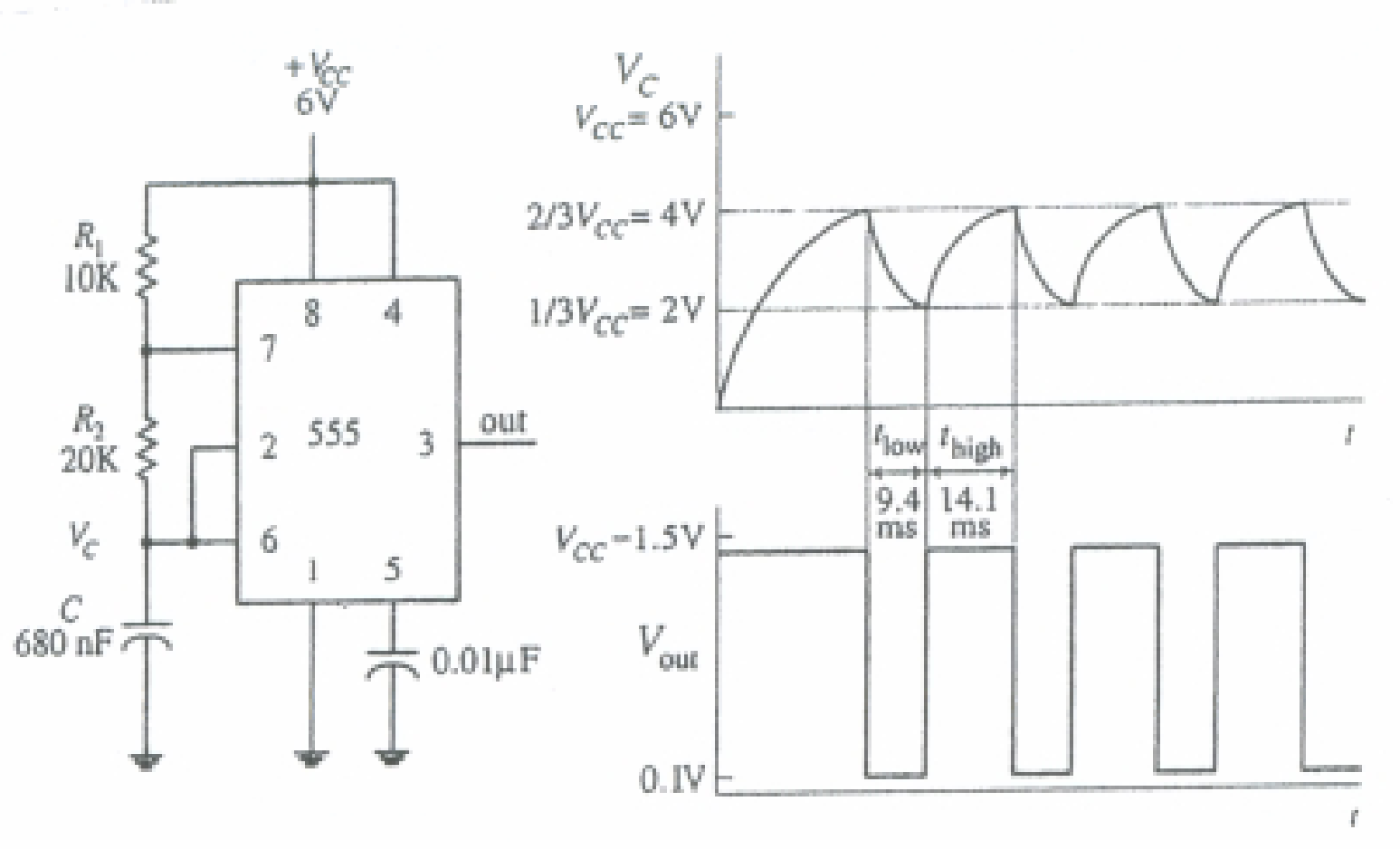
555 Timer without BS2



555 Timer with BS2



Astable Operation 1



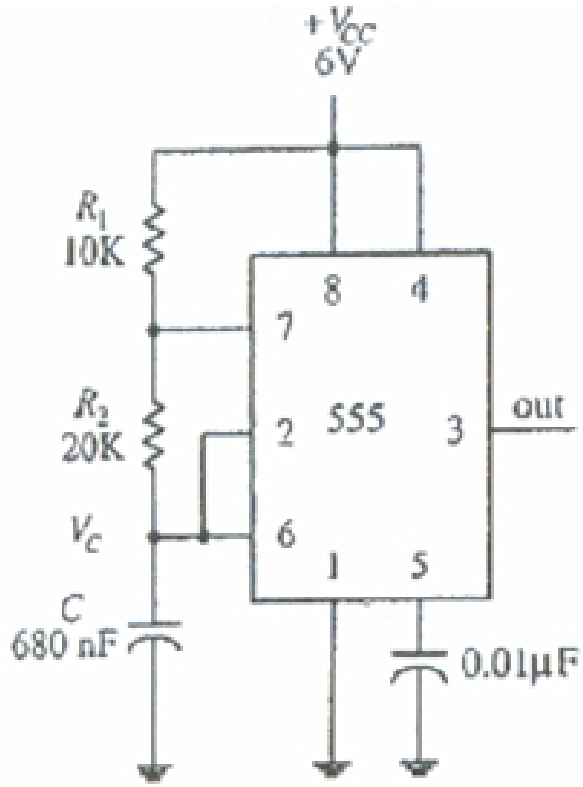
Calculation of Duty Cycle

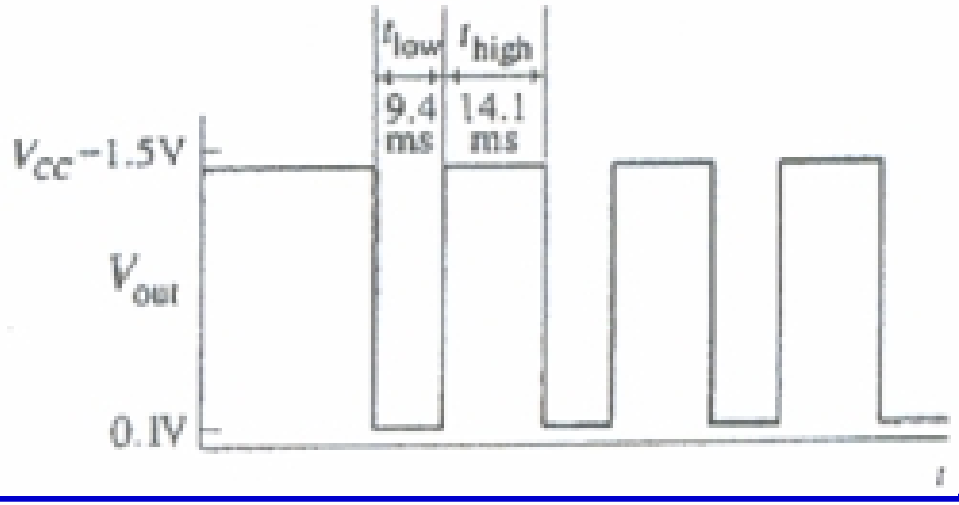
$$t_{low} = 0.693 \; R_2 C$$

$$t_{high} = 0.693 \; (R_1 + R_2) C$$

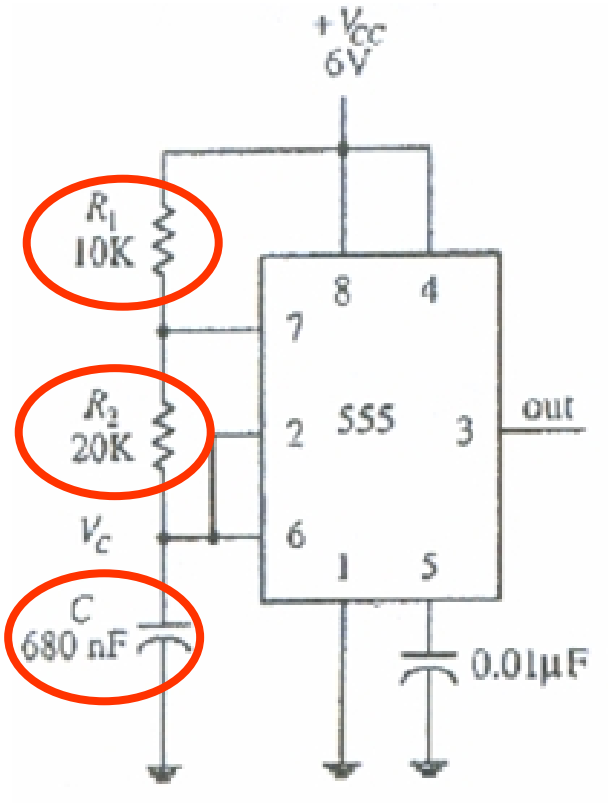
$$Duty \;\; cycle = \frac{t_{high}}{t_{high} + t_{low}}$$

$$f = \frac{1}{t_{high} + t_{low}}$$





Calculation of Duty Cycle



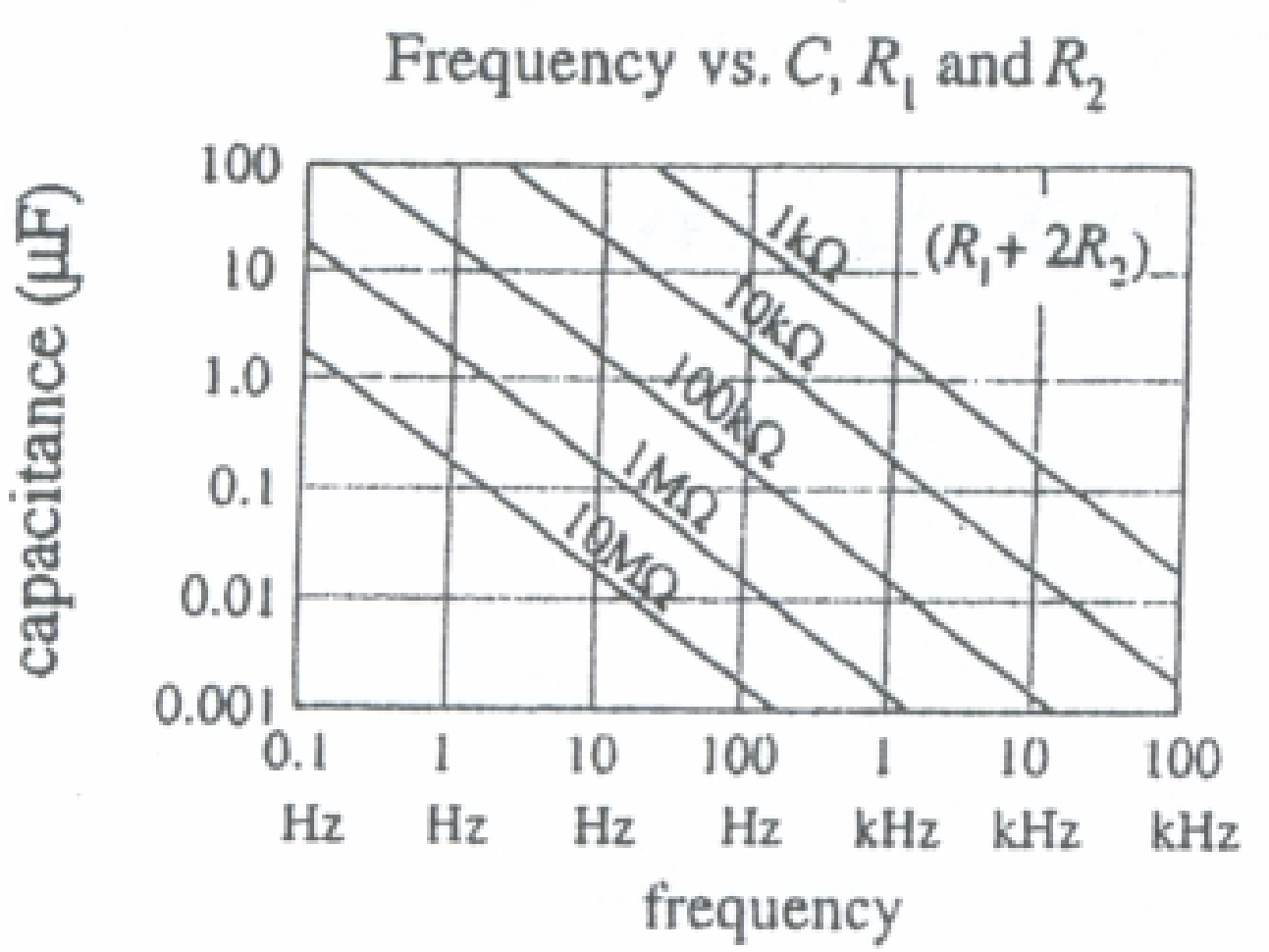
$$t_{low} = 0.693(20K)(680nF) = 9.6ms$$

$$t_{high} = 0.693(10K + 20K)(680nF) = 14.1ms$$

$$Duty\,cycle = \frac{14.1ms}{14.1ms + 9.6ms} = 0.6$$

$$f = \frac{1}{14.1ms + 9.6ms} = 42Hz$$

Astable Operation 2



Applications 1

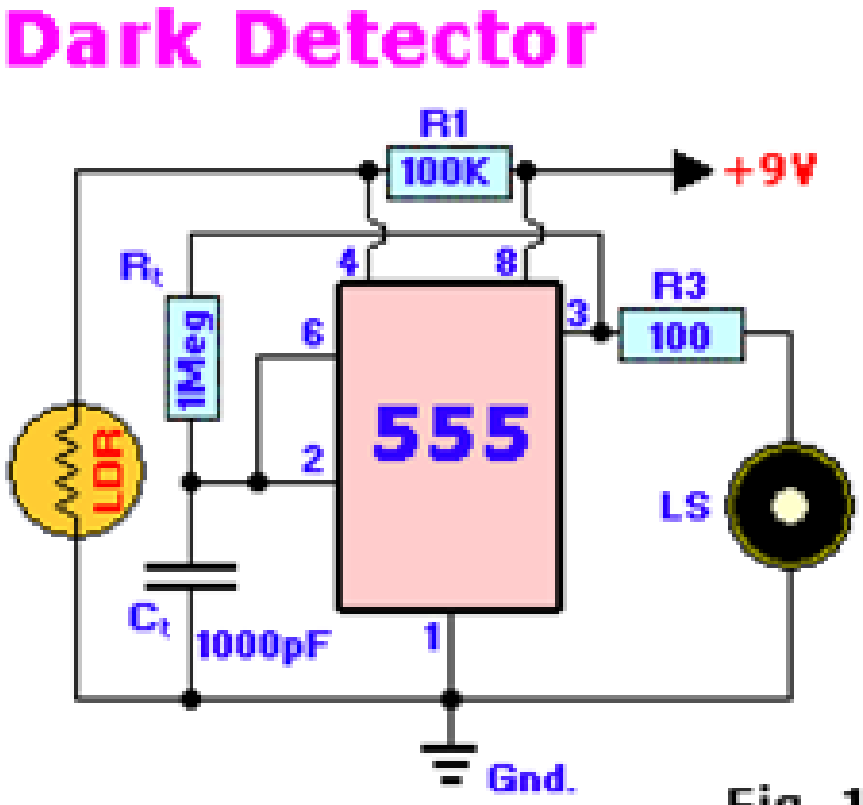


Fig. 1

- It will sound an alarm if it gets too dark all over sudden
- The LDR enables the alarm when light falls below a certain level

Applications 2

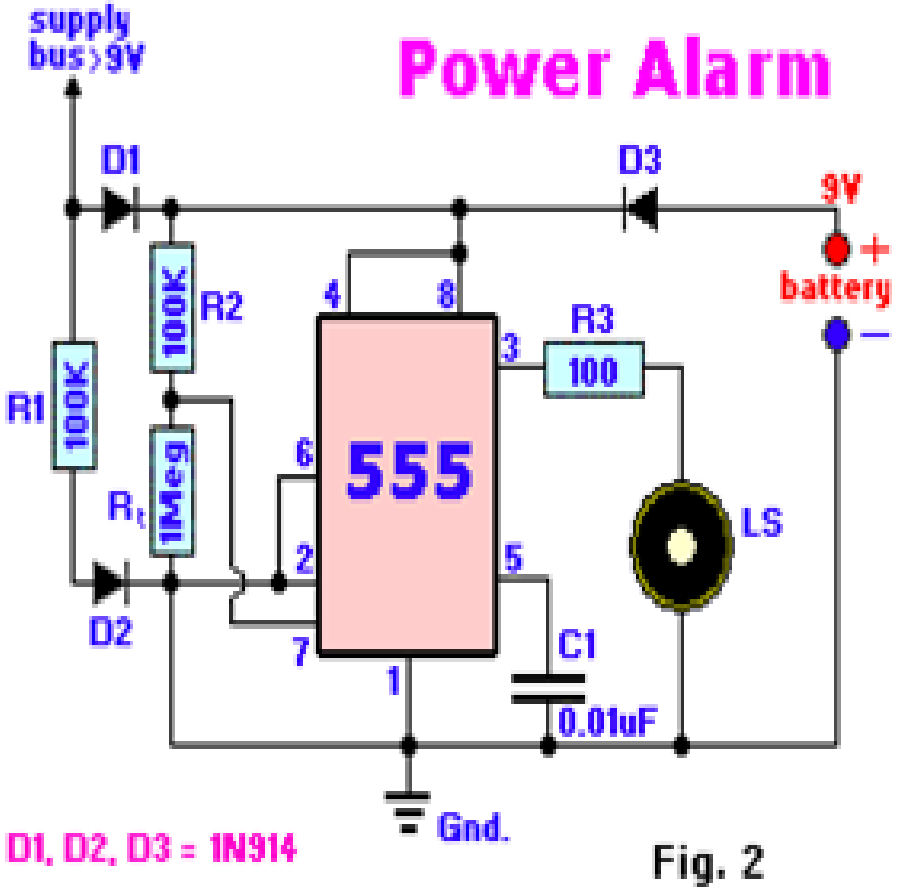


Fig. 2

- This circuit can be used as a audible 'Power-out Alarm'
- When the line voltage fails, the tone will be heard in the speaker

Applications 3

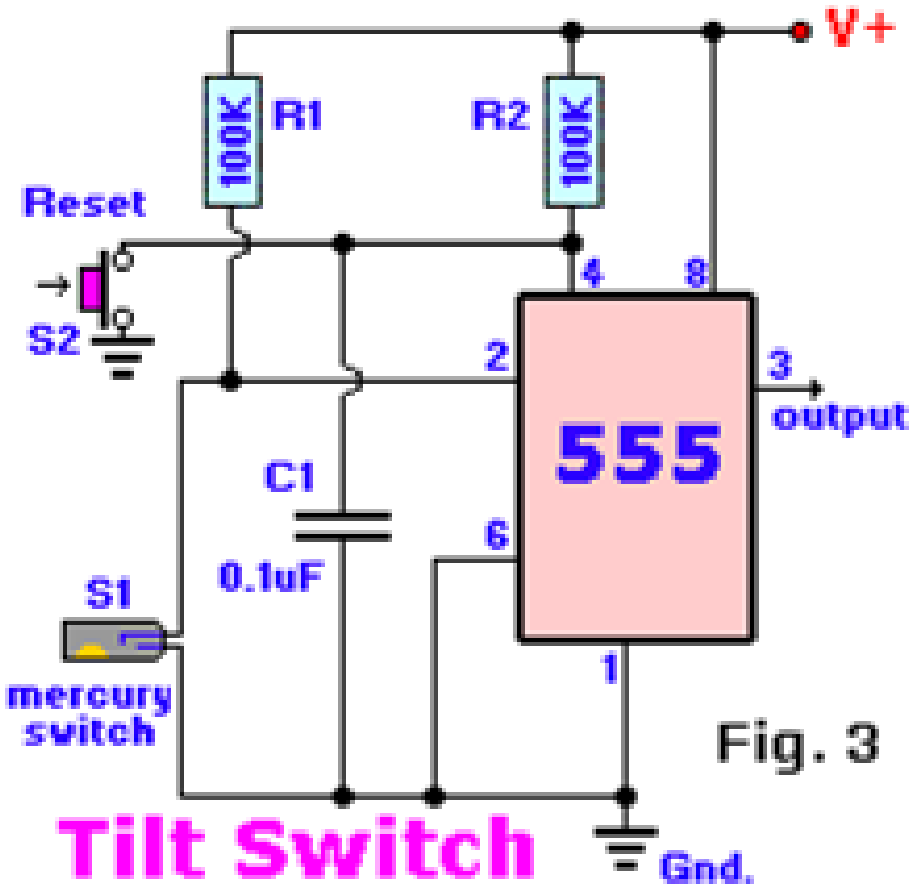


Fig. 3

- **Actually really a alarm circuit, it shows how to use a 555 timer and a small glass-encapsulated mercury switch to indicate 'tilt'.**

Applications 4

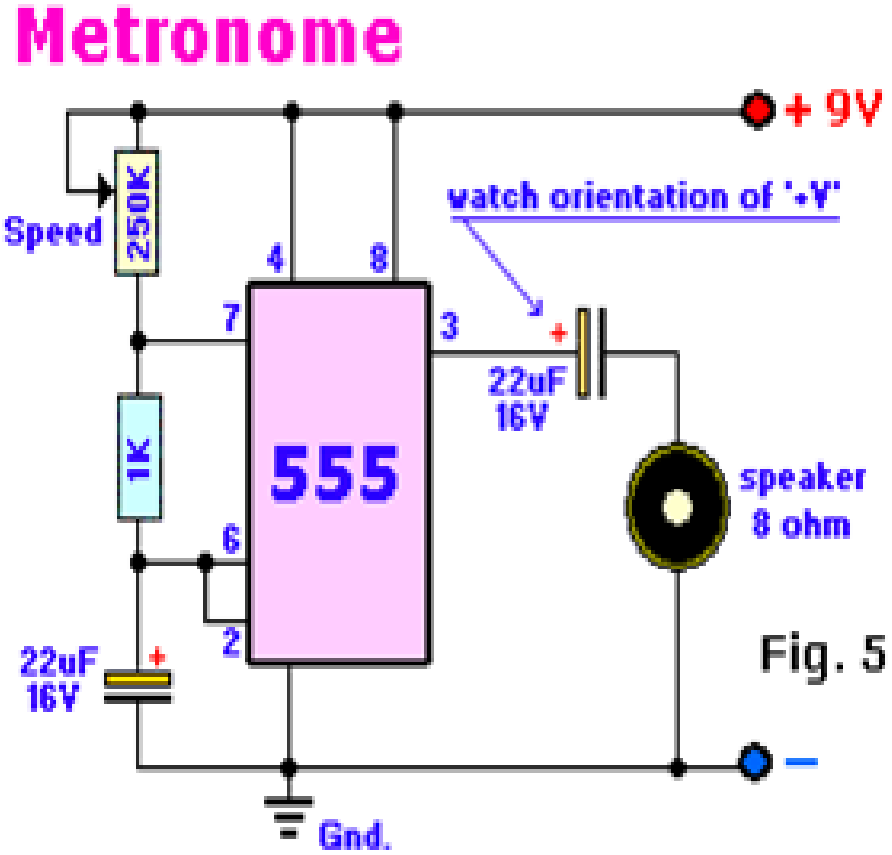


Fig. 5

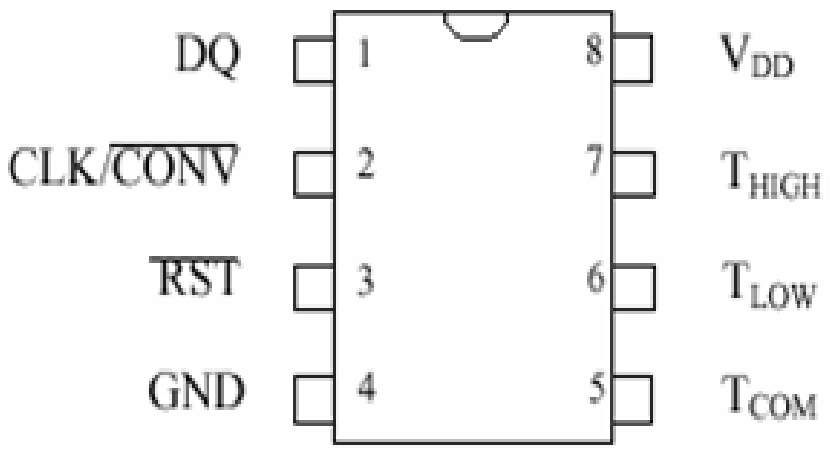
- A Metronome is a device used in the music industry
- It indicates the rhythm by a 'tic-toc' sound which speed can be adjusted with the 250K potentiometer

555 Timer Experiments

Experiments	Chapters
What's micro controller	5
Basic A and D	6
Earth measurements	
Robotics	
StampWorks	17 and 18
Others	

Lecture 10

DS1620

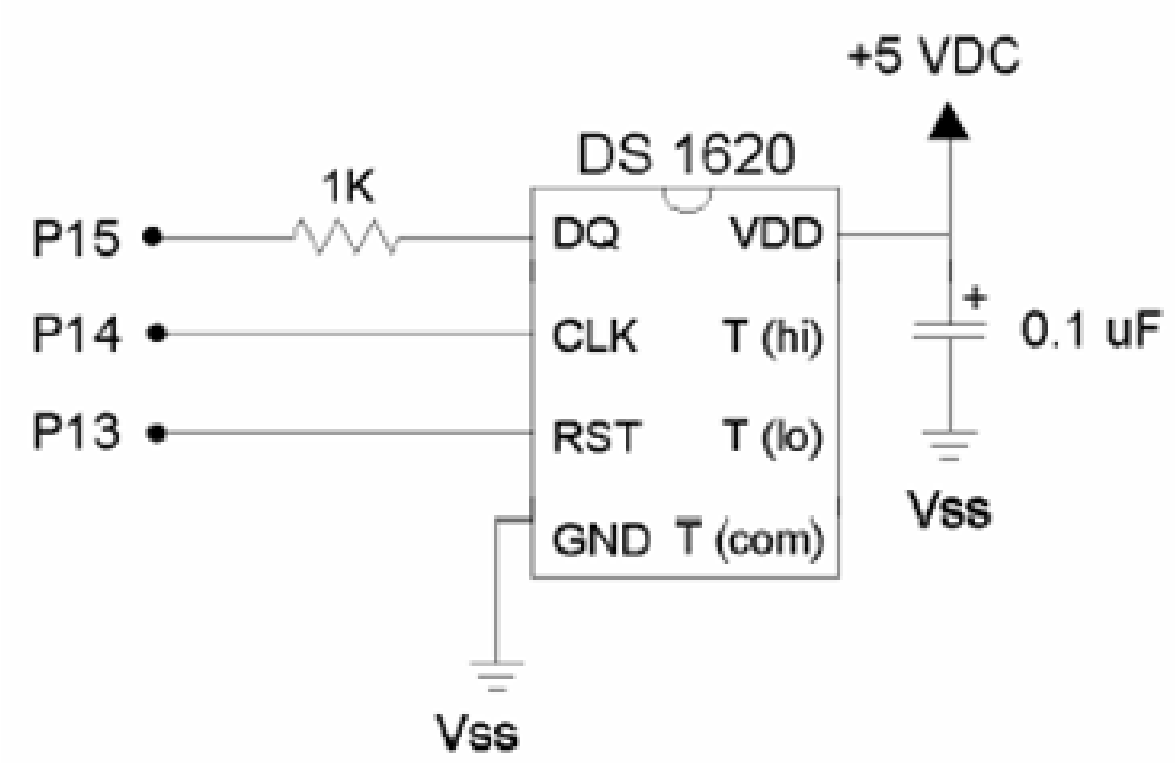


- Digital thermometer
  - Provides 9-bit temperature readings
  - Temperature range from -55ºC to 125ºC
  - Acts as a thermostat

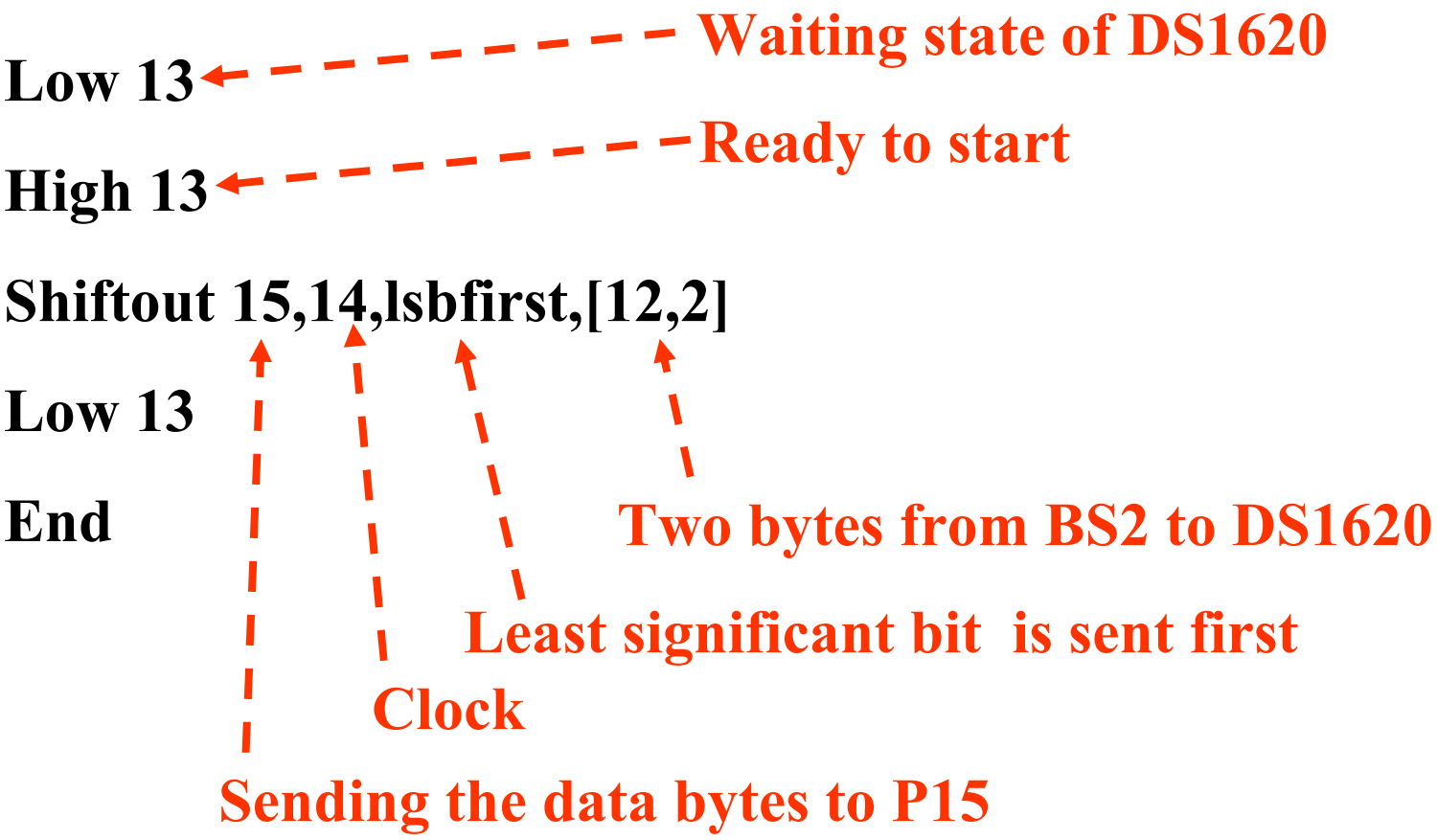
Detail Description

PIN	SYMBOL	DESCRIPTION
1	DQ	**Data Input/Output pin** for 3-wire communication port.
2	CLK/$\overline{\text{CONV}}$	**Clock input pin** for 3-wire communication port. When the DS1620 is used in a stand-alone application with no 3–wire port, this pin can be used as a convert pin. Temperature conversion will begin on the falling edge of $\overline{\text{CONV}}$.
3	$\overline{\text{RST}}$	**Reset input pin** for 3-wire communication port.
4	GND	**Ground pin.**
5	T_{COM}	**High/Low Combination Trigger**. Goes high when temperature exceeds TH; will reset to low when temperature falls below TL.
6	T_{LOW}	**Low Temperature Trigger.** Goes high when temperature falls below TL.
7	T_{HIGH}	**High Temperature Trigger.** Goes high when temperature exceeds TH.
8	V_{DD}	**Supply Voltage.** 2.7V – 5.5V input power pin.

DS1620 with BS2



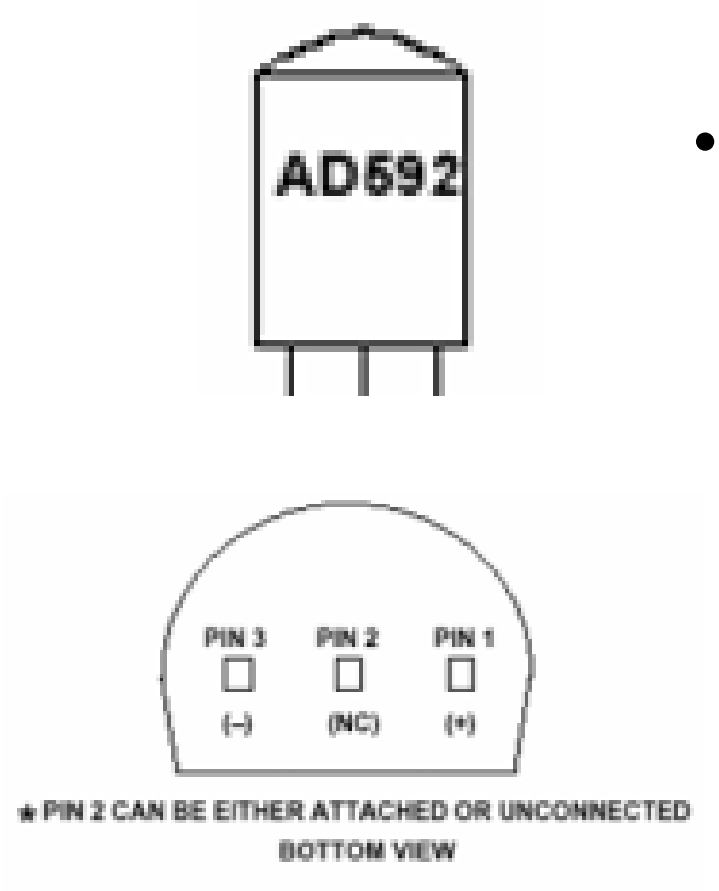
Programming for DS1620 1



Programming for DS1620 2

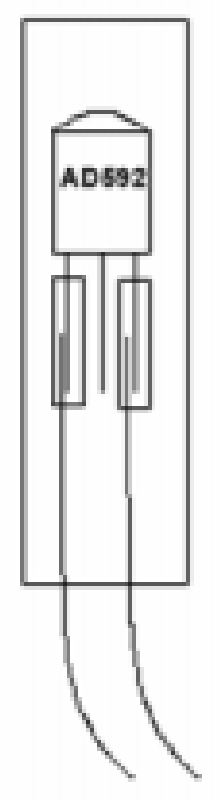
```
high 13 ◄– – – – – – – – – Ready to start
Shiftout 15,14,lsbfirst,[238] ◄– – – Start conversion
low 13

Temploop:
high 13
shiftout 15,14,lsbfirst,[170] ◄ – – Send “get data” command
shiftin 15,14,lsbpre,[x]  ◄– – – –  Get the data
low 13
degC=x/2
Goto Temploop
```

AD592



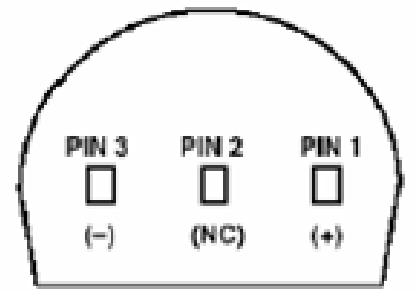
- Analog temperature sensor
  - Provides an output current proportional to absolute temperature
  - Temperature range from -25°C to 105°C
  - Acts as a thermostat
  - Extended out away from the recording instruments

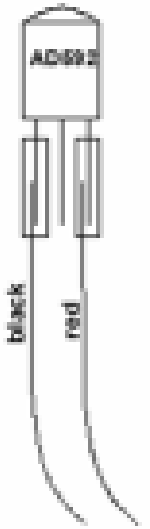
Temperature Probe with AD592



- The part needs to be protected before being inserted into liquid

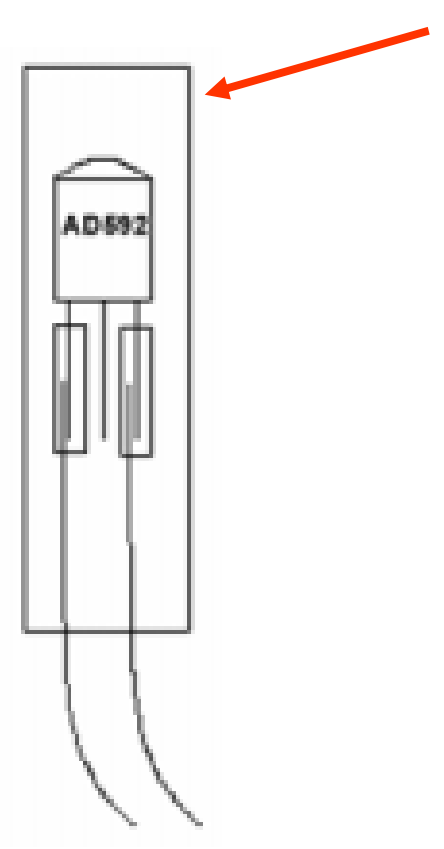
How to Make Temperature Probe 1





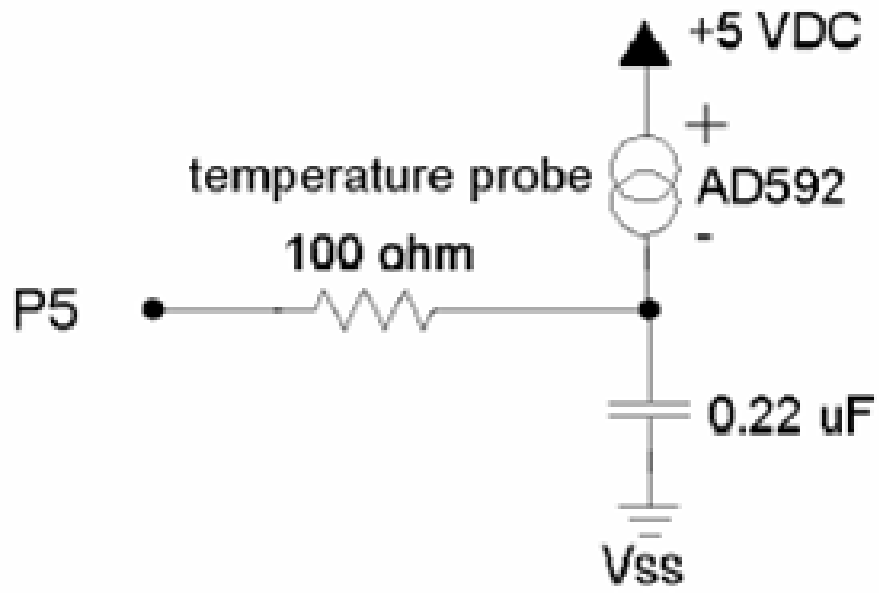
1. Identify the AD 592's (-), NC, and (+) pins from this picture as viewed from the bottom
2. Slip the solder sleeve over the black wire and pin 3 (-)
3. Slip another solder sleeve over the red wire and pin 1 (+)
4. Heat up the connections until the wires are joined

How to Make Temperature Probe 2

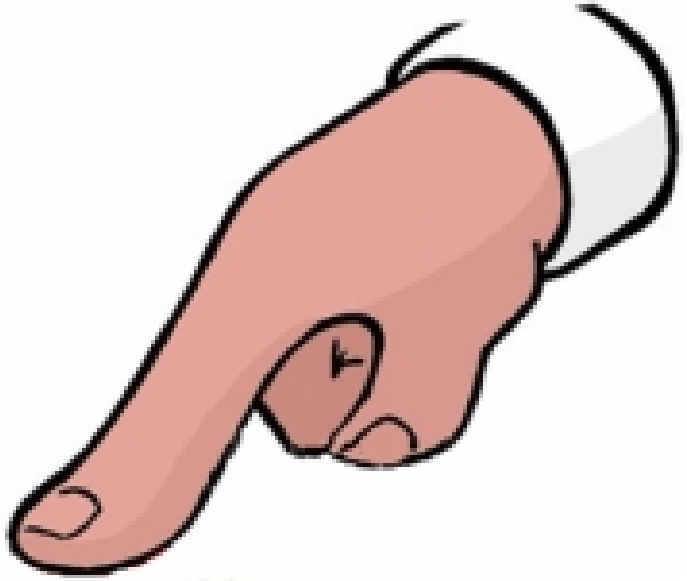


5. Slip the heat shrink tubing over the entire package
6. Fasten the package with a heat gun, and while it's still hot clamp the top portion to ensure that it stays shut

AD592 with BS2



Caution!!



- Be careful when you put your finger on it
- Specially for a big finger

Temperaure Sensors Experiments

Experiments	Chapters
What's micro controller	
Basic A and D	
Earth measurements	1, 2, 3*, and 4
Robotics	
StampWorks	28
Others	

***Use 2 wires for Simple Resistance Detector with proper resistor and capacitor**