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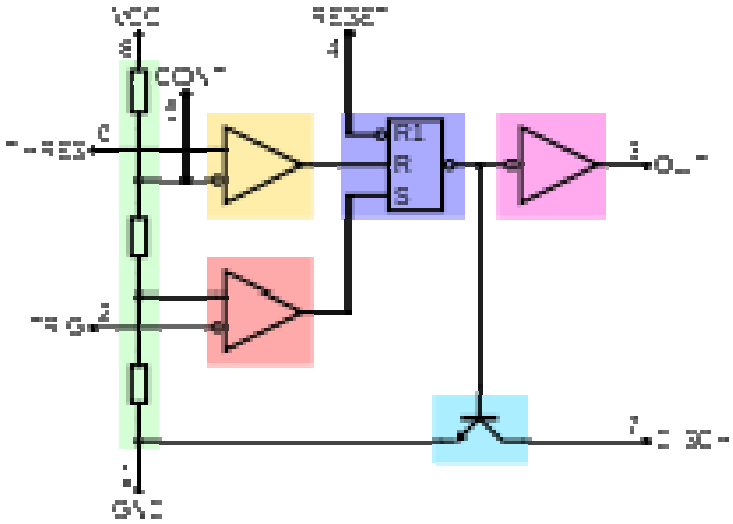
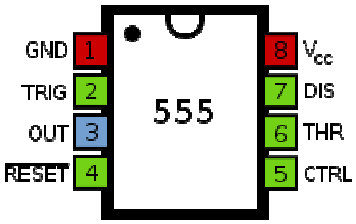
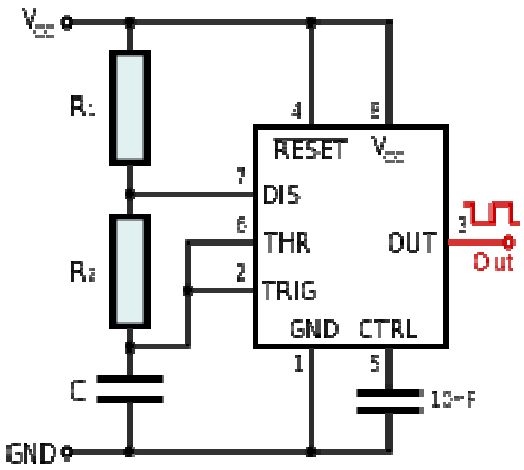
555 timer integrated circuit





Pin	Name	Purpose
1	GND	Ground, low level (0 V)
2	TRIG	OUT rises, and interval starts, when this input falls below 1/3 V_{CC}.
3	OUT	This output is driven to $+V_{CC}$ or GND.
4	RESET	A timing interval may be interrupted by driving this input to GND.
5	CTRL	"Control" access to the internal voltage divider (by default, 2/3 V_{CC}).
6	THR	The interval ends when the voltage at THR is greater than at CTRL.
7	DIS	Open collector output; may discharge a capacitor between intervals.
8	VCC	Positive supply voltage is usually between 3 and 15 V.

Standard astable flip-flop circuit



In astable mode, the 555 timer puts out a continuous stream of rectangular pulses having a specified frequency. Resistor R_1 is connected between V_{CC} and the discharge pin (pin 7) and another resistor (R_2) is connected between the discharge pin (pin 7), and the trigger (pin 2) and threshold (pin 6) pins that share a common node. Hence the capacitor is charged through R_1 and R_2, and discharged only through R_2, since pin 7 has low impedance to ground during output low intervals of the cycle, therefore discharging the capacitor.

In the astable mode, the frequency of the pulse stream depends on the values of R_1, R_2 and C:

$$f = \frac{1}{\ln(2) \cdot C \cdot (R_1 + 2R_2)}$$

The high time from each pulse is given by:

$$\text{high} = \ln(2) \cdot (R_1 + R_2) \cdot C$$

and the low time from each pulse is given by:

$$\text{low} = \ln(2) \cdot R_2 \cdot C$$

where R_1 and R_2 are the values of the resistors in ohms and C is the value of the capacitor in farads.

Used values in our measurement:

R1= 1 kΩ + potentiometer in series (5 or 25 kΩ), R2= 10 kΩ,

C= 100 nF (2x 47 nF in parallel)

Laboratory measurement 1

Measurement on simple electronic circuits

The assignment is divided into two types. The first one is for students from secondary technical schools, the second one for students from comprehensive schools - gymnasiums.

Students from technical schools

Your tasks are:

- to assemble a simple electronic circuit on a solderless breadboard (an astable flip-flop)
- to measure waveforms in various nodes of the flip-flop by the oscilloscope
- to make FFT analysis of the measured signal
- to connect output of an audio device to oscilloscope (MP3 player, voice recorder)
- to make FFT analysis of the measured signal

Students from comprehensive schools

Your tasks are:

- to examine ready made circuit of an astable flip-flop on a solderless breadboard
- to familiarize yourselves with the oscilloscope measurement (waveform reading, voltage/division recalculation, time/division recalculation etc.)
- to measure waveforms in various nodes of the flip-flop by the oscilloscope
- to familiarize yourselves with the FFT analysis
- to make FFT analysis of the measured signal

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