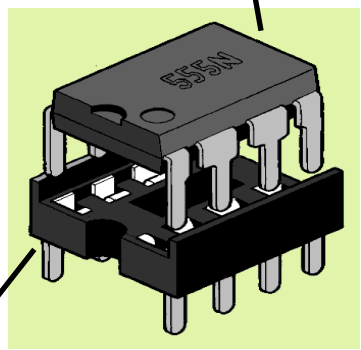
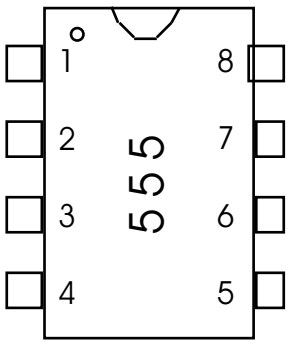
555 TIMER - INTEGRATED CIRCUIT



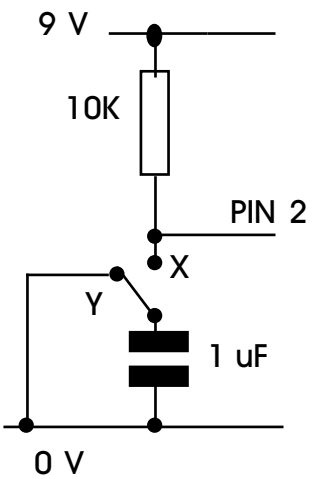
The 555 timer IC is a very simple device to use. With very few extra components it can be used as an **ASTABLE timer** to make flashing light circuits or to make a loudspeaker produce a sound and it can be used as a **MONOSTABLE circuit** to switch a device on AFTER a set time or to switch a device on FOR a set time.
The 555 makes it easy to get accurate time delays.



View from TOP
Note - how the legs are numbered

The 555 timer is an 8 pin D-I-L package containing 25 transistors, 2 diodes and 16 resistors. Its legs are named as follows :-

1. 0v
2. Trigger (start)
3. Output.
4. Reset.
8. 4.5 - 16v supply voltage
7. Discharge.
6. Threshold.
5. Control voltage.



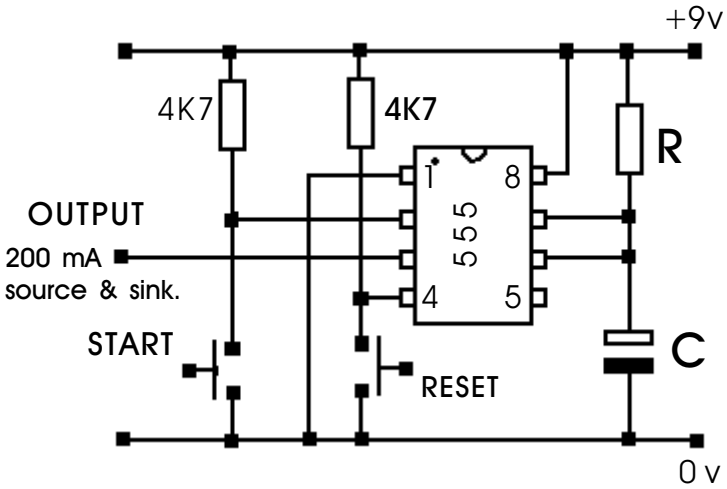
Triggering the 555 timer monostable -

The MONOSTABLE timer is switched on by disconnecting pin 2 (trigger) from 9 volts and connecting it MOMENTARILY to 0 volts.
Sometimes you cannot guarantee to disconnect this trigger connection.
The diagram on the left shows a simple way of turning a switching action that may not be momentary into a quick connection to 0 volts followed by a return to 9 volts.
When the switch is moved to X the voltage on pin 2 drops to 0volts and then rises to 9 volts as the capacitor charges.
When the switch is moved to Y the capacitor can discharge.

555 TIMER - MONOSTABLE MODE

When the START switch is pressed the OUTPUT wire goes to 9 volts. It stays at 9 volts for a time interval called T which depends on the values of R and C. To calculate T -

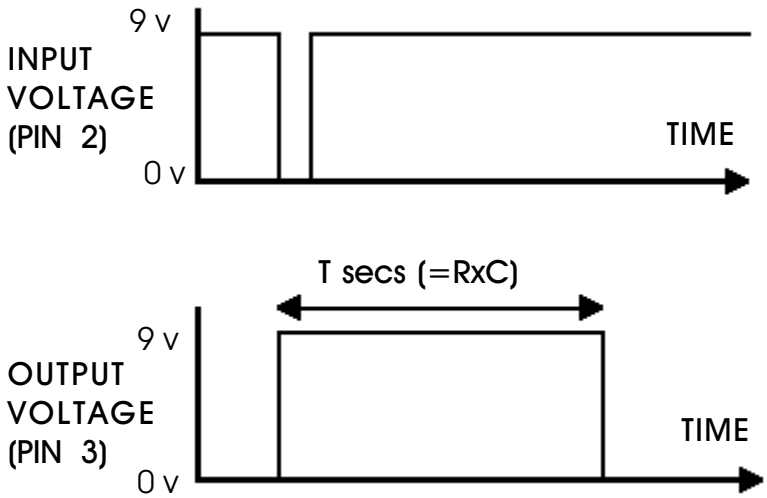
T = approx	R	x	C
secs	ohms		farads



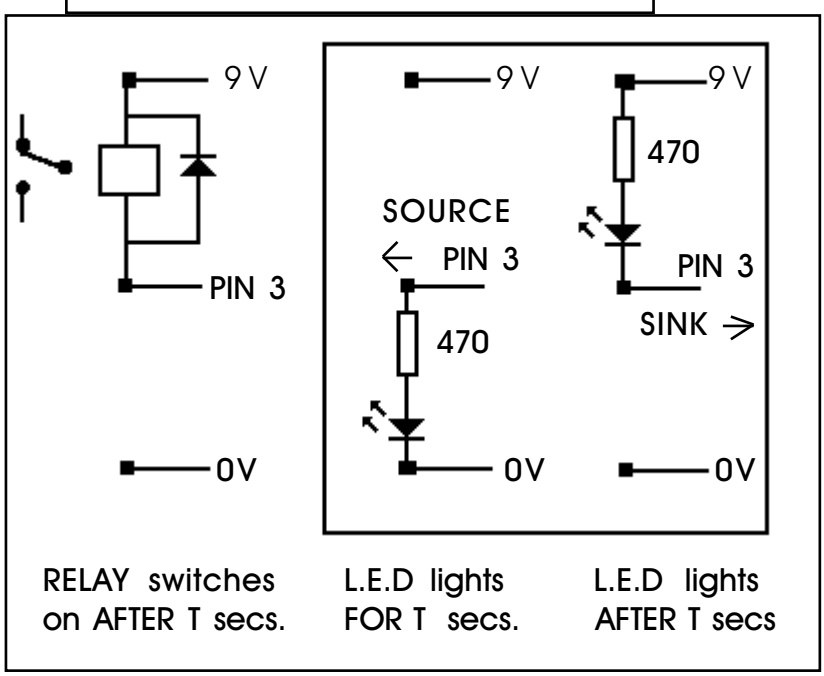
Putting a VARIABLE RESISTOR in place of R will give you a variable time period. The chart below shows the approximate time period for various resistors and capacitors.

R k	C uF	T s
100	10	1
500	10	5
500	50	25
500	100	50

These graphs show how the output changes in response to the input.



POSSIBLE OUTPUT ARRANGEMENTS



The 555 timer output can either supply (source) up to 200mA to operate small bulbs or buzzers
or it can absorb (sink) up to 200mA.

If you want to switch something that draws more than 200 mA then you can put a RELAY onto the output terminals (either as a source or a sink). You can then switch any device, even a 240 volt AC powered one. You can also use a TRANSISTOR to operate loads up to about 1 amp (BFY 51/BC639)

RESET BUTTON - If you press this button it connects pin 4 to 0 volts. This makes the output return to 0 volts even when the timer is in the middle of an operation.

555 MONOSTABLE CIRCUITS

This sheet shows some possible arrangements of the 555 monostable circuit. They all give a VARIABLE TIME DELAY (pin 3 - output - goes 'high' (9v) for a certain time)

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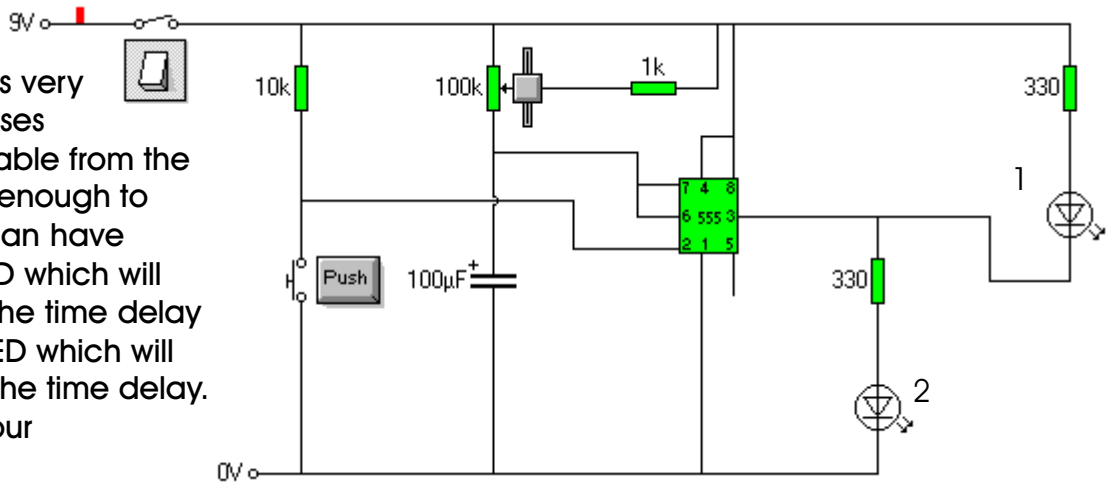
555 monostable - LED 1 glows AFTER the time delay (T= R x C)
LED 2 glows DURING the time delay.

This timer circuit is very simple. It only uses the current available from the 555 which is just enough to drive LEDs. You can have either the TOP LED which will come on AFTER the time delay or the BOTTOM LED which will stay on DURING the time delay. It depends on your application.



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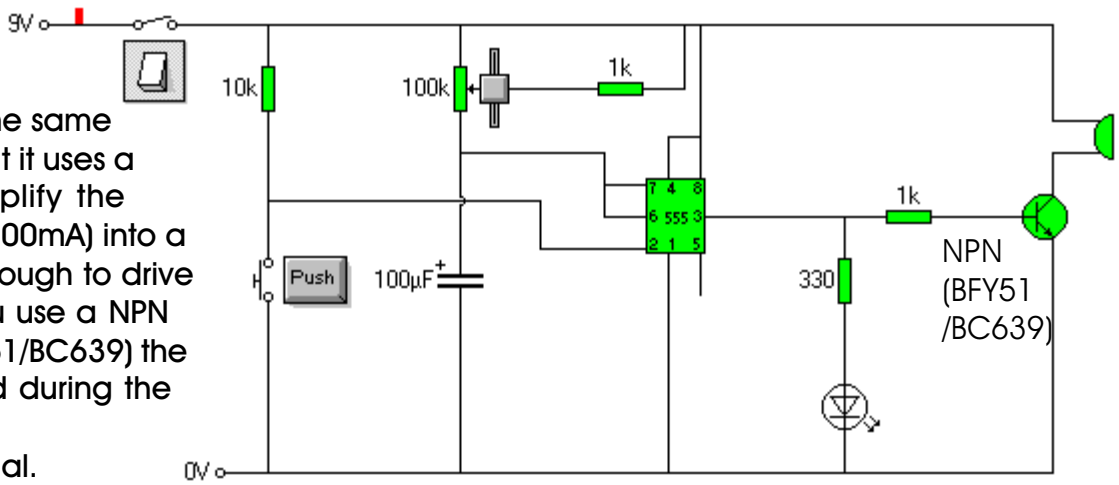
555 monostable - BUZZER sounds DURING the time delay (T= R x C)
(LED glows DURING the time delay)

This circuit has the same timing system but it uses a transistor to amplify the output current (200mA) into a current large enough to drive the buzzer. If you use a NPN transistor (ie BFY51/BC639) the buzzer will sound during the time delay.
The LED is optional.



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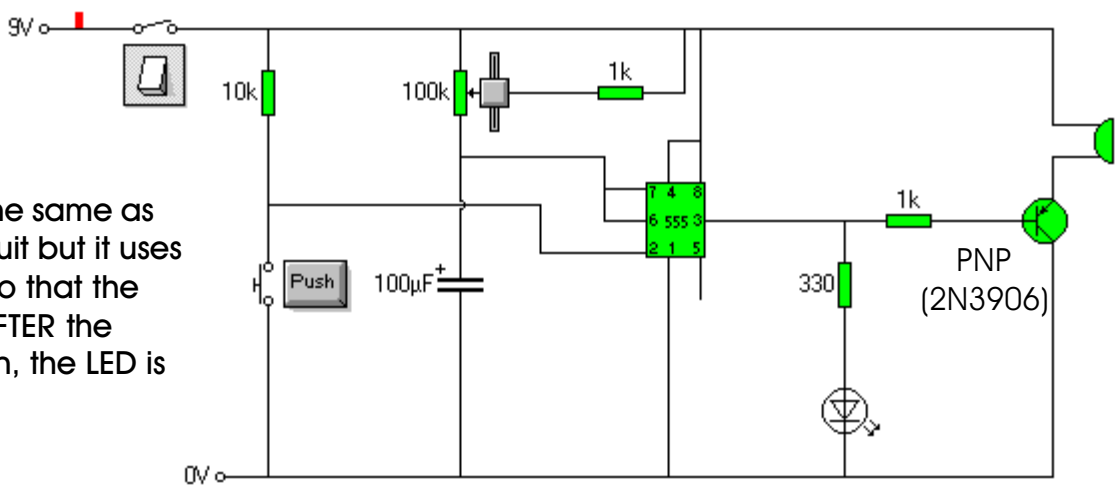
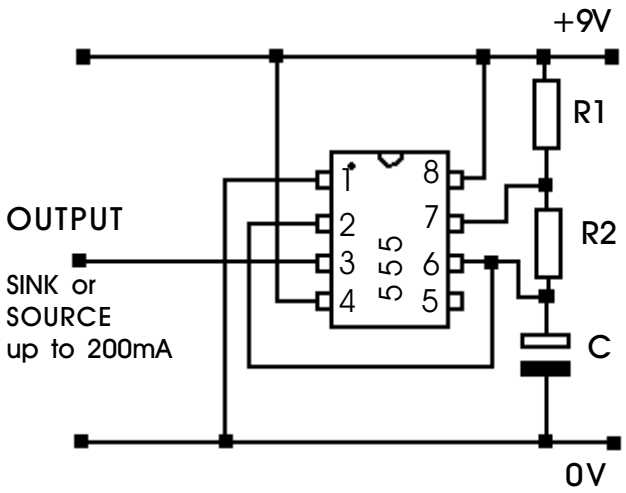
555 monostable - BUZZER will sound AFTER the time delay (T= R x C)
(LED glows DURING the time delay.)

This is basically the same as the previous circuit but it uses a PNP transistor so that the buzzer sounds AFTER the time delay. Again, the LED is optional

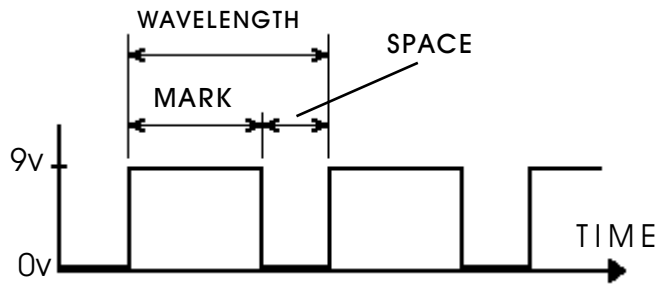


555 TIMER - ASTABLE (OSCILLATOR) (PULSE GENERATOR) MODE

The ASTABLE (MULTIVIBRATOR) circuit needs no trigger to start it. As soon as power is supplied the output will begin to oscillate between 9 volts and 0 volts. The time the output spends in each state depends on the values of R1 , R2 and C.



The astable circuit can be made to oscillate very quickly (up to millions of cycles per sec) or slowly (down to many minutes per cycle). It can be used to make bulbs flash, drive a loudspeaker to produce a noise or be used as a counter/ timer.



If R2 >>R1 then mark/space ratio =1 approx and you get a SQUARE WAVE OUTPUT.

The time the output is HIGH (9v) is called MARK
and the time the output is LOW (0v) is called SPACE. The time periods depend on the values of R1, R2 and C and can be calculated using :-

MARK TIME = 0.7 x (R1 + R2) x C

SPACE TIME = 0.7 x R2 x C

(R1 & R2 in OHMS , C in FARADS , T in SECS)

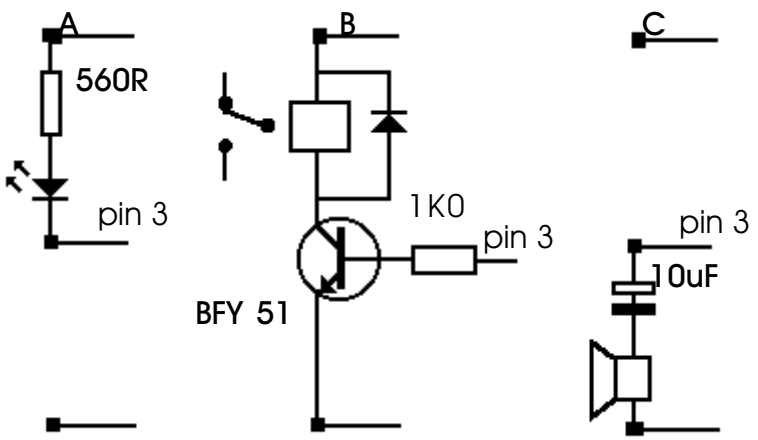
Other useful values to calculate are :-

$$\text{MARK/SPACE RATIO} = 1 + \frac{R1}{R2}$$

$$\text{FREQUENCY} = \frac{1.44}{(R1+2R2) \times C} \text{ Hz}$$

(No of cycles per second)

POSSIBLE OUTPUT SYSTEMS.



OUTPUT SYSTEM B can be used to drive devices that draw more than 200mA.

OUTPUT SYSTEM C will give an sound output. It will be a clicking sound for low frequencies and a tone for higher frequencies.

555 ASTABLE (OSCILLATOR or MULTIVIBRATOR) CIRCUITS

This sheet shows some possible arrangements of the 555 timer as an ASTABLE circuit. This circuit will oscillate turning the output alternately high and low.

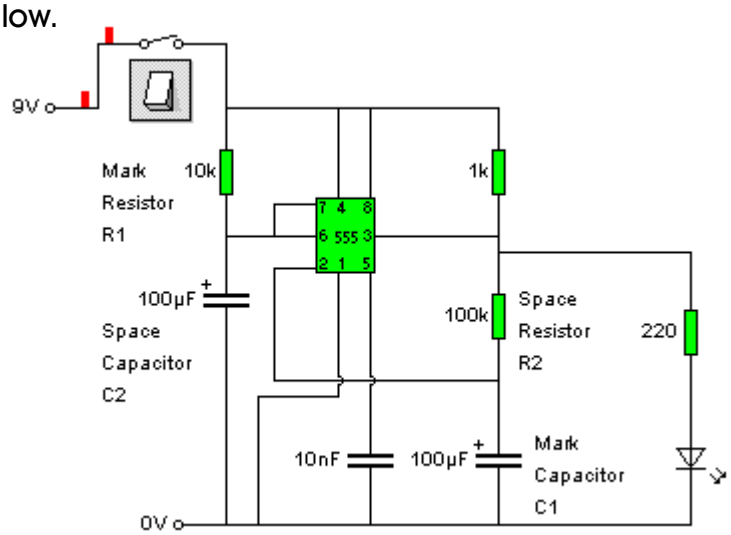
This very simple circuit is used to switch an LED on and off repeatedly.

MARK TIME - (time output is high)
The LED will be ON for (1.1 x R1 x C1) secs.

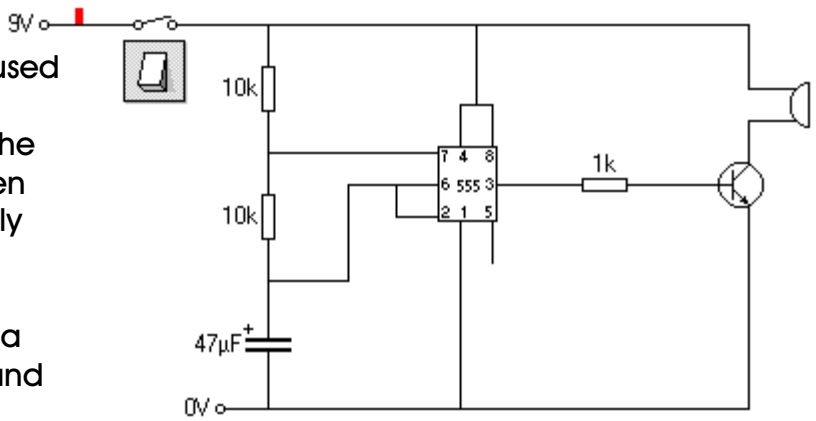
SPACE TIME - (time output is low)
The LED will be OFF for (1.1 x R2 x C2) secs

FREQUENCY - (number of pulses per second)

$$\text{Frequency} = \frac{0.72}{(R \times C)} \quad \text{Hz}$$



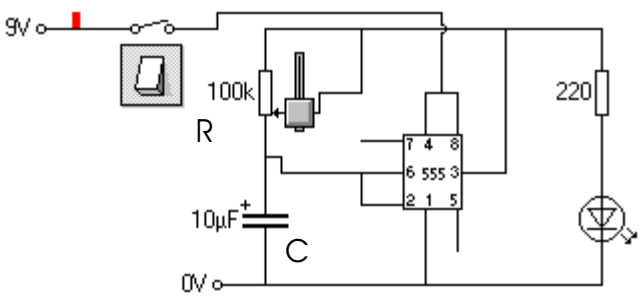
In this circuit the current from the 555 is used to switch on (bias) the transistor (BFY51/ BC639) so that a buzzer can be driven. The buzzer uses too much current to be driven directly from the 555 timer which can only provide 200mA.
You can replace the buzzer with a loud-speaker and produce a tone by having a higher frequency output (Small resistors and capacitors).



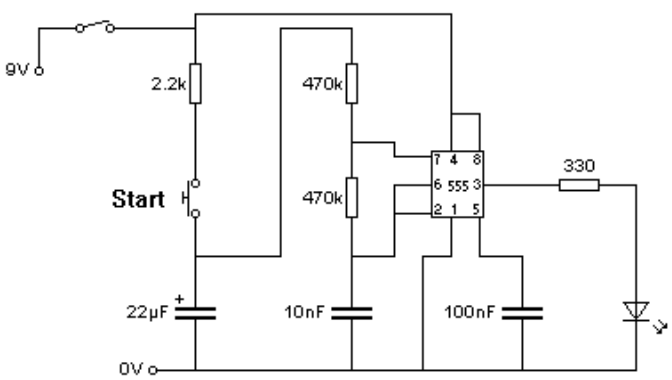
This last simple little circuit will only give equal mark & space times.
Mark time = Space time = 0.7 x R x C

$$\text{Frequency} = \frac{0.72}{R \times C} \quad \text{Hz}$$

The variable resistor allows you to vary the frequency.



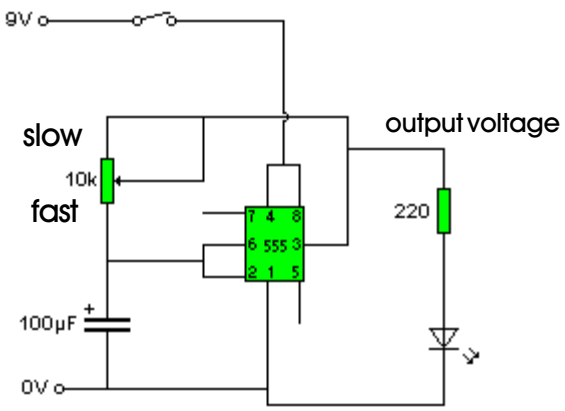
With this DIMINISHING ASTABLE circuit, when you press START the output oscillates quickly and then slows down and eventually stops.
It can be very useful as a clock input for electronic dice.



Diminishing astable - output oscillates slower and slower and then

555 astable timer circuits

Variable resistor to change the frequency

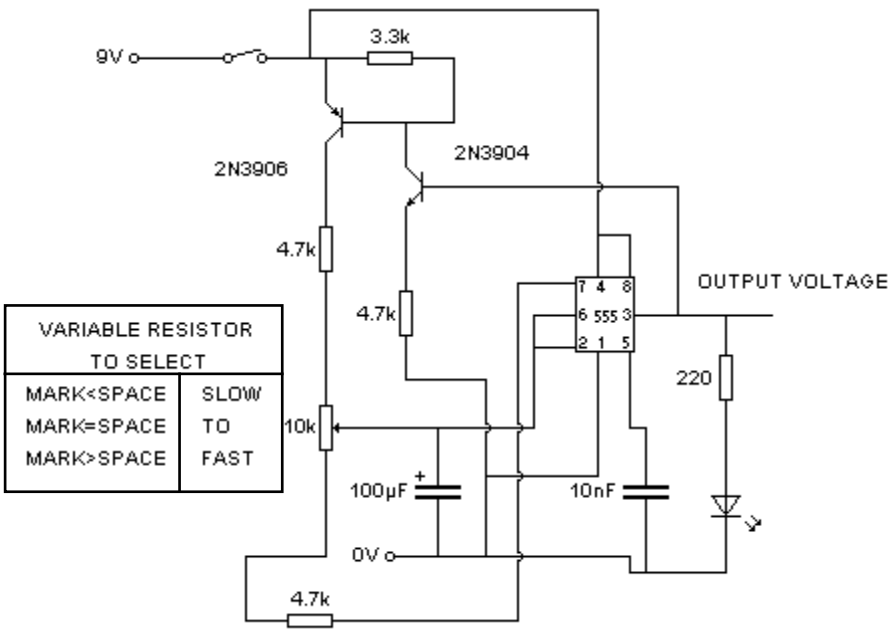


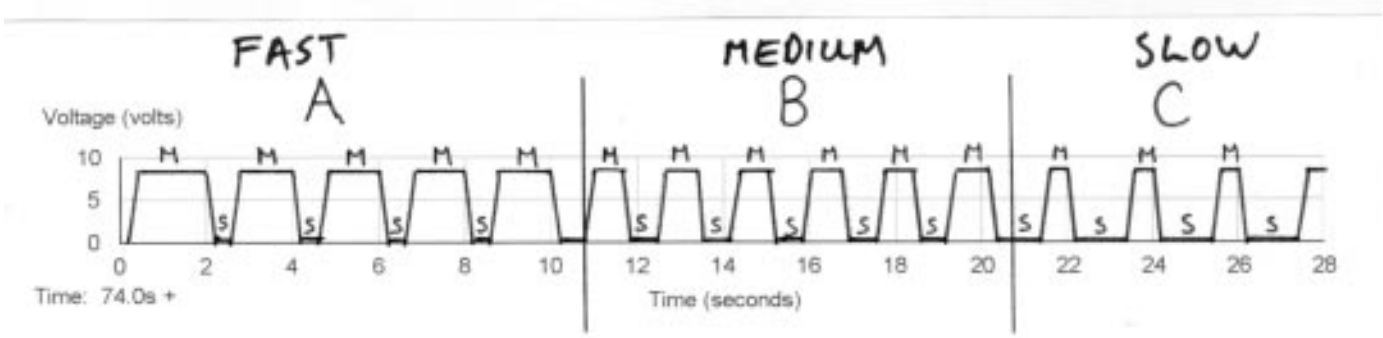
A 555 astable with a fixed mark/space ratio could be used as a METRONOME.
This simple circuit has a fixed mark/ space ratio of 1.
If you alter the variable resistor you speed up or slow down the flashing rate (frequency) but the ratio of TIME ON to TIME OFF remains the same (TIME ON = TIME OFF)
To produce an audible signal you could use it to drive a buzzer.

This circuit is much more complex but it allows you to vary the mark / space ratio.
If you connected to output to a DC motor you can controol the motor speed.
The graph below shows how the output voltage varies with time as the variable resistor is moved.

Section A Mark > Space
Section B Mark = Space
Section C Mark < Space

The longer the motor is on for (compared to its OFF time) the faster it will go

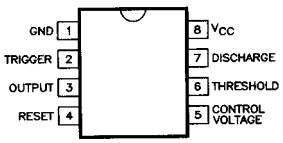




M = MARK = TIME OUTPUT IS HIGH.
S = SPACE = TIME OUTPUT IS LOW.

NE555N Timer

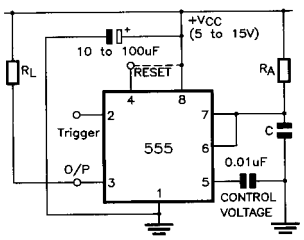
SGS-Thomson
Philips Components



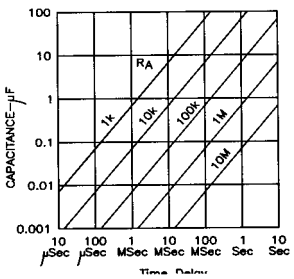
555

The 555 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 (monostable) mode of operation the time is precisely controlled by one external resistor and one capacitor. For stable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms and the output structure can source or sink up to 200mA or drive TTL directly. This IC may also be *correctly* supplied marked as MC1455PI. Supply decoupling must be provided close to the IC to counter the 'crowbar' effect of the device's internal discharge switch, a suitable value is 10 to 100µF as shown in the accompanying diagrams.

Monostable Mode

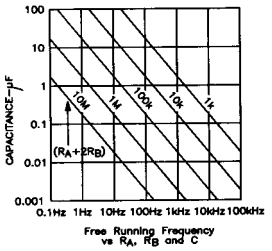


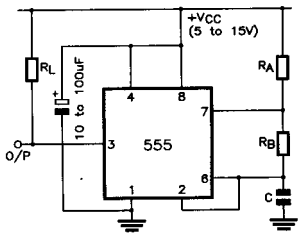
Time Delay vs R_A and C



On time after triggering (i.e. applying a voltage to pin 2 less than $^1/_3$ supply voltage) is equal to $1{\cdot}1R_AC$. The load may be connected to V_{CC} for normally-on operation or between pin 3 and ground for normally- off. Connecting reset to ground during on time, drives the output low until a new trigger pulse occurs. Additional trigger pulses during on time have no effect. If reset is not being used, connect it to V_{CC}.

Astable Mode (Oscillator)





Free Running Frequency vs R_{A1}, R_B and C

The frequency is equal to $1{\cdot}44/[(R_A + 2R_B)C]$. The charge time (output high) is given by $t_1 = 0{\cdot}693 (R_A + R_B)C$ and the discharge time (output low) is given by $t_2 = 0{\cdot}693(R_B)C$.

Characteristics (typical)

Supply voltage:	4·5V (min), 16V (max)
Supply current:	3mA (V_{CC} = 5V), 10mA (V_{CC} = 15V)
Threshold voltage:	V_{CC} x 0·667
Trigger voltage:	5V (V_{CC} = 15V), 1·67V (V_{CC} = 5V)
Trigger current:	0·5µA
Threshold current:	0·1µA
Control voltage level:	10V (V_{CC} = 15V), 3·33V (V_{CC} = 5V)

AV71N is supplied by Phillips Components

Order Code	Type	Price each exc. VAT 1+	25+	100+	Inc. VAT each 1+
AV71N	Timer NE555N PC	£0.357	£0.310	£0.260	£0.42
QH69W	NE555N	£0.272	£0.230	£0.210	£0.32

This page shows the different types of timer IC that are available.

The NE555 is the one we normally use.

You get example circuits and charts to work out the values of R and C to give the timing you want.

TS555/6CN Low Power Timer

SGS Thomson

A low-power pin-for-pin replacement for the 555, but requiring only about one fiftieth of the supply current. The device has extremely low trigger, threshold and reset current, typically 20pA, and a very wide supply voltage range 2V to 18V. Supply decoupling close to the device is not required. The outputs are fully CMOS, TTL and MOS compatible. Choose high values for timing resistors to keep supply currents low and low values for capacitance which should be low leakage types, not ceramic. Also available in a dual version, AV73Q.

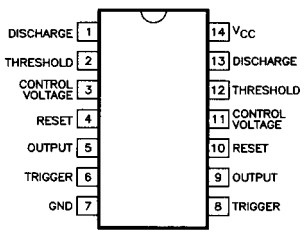
Specifications:

Supply voltage:	2V to 18V
Supply current:	170µA at 5V, 360µA at 15V
Threshold current (V_{DD} = 5V):	10pA
Trigger current (V_{DD} = 5V):	10pA
Reset current (V_{DD} = 5V):	±10pA
Reset voltage level:	0·7V
Output sink current:	100mA max
Output source current:	10mA max
Max frequency in astable mode:	2·1MHz

Order Code	Type	Price each exc. VAT 1+	25+	100+	Inc. VAT each 1+
AV73Q	Timer TS556CN SGS	£0.842	£0.550	£0.440	£0.99
AA76H	TS555CN	£0.417	£0.290	£0.260	£0.49

The low power timer would be used when you need a timer that takes very little current

NE556N Dual Timer



The 556 is a single 14-pin DIL package containing two 555 timers.
AV72P is the Philips version.
AV73Q is the SGS version.

Order Code	Type	Price each exc. VAT 1+	25+	100+	Inc. VAT each 1+
QH67X	NE556N	£0.331	£0.290	£0.210	£0.39
AV73Q	Timer TS556CN SGS	£0.842	£0.550	£0.440	£0.99
AV72P †	Timer NE556N PC	£0.306			£0.36

The 556 has two timers on it so you can save space on your PCB and money