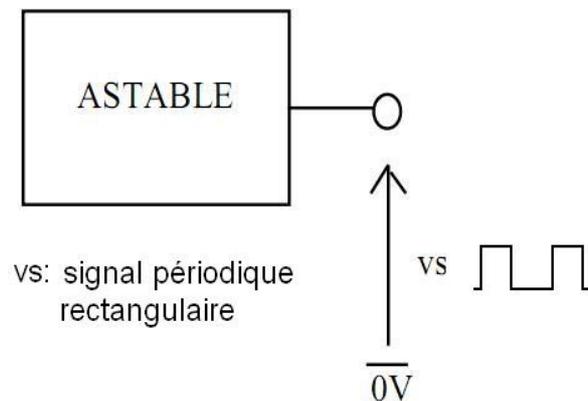


La fonction Astable

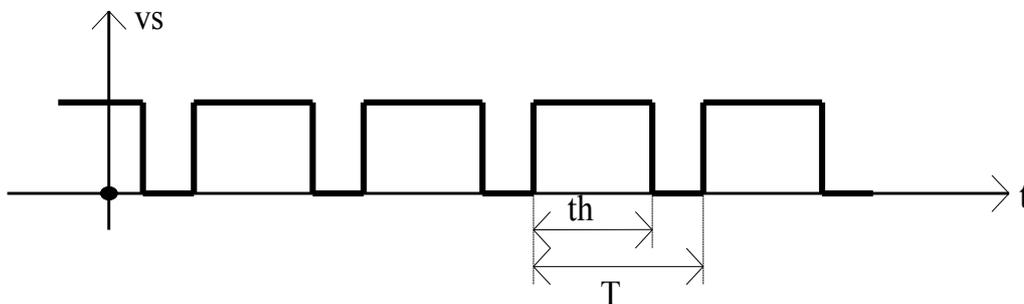
1 Définition

La fonction astable génère un signal périodique rectangulaire ayant une fréquence et un rapport cyclique déterminé. Il n'y a pas de signal de commande.



2 Le rapport cyclique

- rapport cyclique: on appelle rapport cyclique d'un signal périodique le rapport, sur une période, de l'état haut sur la période de ce signal.



$$\text{rapport cyclique: } r = \frac{th}{T}$$

3 Exercice: utilisation du circuit NE555 (voir documentation du constructeur en annexe)

Réalisation à l'aide du circuit intégré NE555 la fonction astable dont le signal de sortie a une fréquence de 1000 Hz et un rapport cyclique est de 0,3.

on demande:

- Schéma structurel de câblage
- Nomenclature

Figure 13

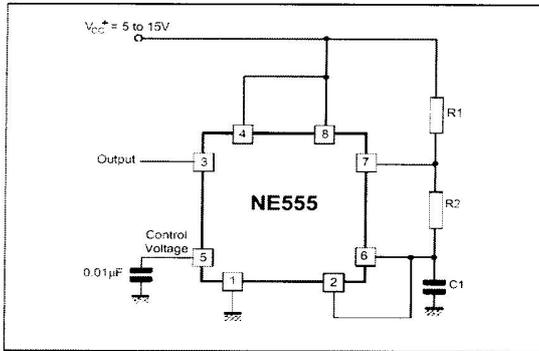


Figure 14 shows actual waveforms generated in this mode of operation.

The charge time (output HIGH) is given by :

$$t_1 = 0.693 (R_1 + R_2) C_1$$

and the discharge time (output LOW) by :

$$t_2 = 0.693 (R_2) C_1$$

Thus the total period T is given by :

$$T = t_1 + t_2 = 0.693 (R_1 + 2R_2) C_1$$

The frequency of oscillation is then :

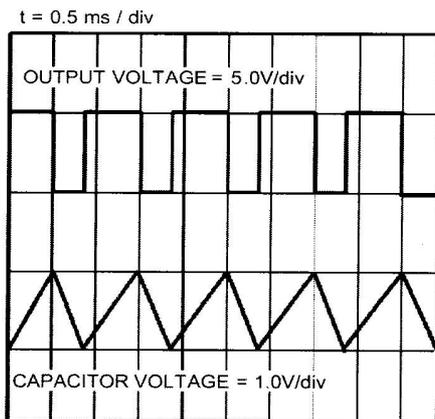
$$f = \frac{1}{T} = \frac{1.44}{(R_1 + 2R_2) C_1}$$

and may be easily found by figure 15.

The duty cycle is given by :

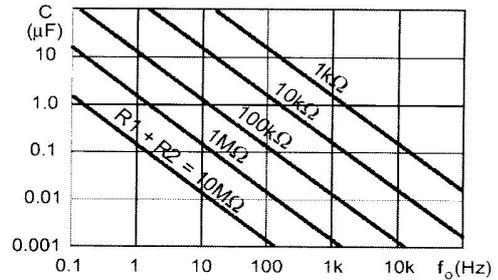
$$D = \frac{R_2}{R_1 + 2R_2}$$

Figure 14



$R_1 = R_2 = 4.8k\Omega$, $C_1 = 0.1\mu F$, $R_L = 1k\Omega$

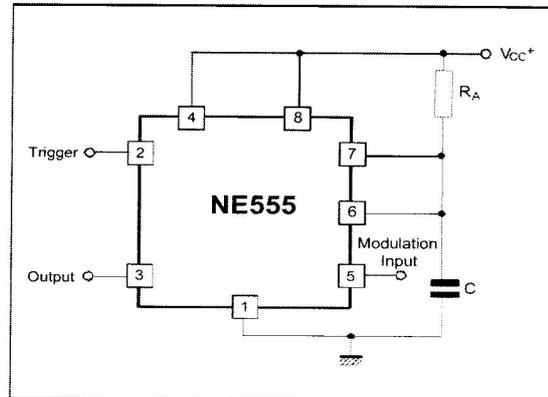
Figure 15 : Free Running Frequency versus R_1 , R_2 and C_1



PULSE WIDTH MODULATOR

When the timer is connected in the monostable mode and triggered with a continuous pulse train, the output pulse width can be modulated by a signal applied to pin 5. Figure 16 shows the circuit.

Figure 16 : Pulse Width Modulator.



LINEAR RAMP

When the pullup resistor, R_A , in the monostable circuit is replaced by a constant current source, a linear ramp is generated. Figure 17 shows a circuit configuration that will perform this function.

Figure 17.

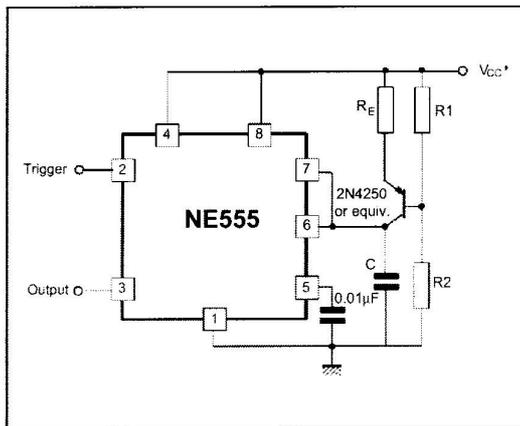
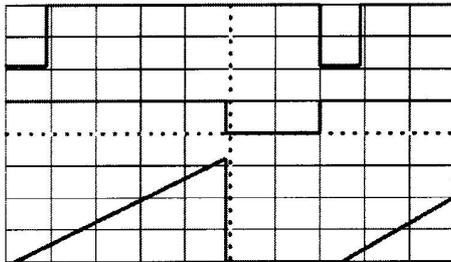


Figure 18 shows waveforms generated by the linear ramp.

The time interval is given by :

$$T = \frac{(2/3 V_{CC} R_E (R_1 + R_2) C}{R_1 V_{CC} - V_{BE} (R_1 + R_2)} V_{BE} = 0.6V$$

Figure 18 : Linear Ramp.



$V_{CC} = 5V$
 Time = $20\mu s/DIV$
 $R_1 = 47k\Omega$
 $R_2 = 100k\Omega$
 $R_E = 2.7k\Omega$
 $C = 0.01\mu F$

Top trace : input 3V/DIV
 Middle trace : output 5V/DIV
 Bottom trace : output 5V/DIV
 Bottom trace : capacitor voltage
 1V/DIV

50% DUTY CYCLE OSCILLATOR

For a 50% duty cycle the resistors R_A and R_E may be connected as in figure 19. The time period for the output high is the same as previous,

$$t_1 = 0.693 R_A C.$$

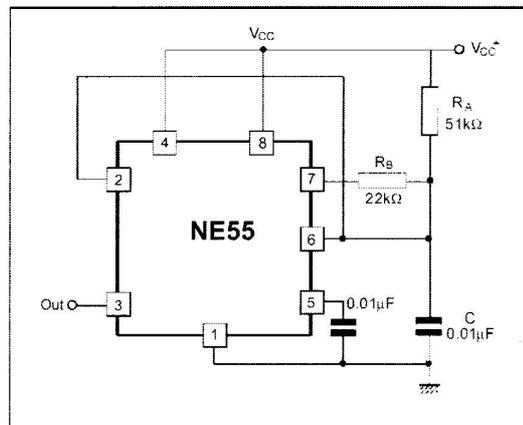
For the output low it is $t_2 =$

$$[(R_A R_B) / (R_A + R_B)] C \ln \left[\frac{R_B - 2R_A}{2R_B - R_A} \right]$$

Thus the frequency of oscillation is $f = \frac{1}{t_1 + t_2}$

Note that this circuit will not oscillate if R_B is greater

Figure 19 : 50% Duty Cycle Oscillator.



than $1/2 R_A$ because the junction of R_A and R_B cannot bring pin 2 down to $1/3 V_{CC}$ and trigger the lower comparator.

ADDITIONAL INFORMATION

Adequate power supply bypassing is necessary to protect associated circuitry. Minimum recommended is $0.1\mu F$ in parallel with $1\mu F$ electrolytic.