Circuito Integrado 555

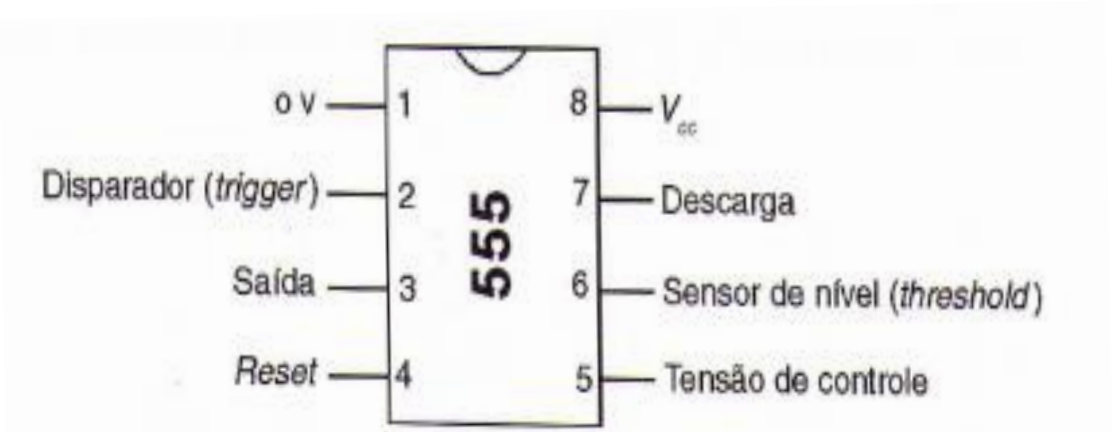
Eletrônica para Computação

Prof. José Paulo G. de Oliveira

Conteúdo

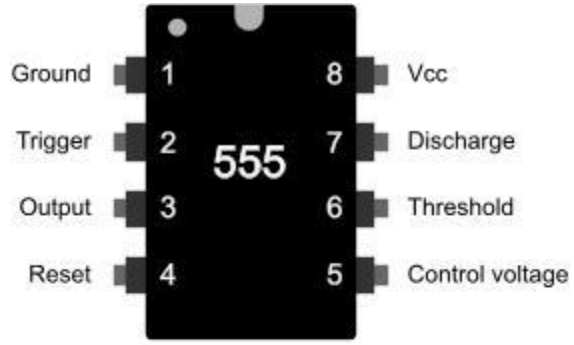
- Visão geral
- Circuitos astáveis
- Frequência de oscilação
- Circuitos monoestáveis
- Controle de frequência
- Aplicações

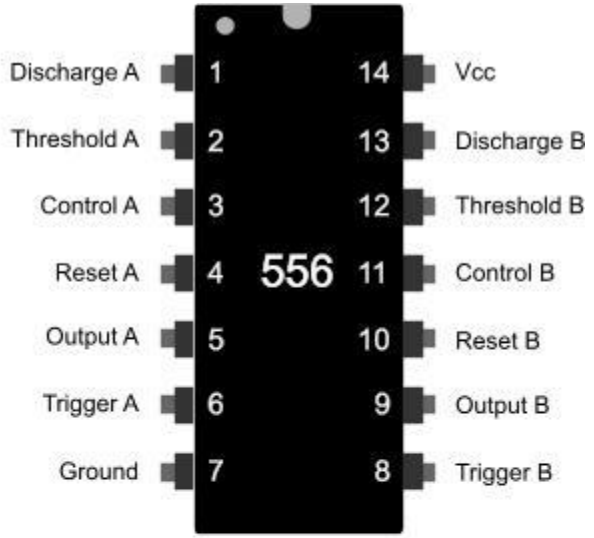
Circuito Integrado 555

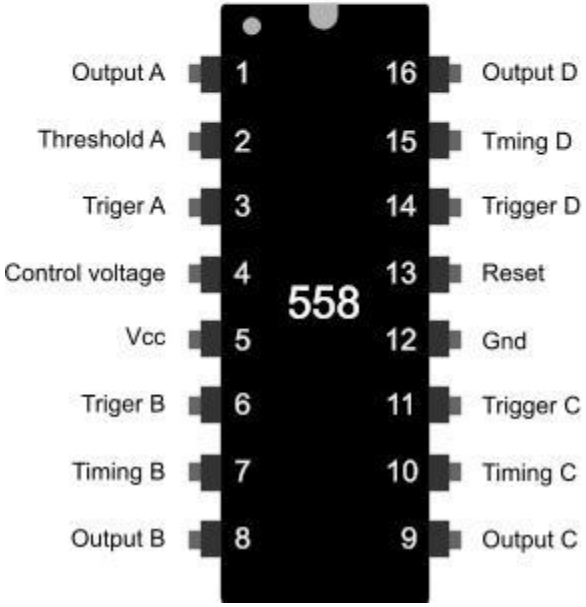


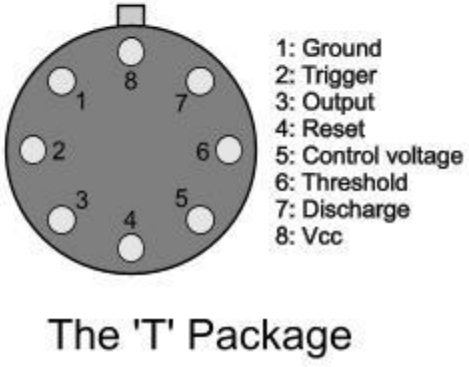
- **Lançado em 1971 pela *Signetics* (Adquirida pela *Philips* em 1975)**
- **Um dos CIs mais populares e mais vendidos no mundo**
- **2 diodos, 23 transistores e 16 resistores**
- **Corrente de saída máxima – 0.2 A**

Circuito Integrado 555

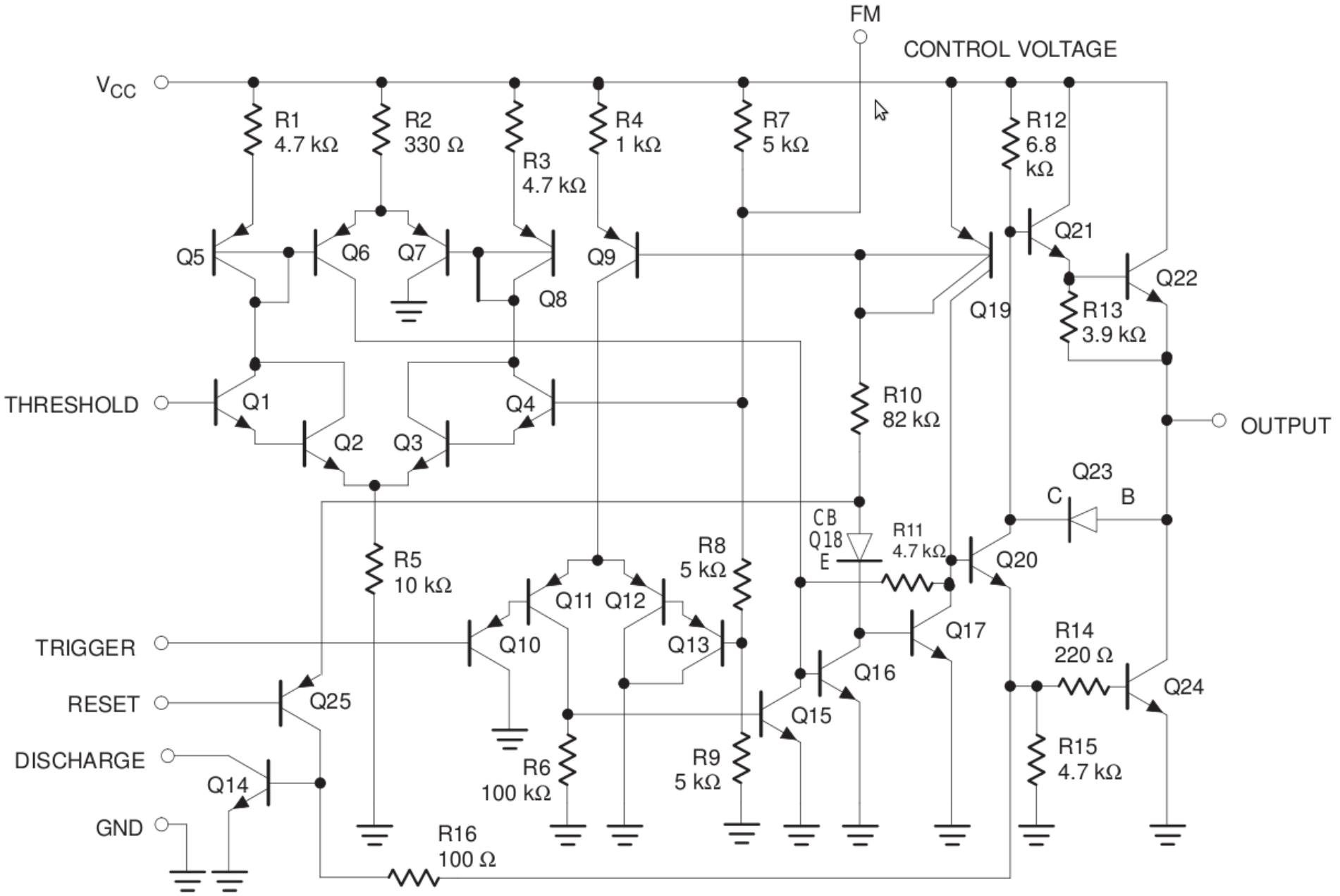


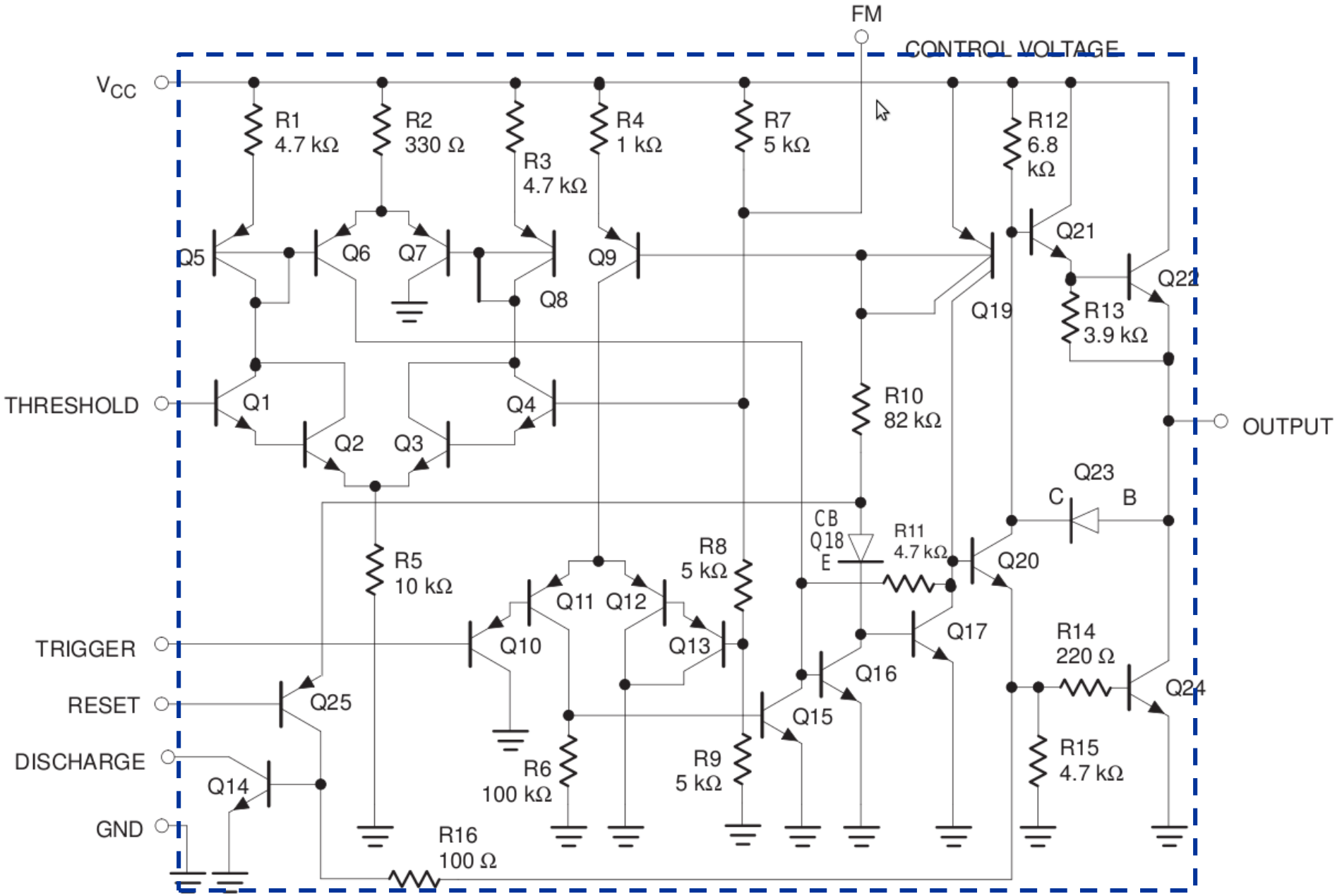






The 'T' Package


FM
CONTROL VOLTAGE
V_{CC}
R1
4.7 kΩ
R2
330 Ω
R3
4.7 kΩ
R4
1 kΩ
R7
5 kΩ
R12
6.8
kΩ
Q5
Q6
Q7
Q8
Q9
Q19
Q21
Q22
R13
3.9 kΩ
THRESHOLD
Q1
Q2
Q3
Q4
R10
82 kΩ
OUTPUT
Q23
C
B
CB
Q18
E
R11
4.7 kΩ
Q20
R5
10 kΩ
R8
5 kΩ
Q11
Q12
Q10
Q13
Q17
TRIGGER
RESET
Q25
Q16
Q15
R14
220 Ω
Q24
DISCHARGE
Q14
R6
100 kΩ
R9
5 kΩ
R15
4.7 kΩ
GND
R16
100 Ω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Q6
Q7
Q8
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THRESHOLD
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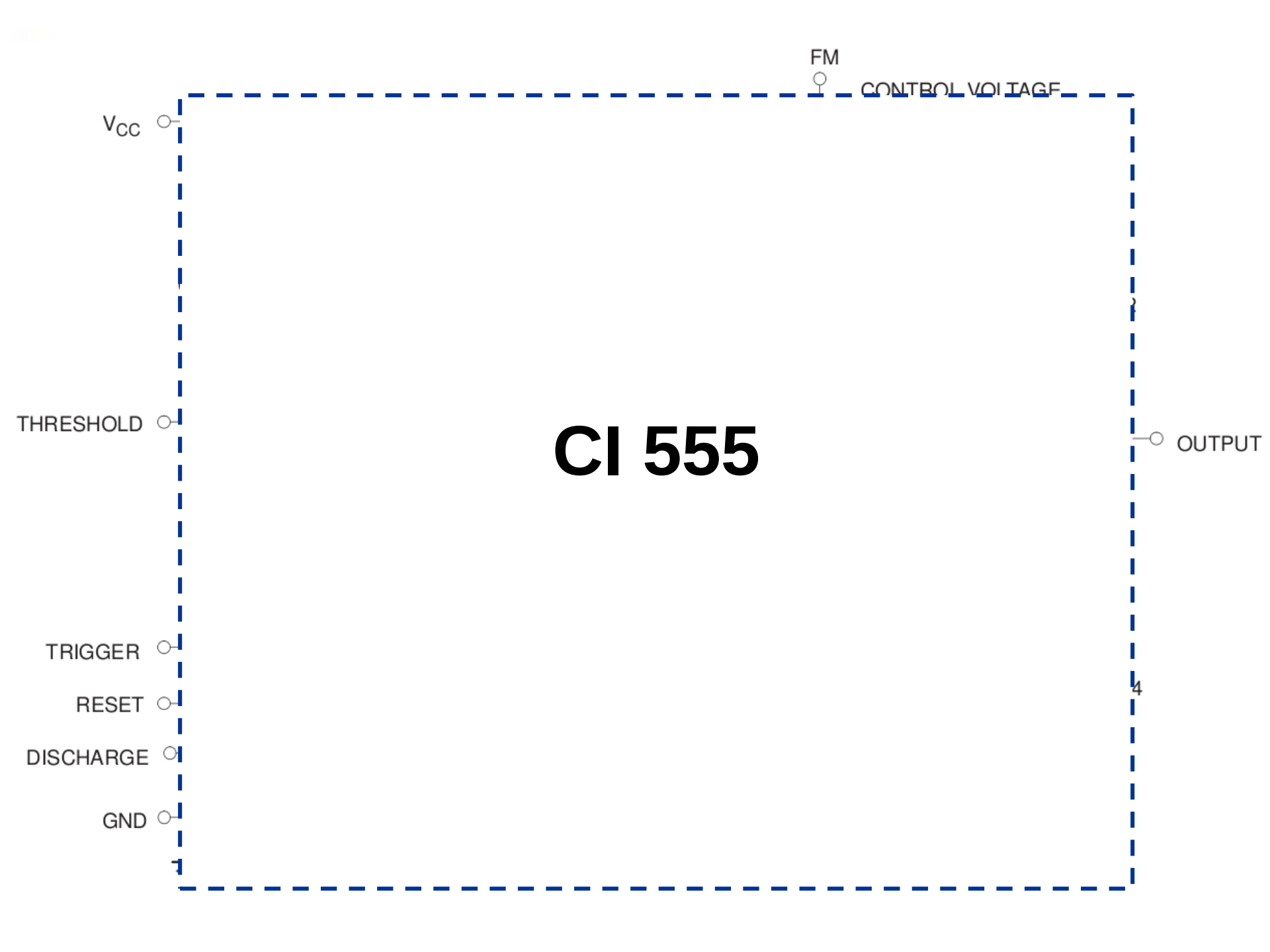
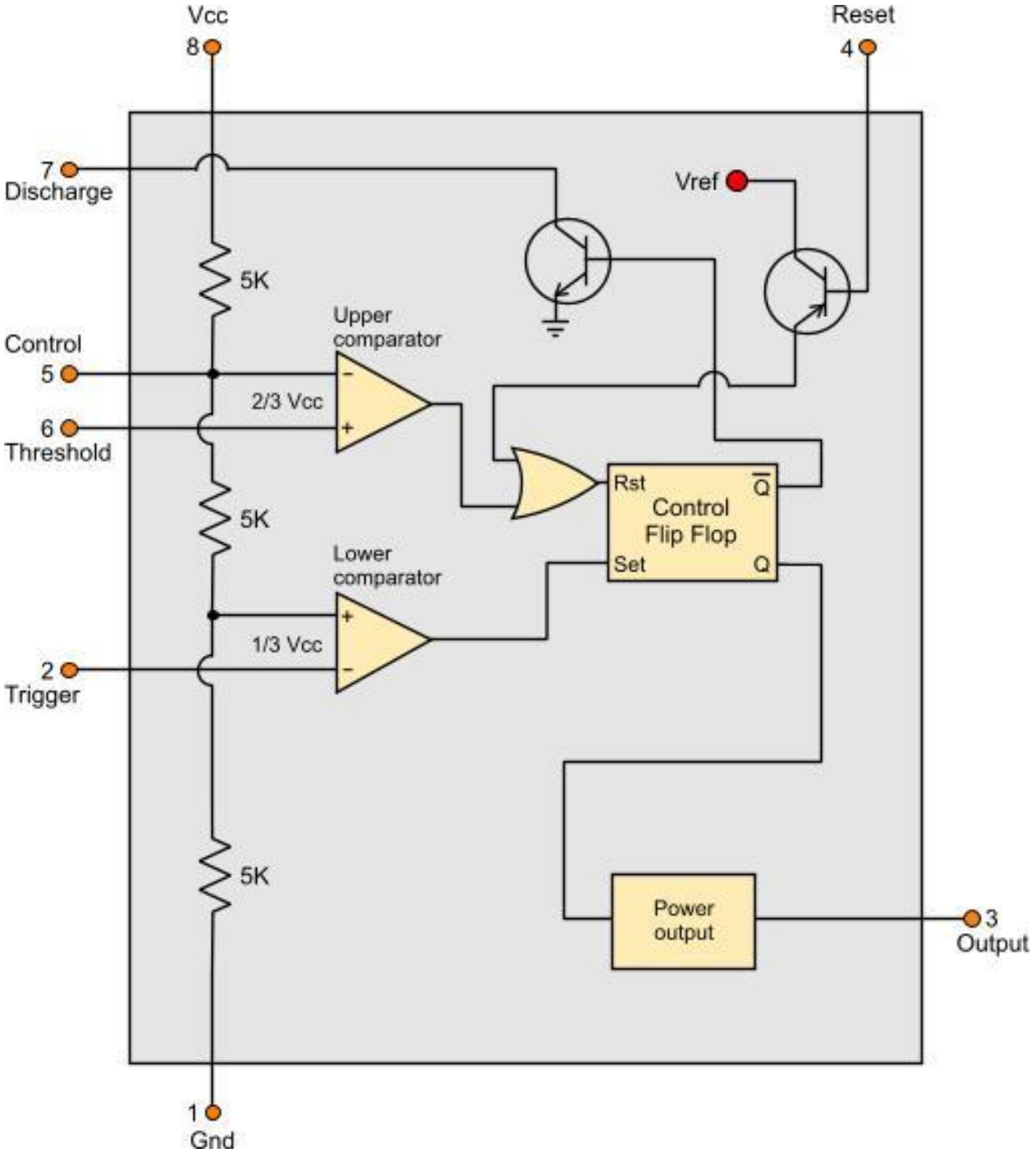
R15
4.7 kΩ
GND
R16
100 Ω

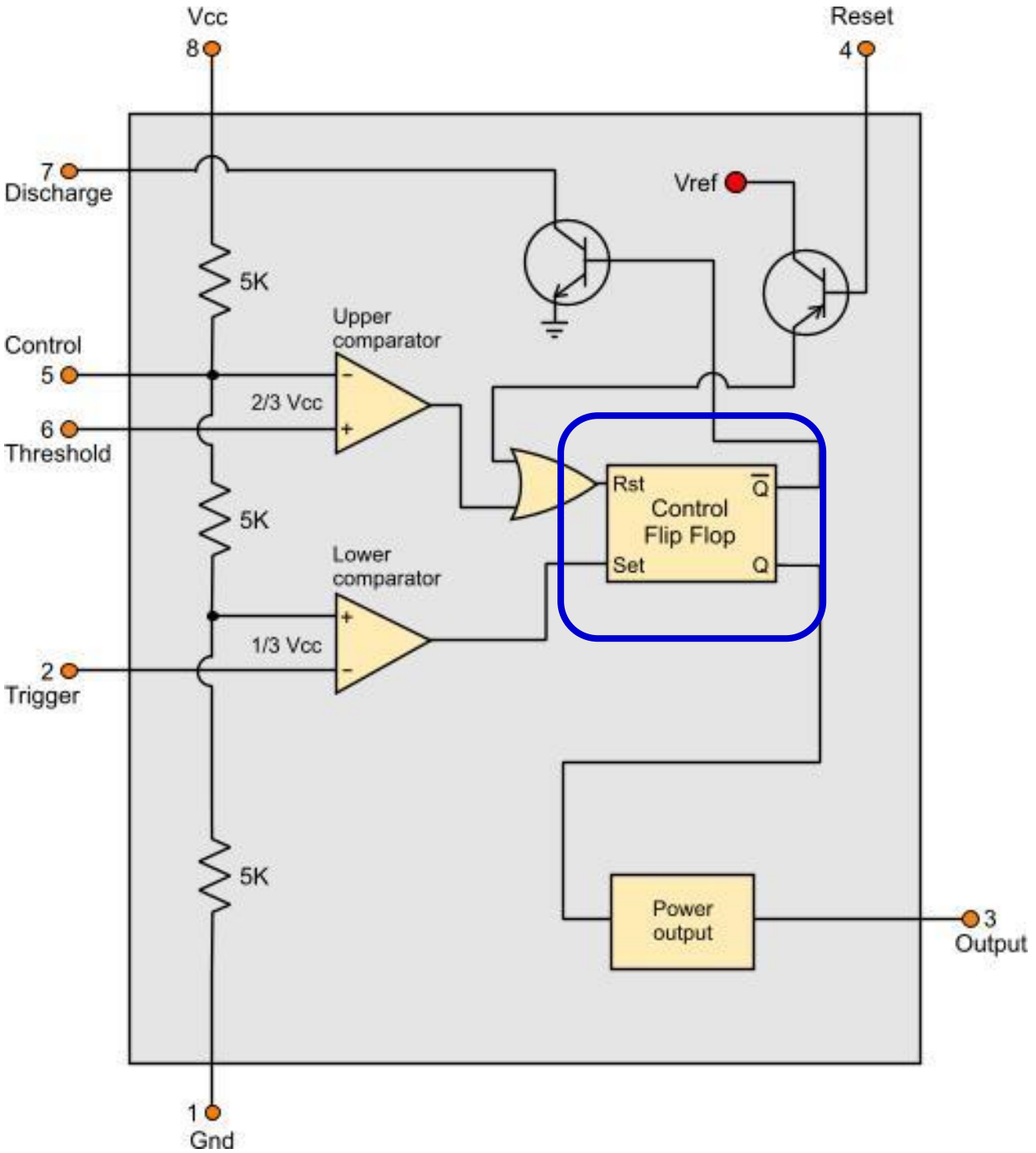

FM
CONTROL VOLTAGE
V_{CC}
THRESHOLD
TRIGGER
RESET
DISCHARGE
GND
OUTPUT
CI 555


Vcc
8
Reset
4
7
Discharge
Vref
5K
Upper
comparator
Control
5
2/3 Vcc
6
Threshold
Rst
Q
Control
Flip Flop
Set
Q
5K
Lower
comparator
1/3 Vcc
2
Trigger
5K
Power
output
3
Output
1
Gnd

Tipos de circuito com 555

- **555 Timer** como multivibrador astável
- **555 Timer** como multivibrador monoestável
- **555 Timer** no modo bi-estável

Flip-flop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Rst
Q
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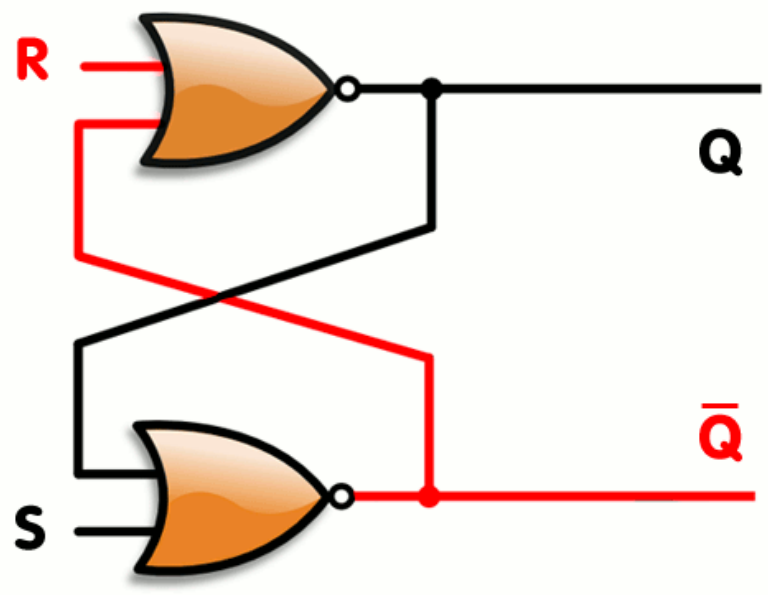
Flip Flop
Set
Q
5K
Lower
comparator
1/3 Vcc
2
Trigger
5K
Power
output
3
Output
1
Gnd

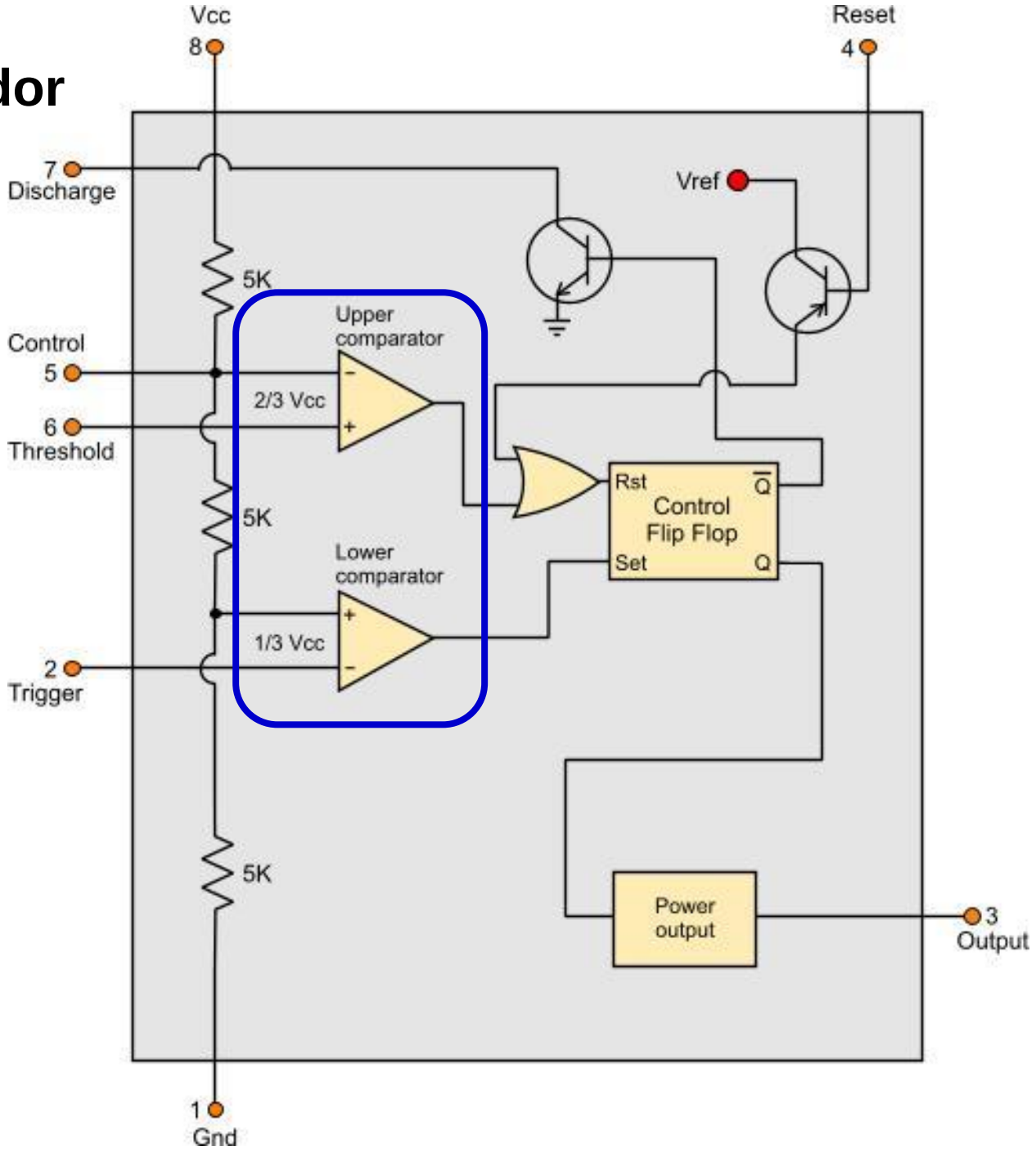
Flip-Flpo SR

Operação do FF SR

S	R	Ação
0	0	-
0	1	Q = 0
1	0	Q = 1
1	1	Proibido



Comparador


Vcc
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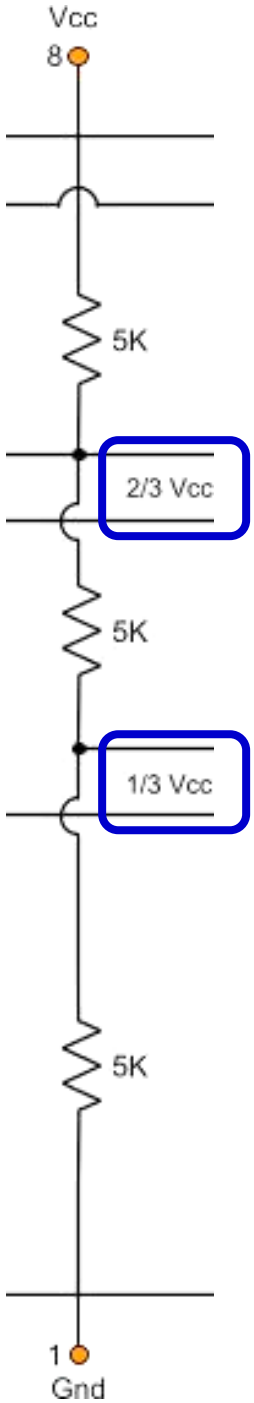
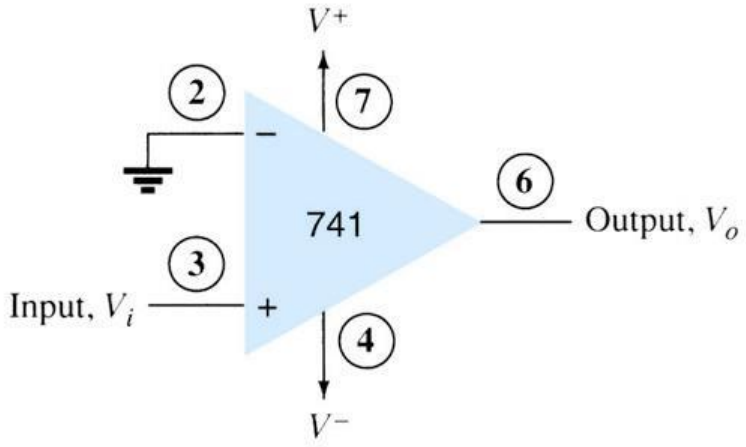
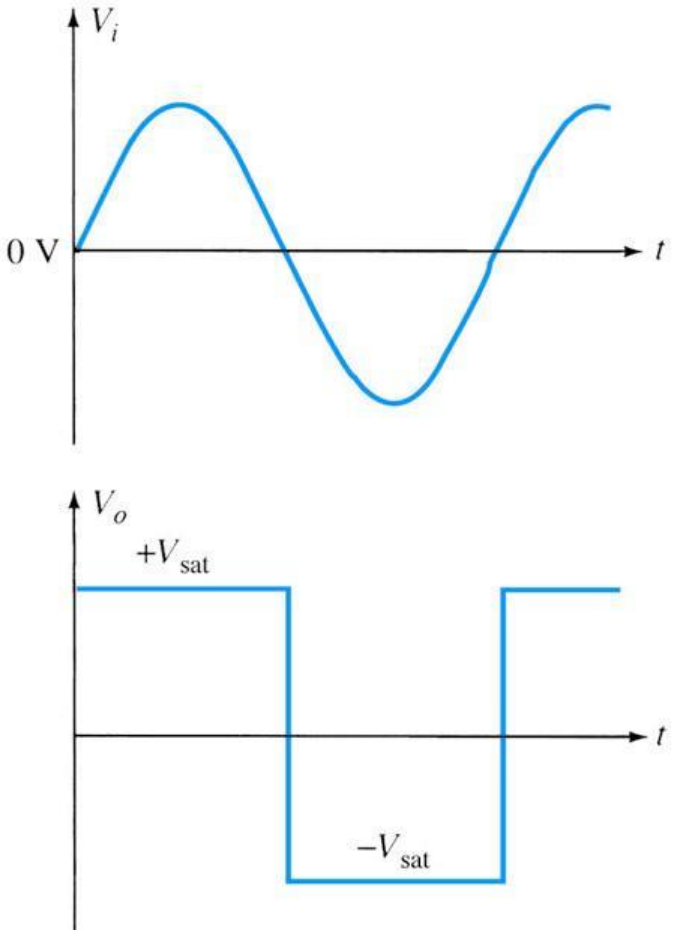
Comparador

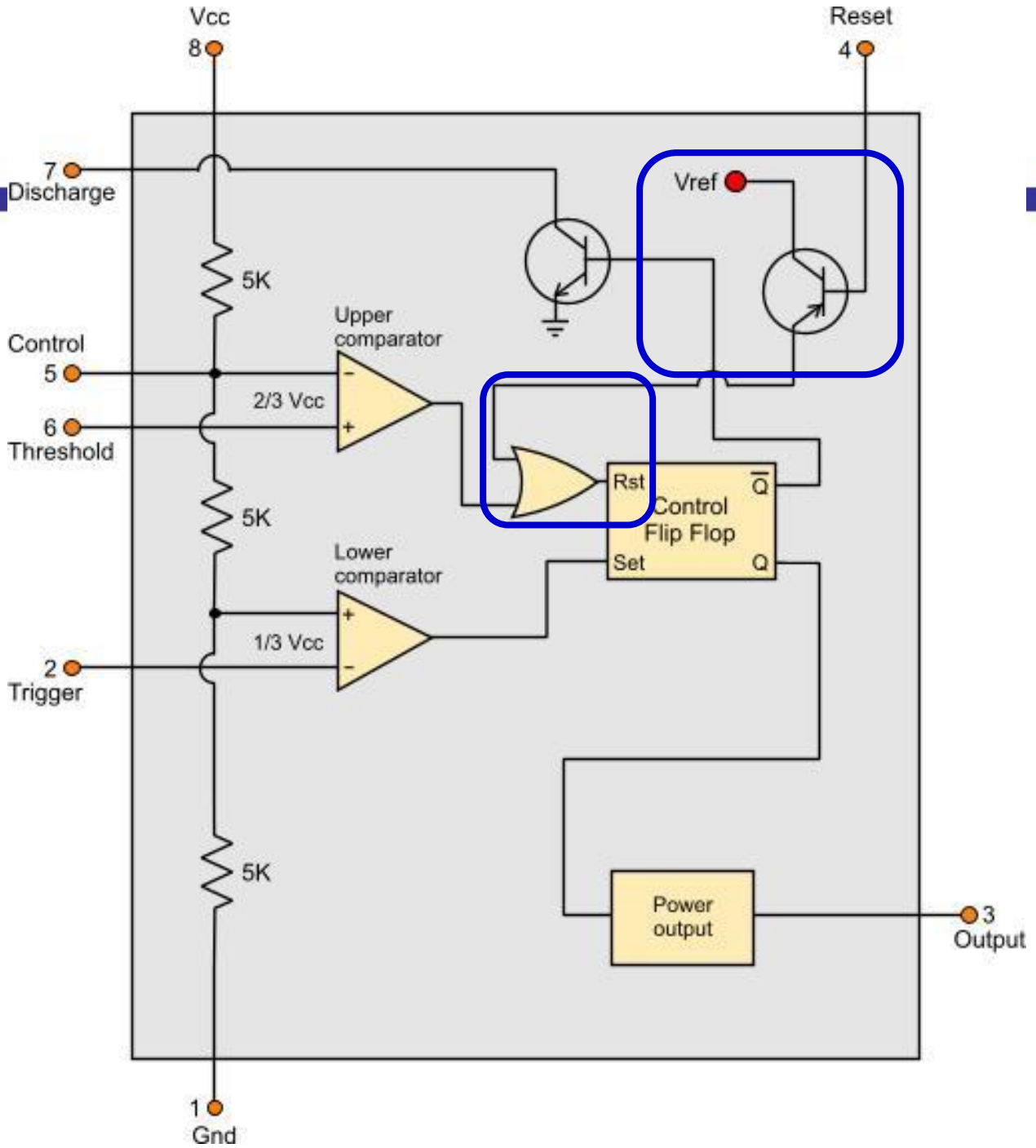


Comparador





Reset


Vcc
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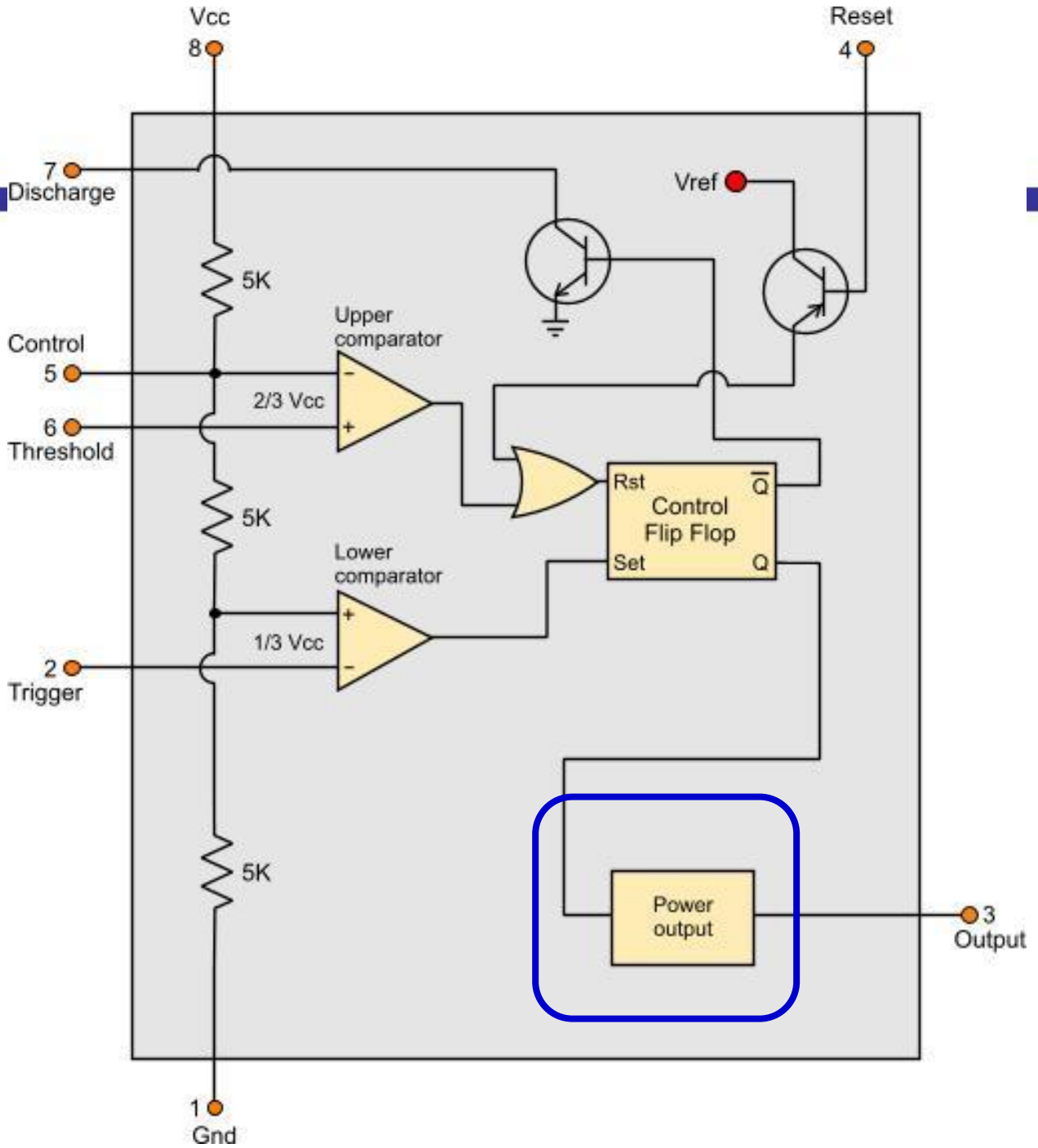
Saída


Vcc
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5K
Lower
comparator
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2
Trigger
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Power
output
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Output
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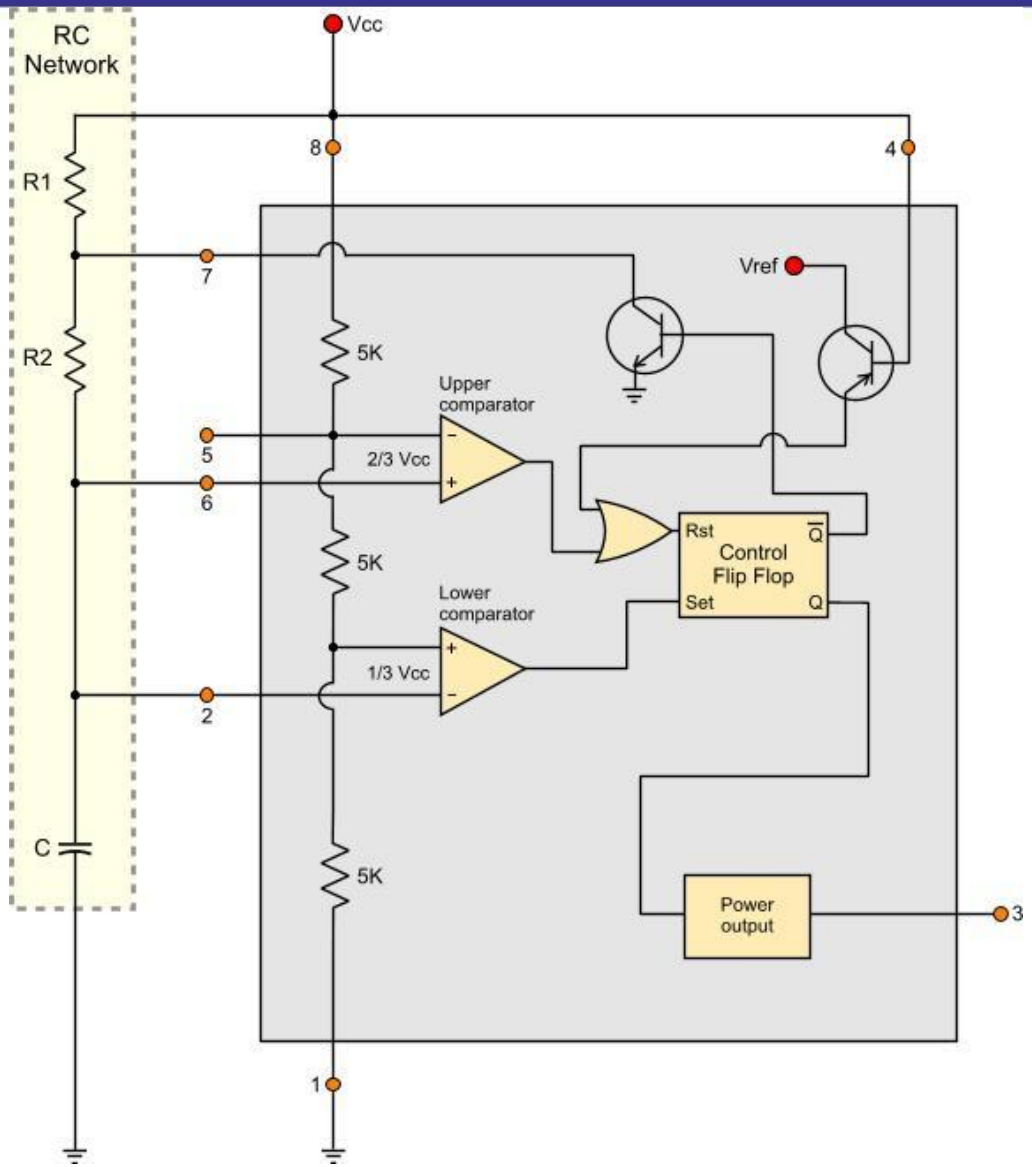
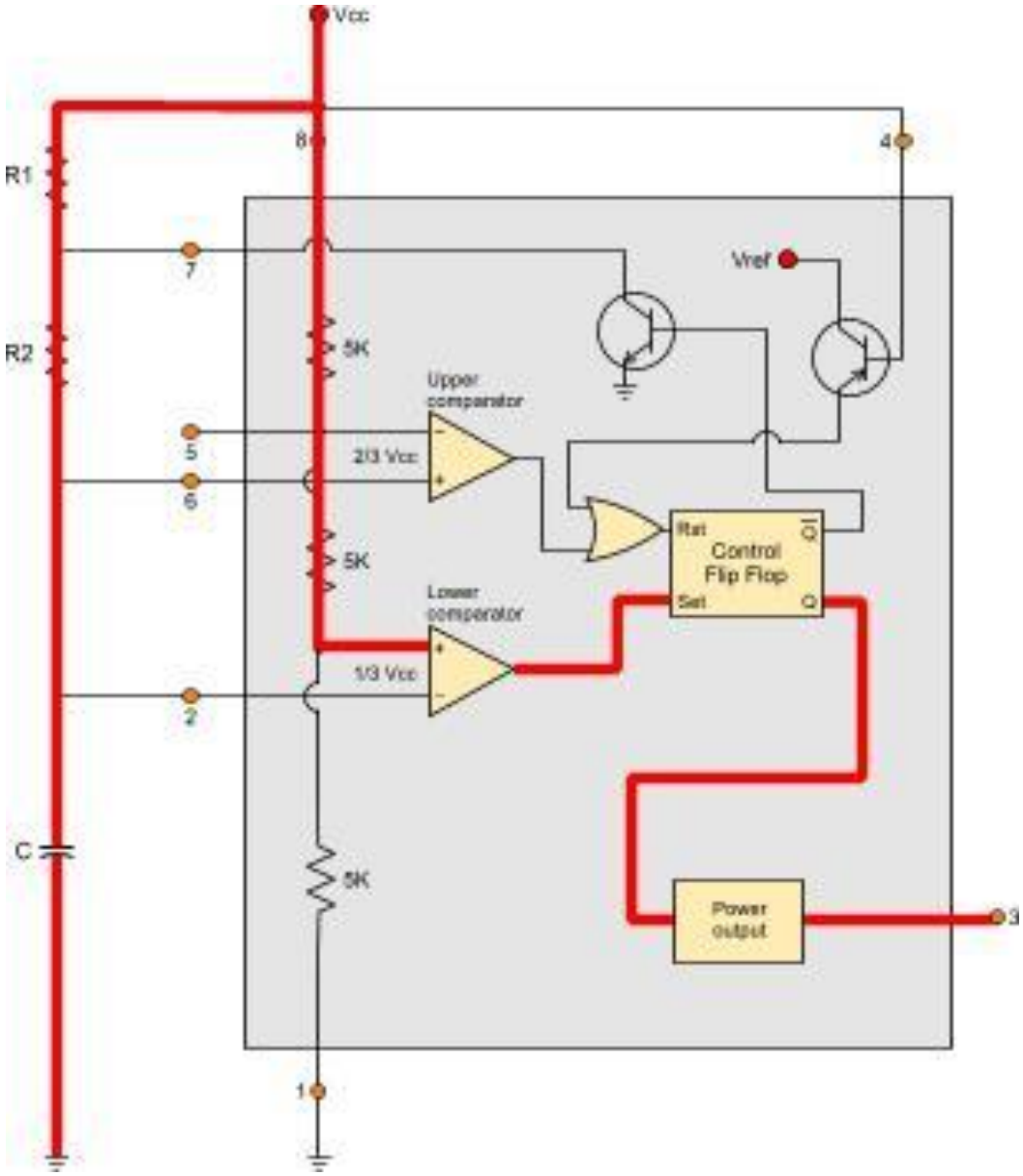
Circuitos Astáveis com 555

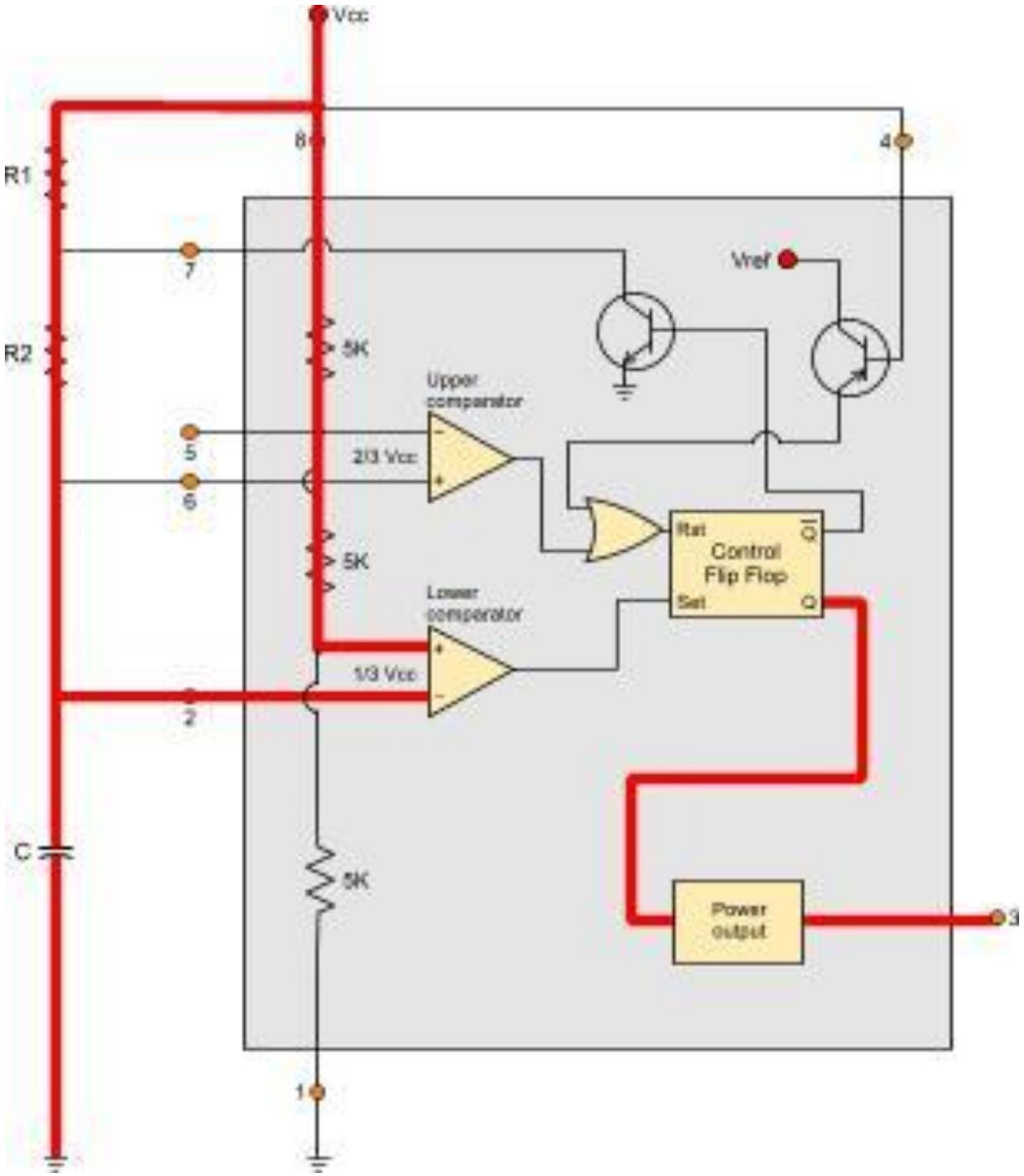


Primeiro passo - início:



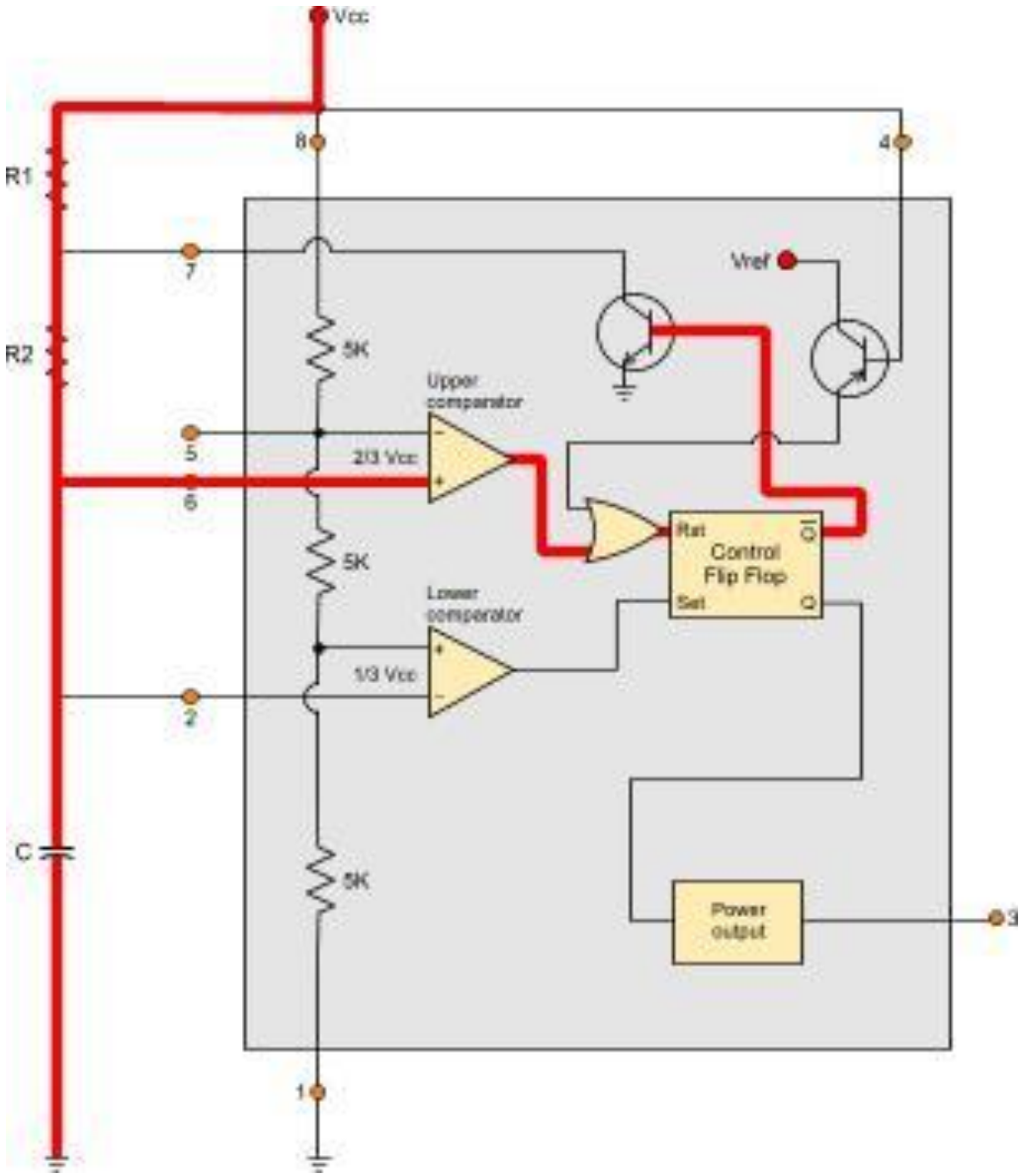
- **C está descarregado**
- **Comparador 1 => Off**
- **Comparador 2 => On**
- **FF => On**
- **Saída => On**

Segundo passo – Carga do capacitor:



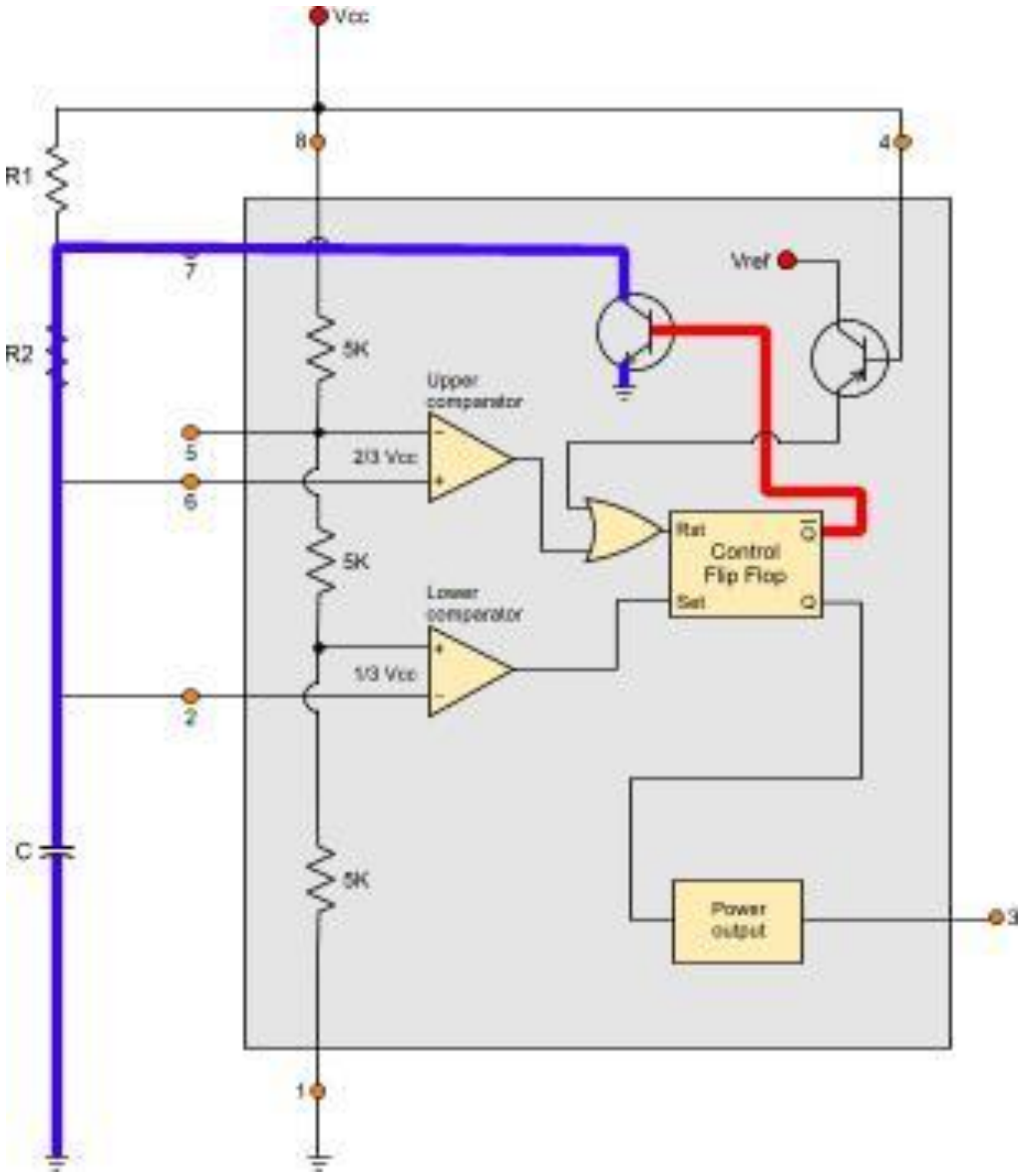
- **C se carregando por R1 e R2**
- **C => 1/3 Vcc**
- **Comparador 1 => Off**
- **Comparador 2 => Off**
- **FF => On**
- **Saída => On**

Terceiro passo – Saída em Off:



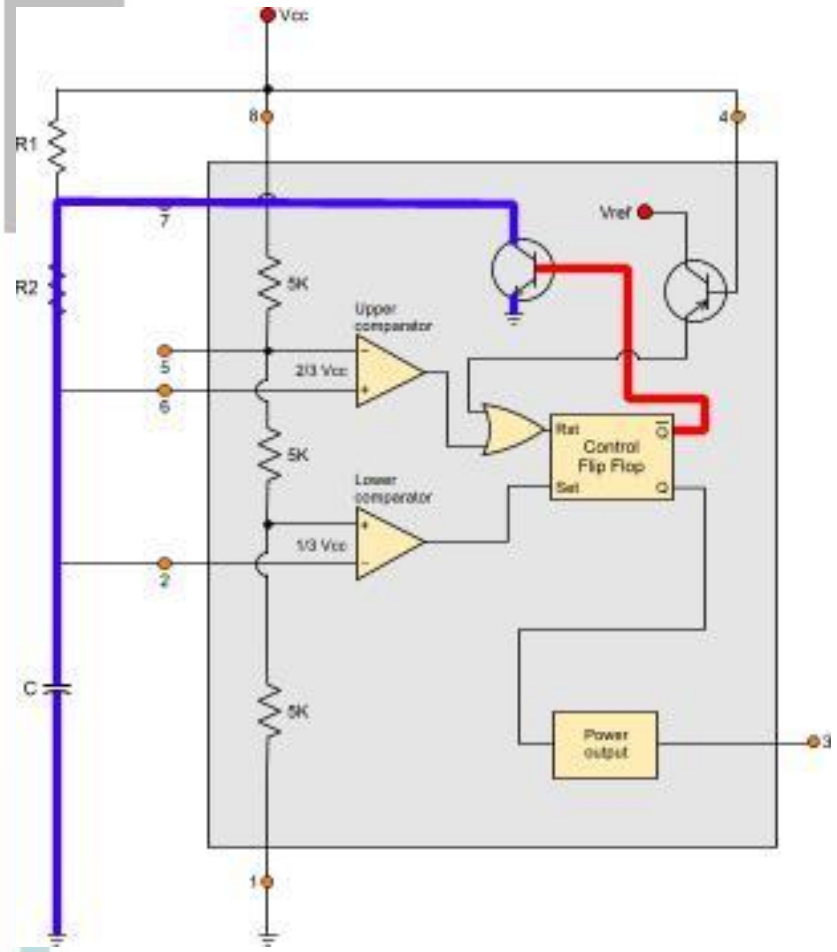
- **C => 2/3 Vcc**
- **Comparador 1 => Off**
- **Comparador 2 => On**
- **FF => Off**
- **Saída => Off**

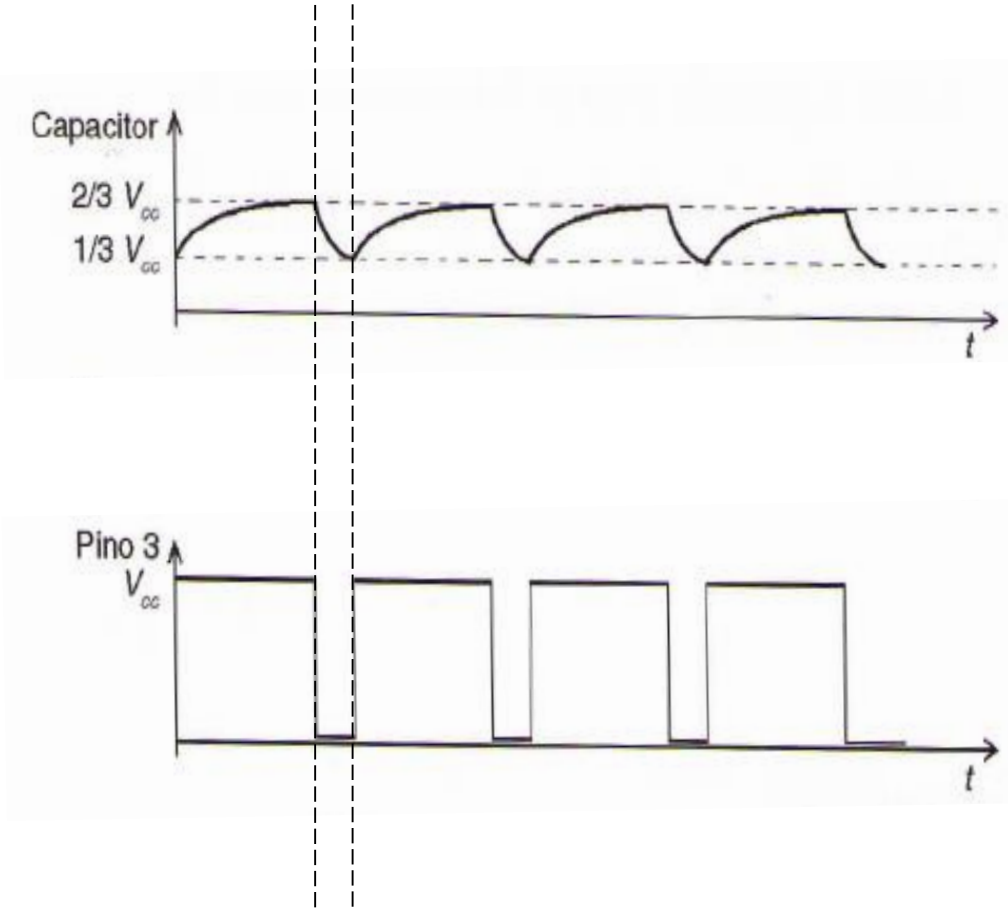
Quarto passo – Descarga do capacitor:



- **Comparador 1 => Off**
- **Comparador 2 => Off**
- **FF => Off**
- **Saída => Off**
- **Saída complementar => On**
- **Transistor aterrado**
- **Capacitor se descarrega via R2**

Formas de Onda



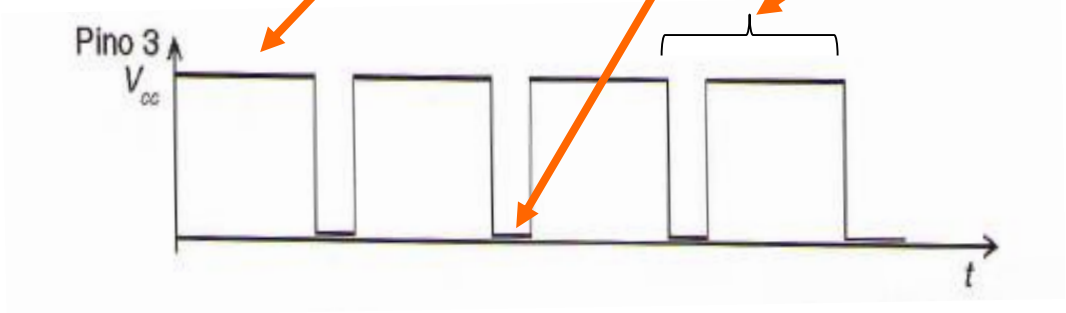


Valores de tempo

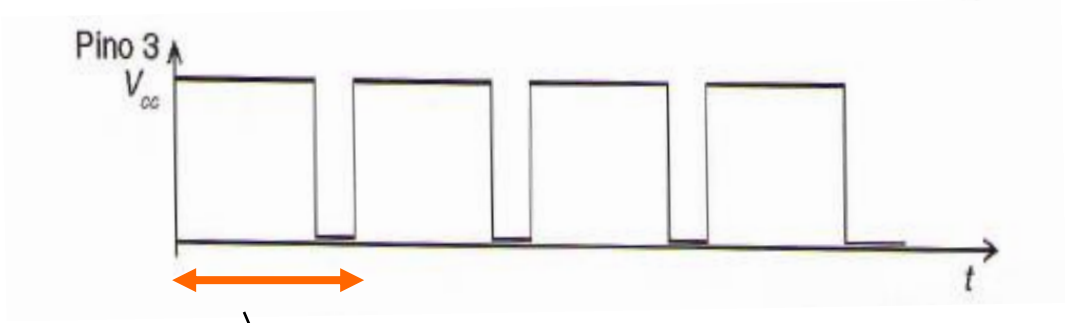
$$T_{alto} = 0.693(R_1 + R_2)C$$

$$T_{baixo} = 0.693R_2C$$

$$T_{total} = 0.693(R_1 + 2R_2)C$$

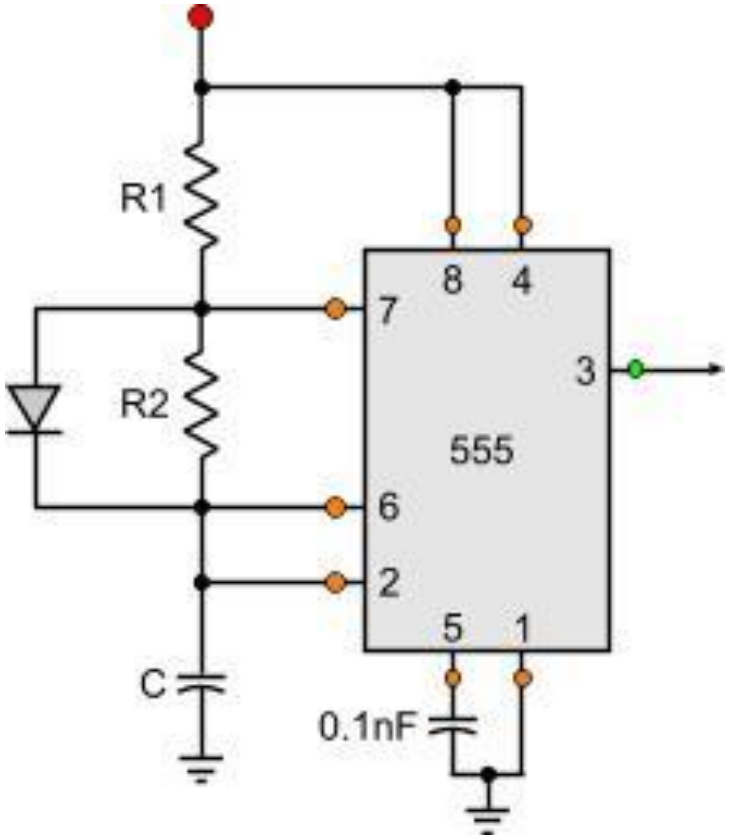


Valores de frequência



$$f = \frac{1}{T_{total}} = \frac{1.443}{(R_1 + 2R_2)C}$$

Configuração Simétrica



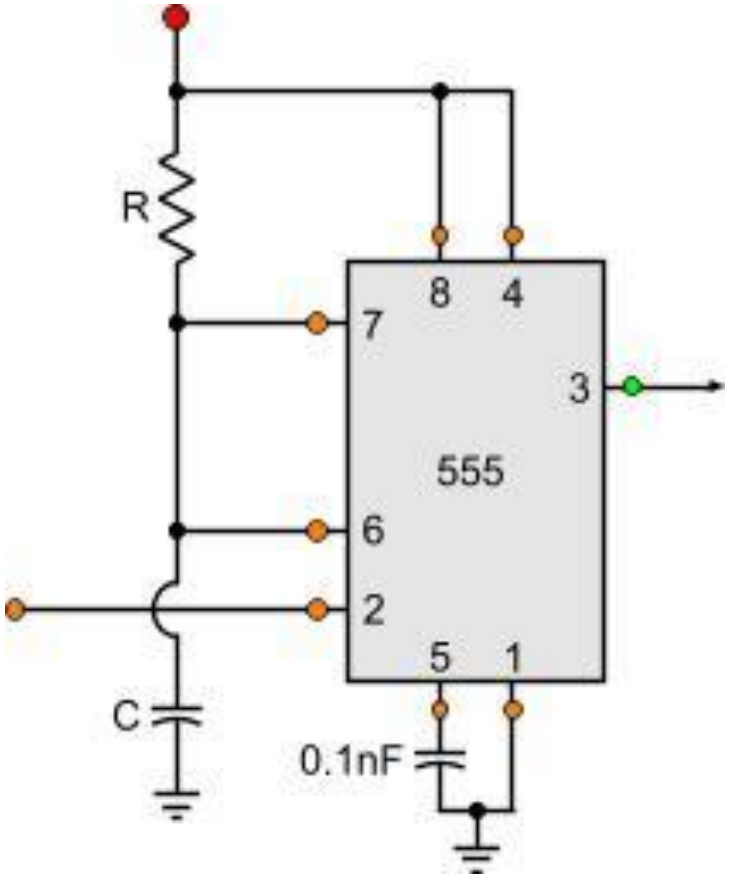
$$Se \;\; R_1 = R_2 = R_t$$

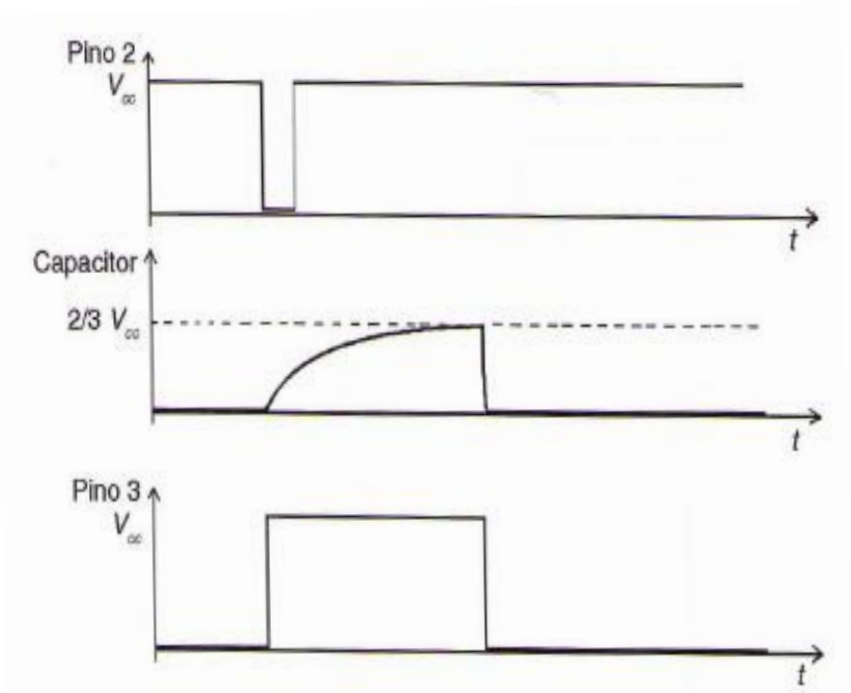
$$T_{alto} = T_{baixo} = 0.67 R_t C$$

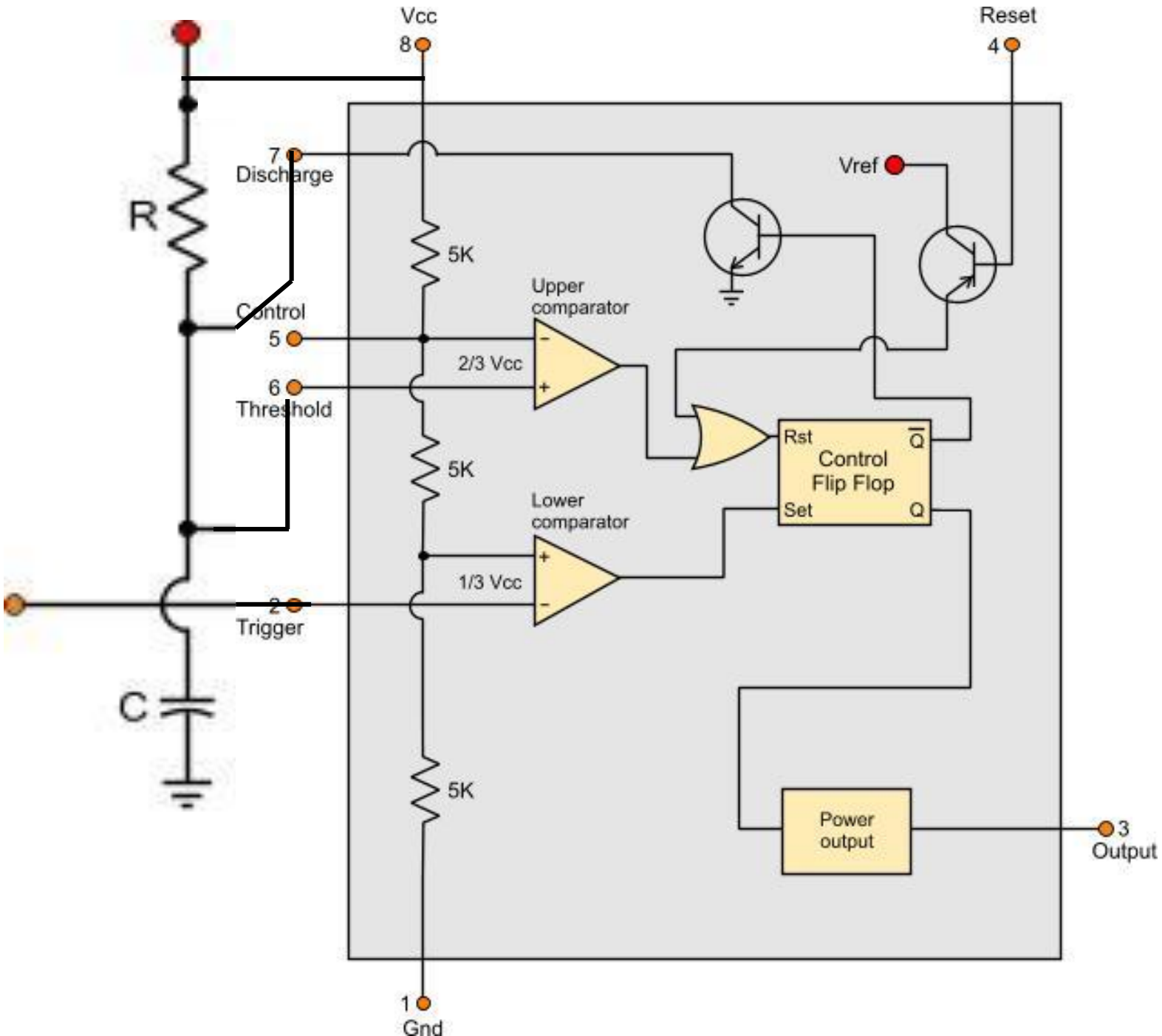
$$T_{total} = 1.34 R_t C$$

$$f = \frac{0.74}{\mathrm{R_t}\, C}$$

Circuito Monoestável






Vcc
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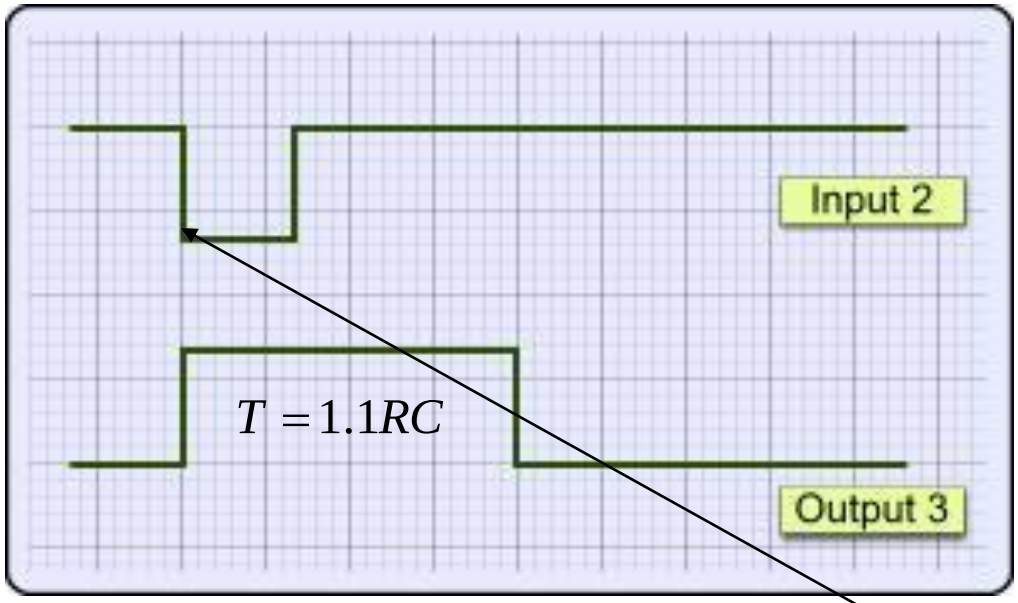
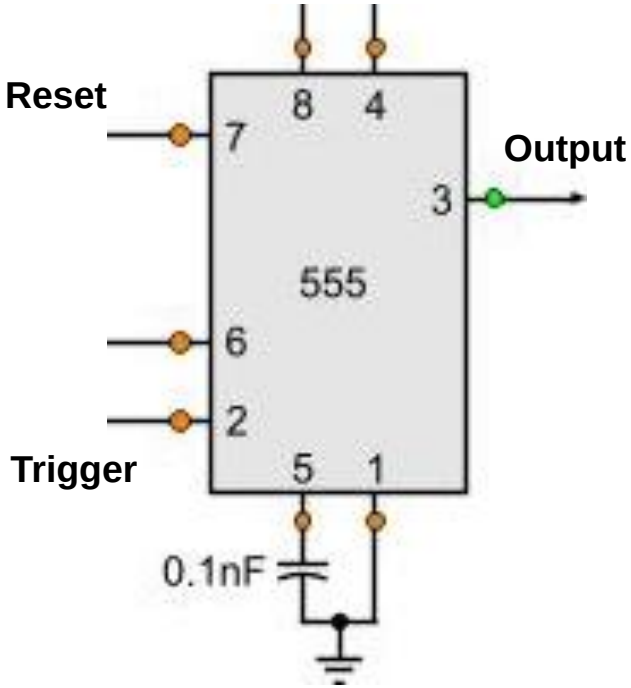
1
Gnd

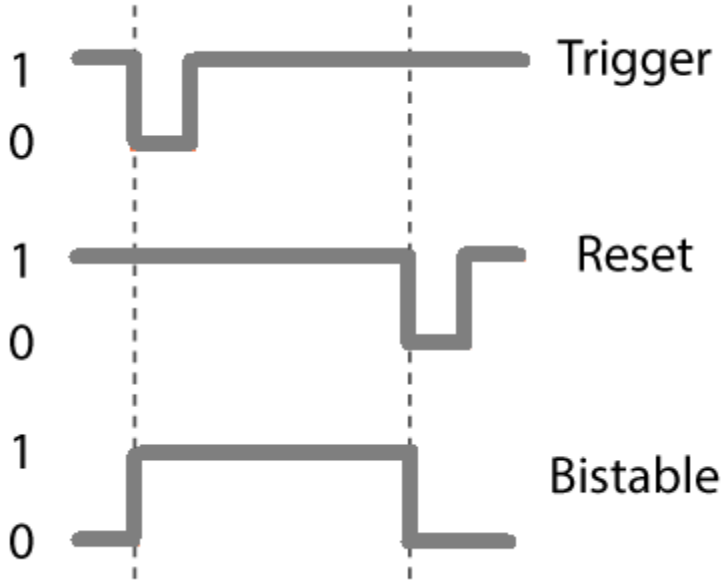
Aplicação



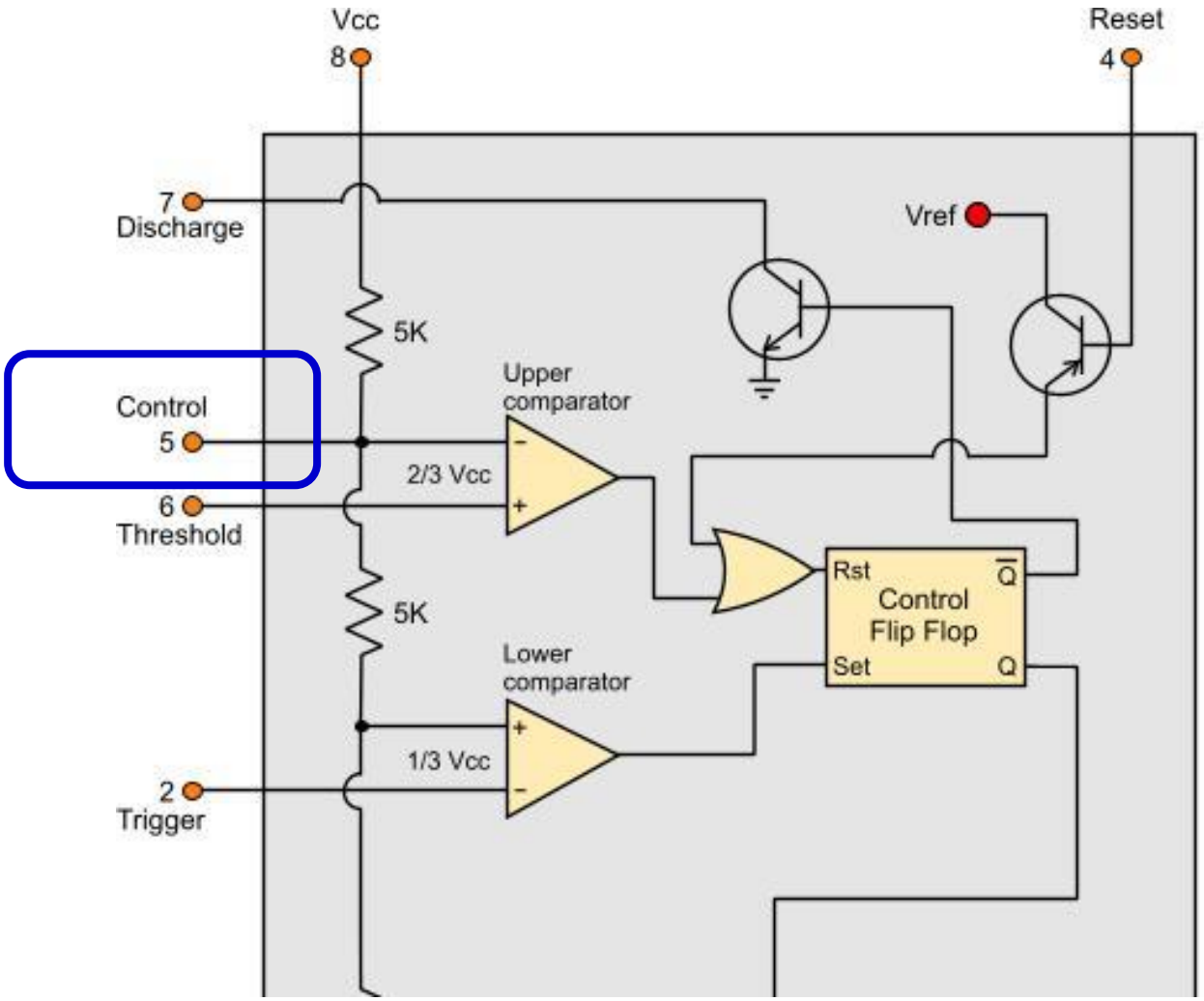
Conta-se o tempo a partir de um <u>evento</u>

Circuito Bi-estável





Controle de Tensão



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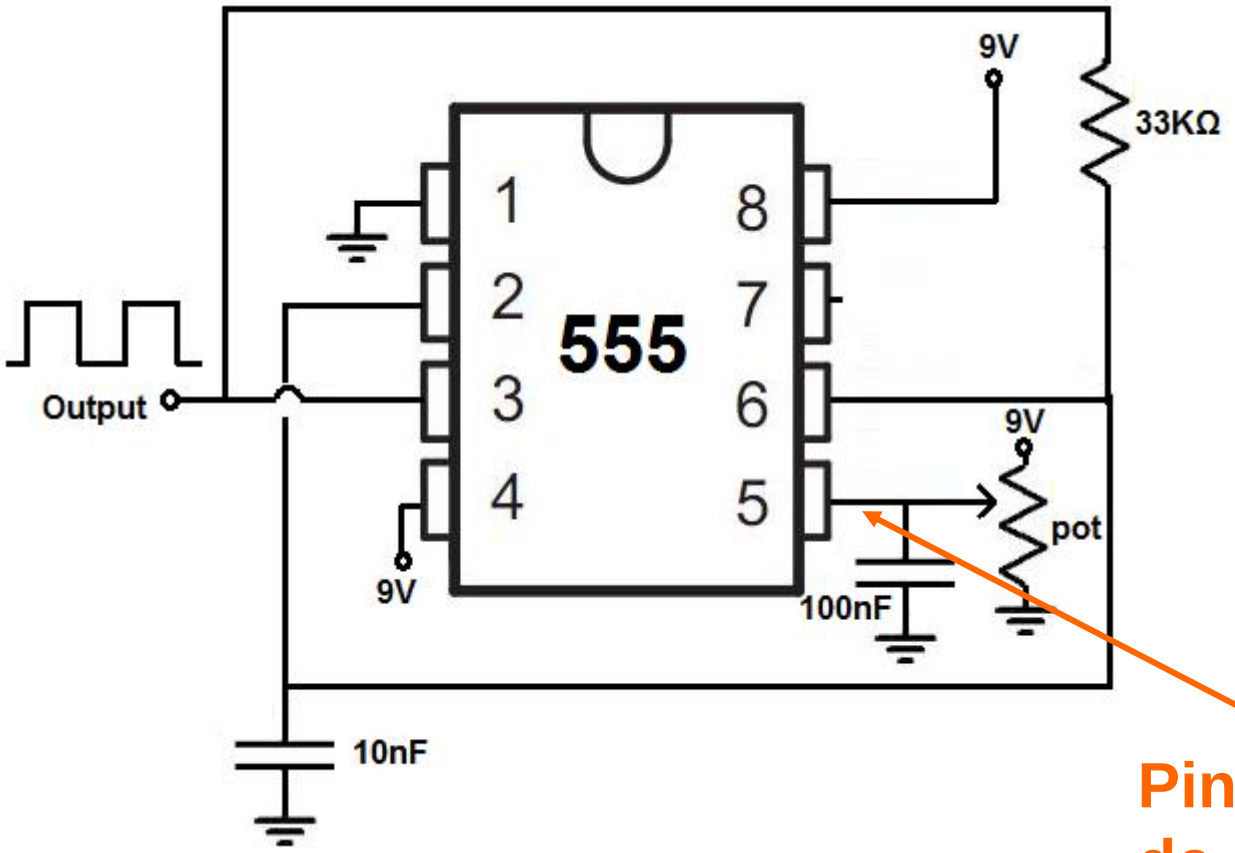
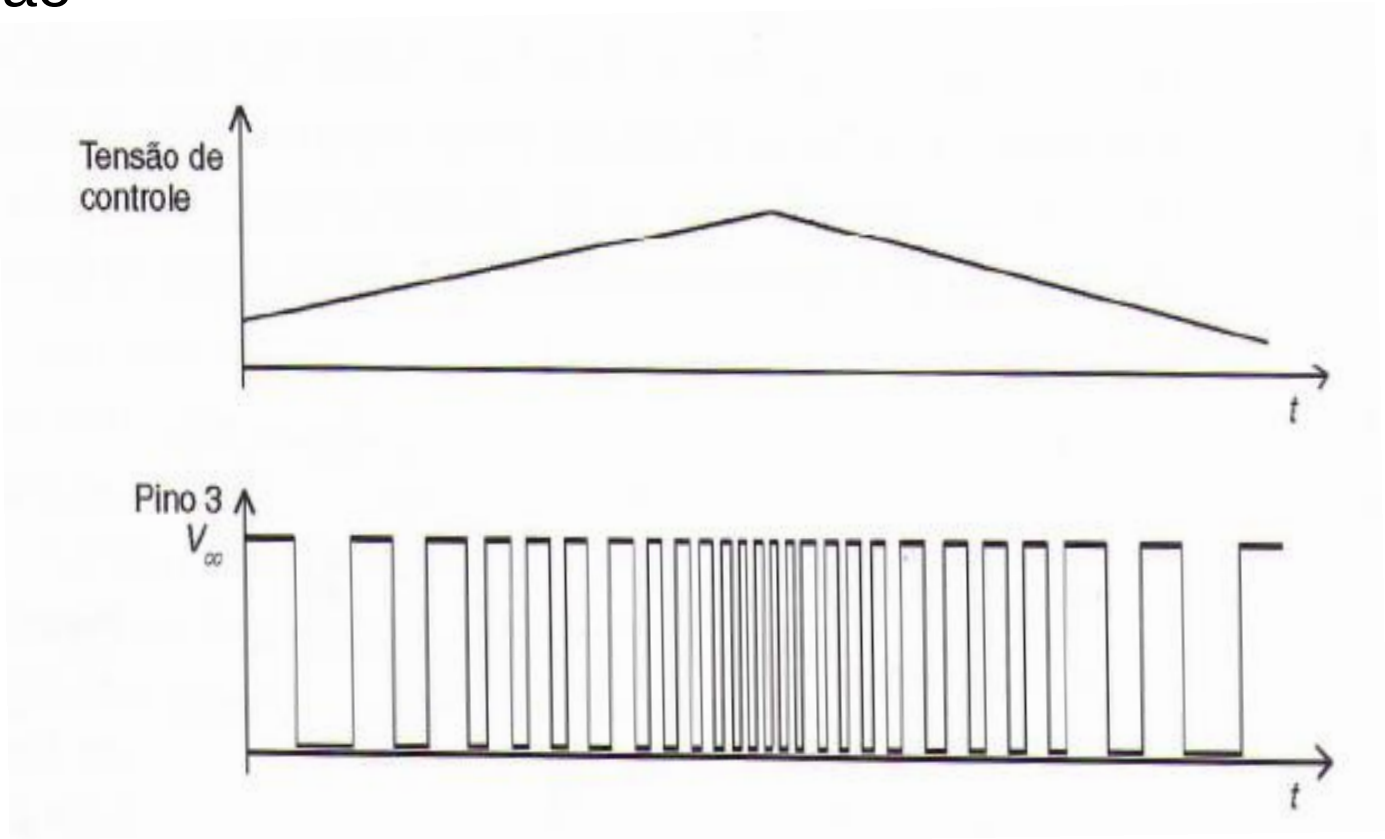
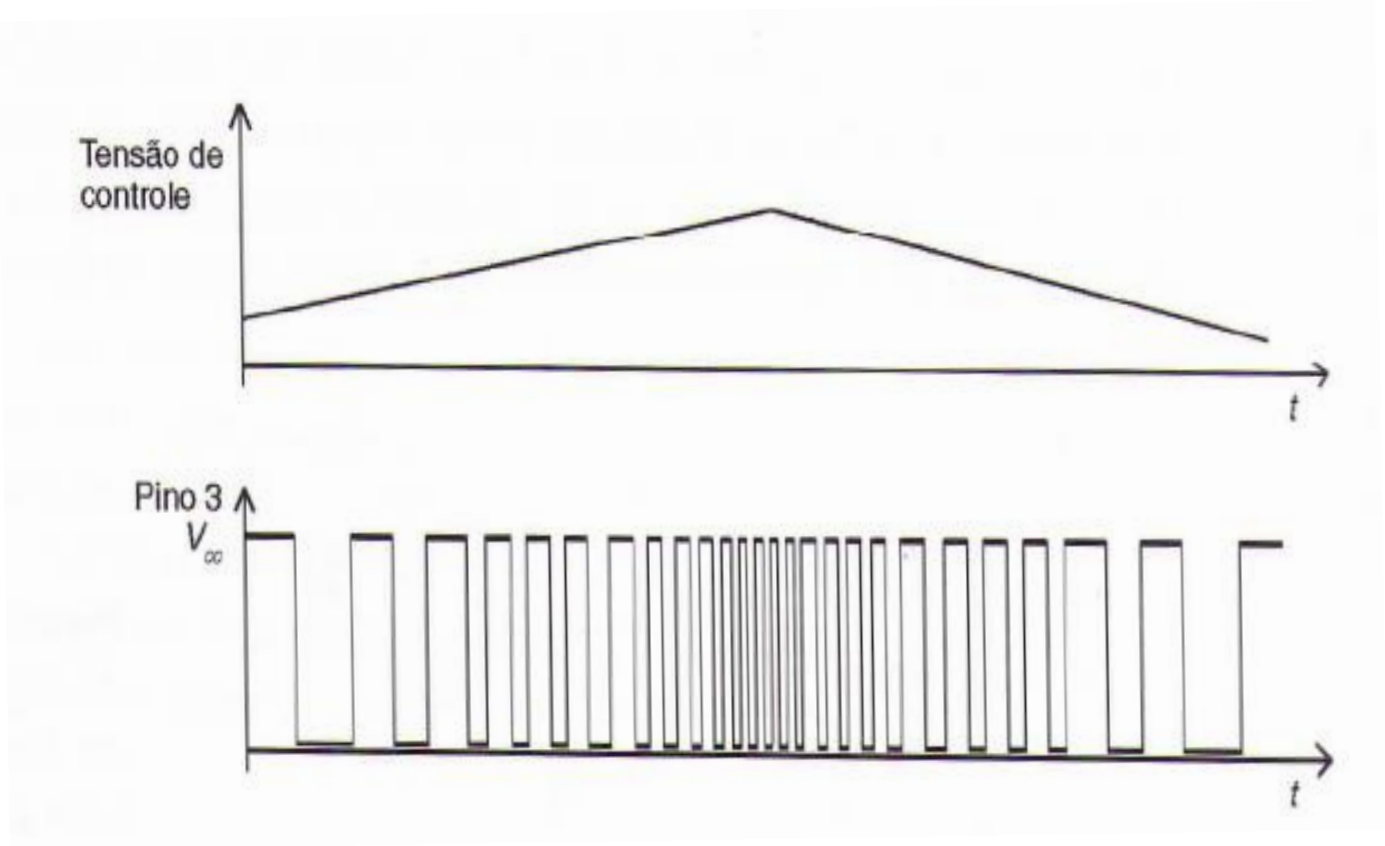


Controle de Tensão

- Tensão de controle pode variar entre 0.45Vcc e 0.9 Vcc
- A frequência do sinal de saída varia de acordo com essa tensão

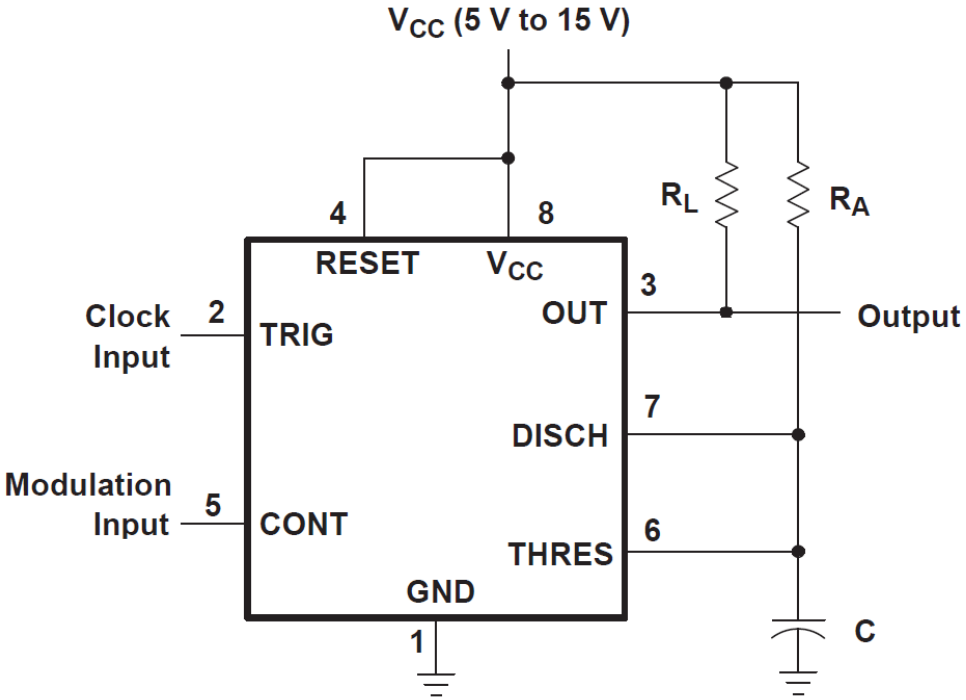


Controle de frequência por tensão



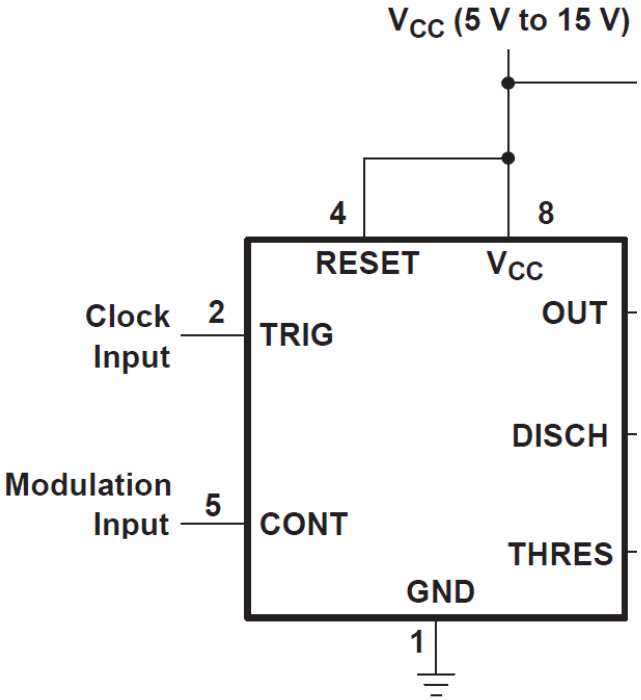
VCO – Voltage Controlled Oscillator

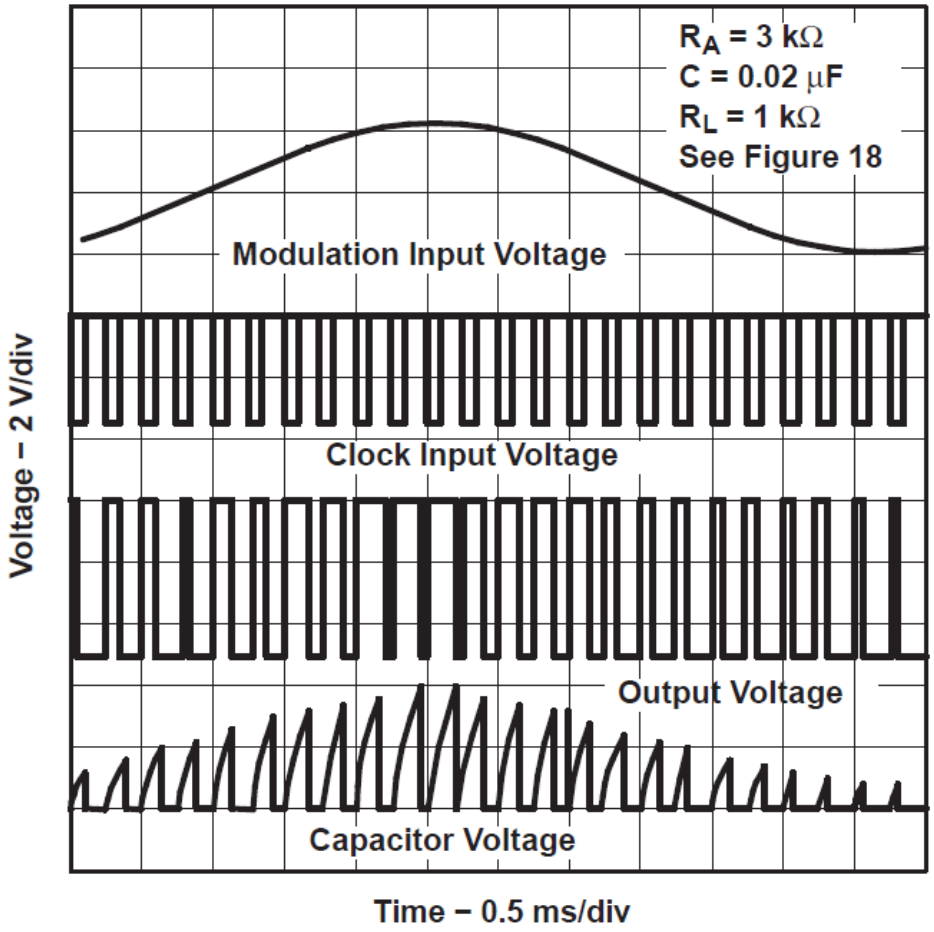
Controle de frequência por tensão



PWM – Pulse Width Modulation

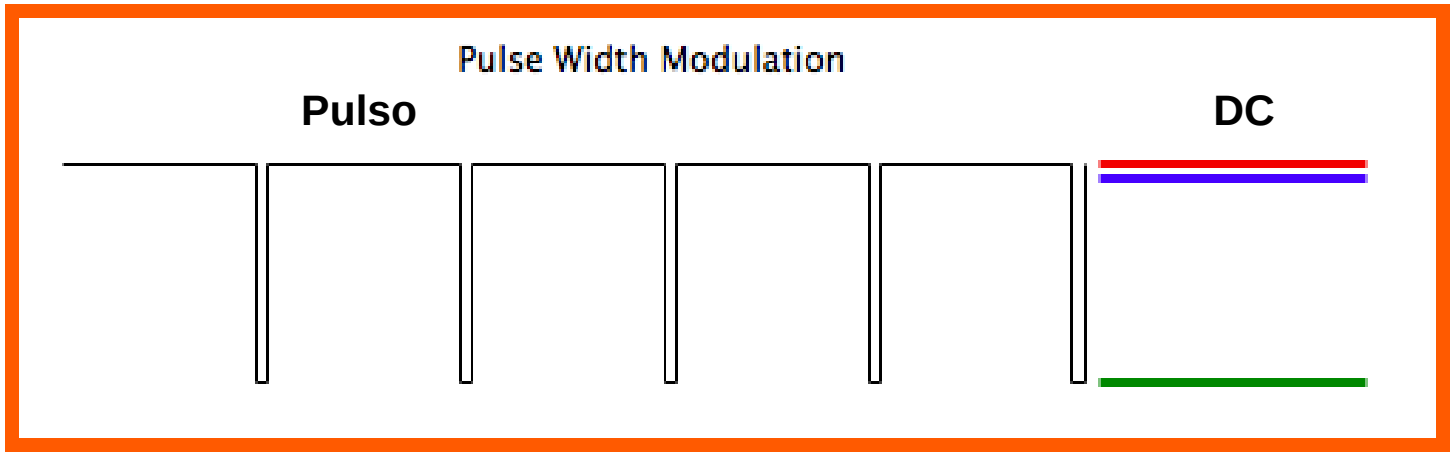
Controle de frequência por tensão





PWM – Pulse Width Modulation

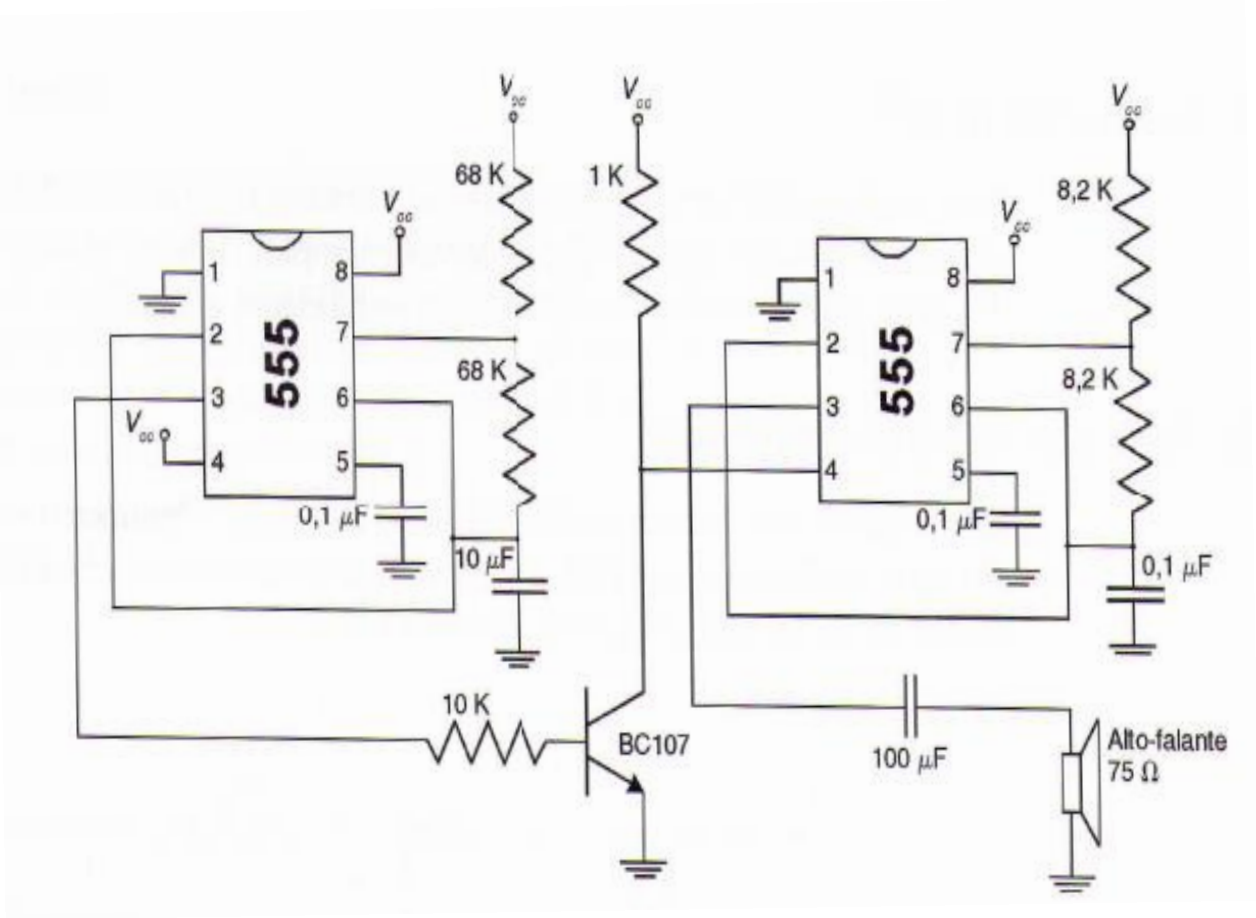
Controle de frequência por tensão



PWM – Pulse Width Modulation

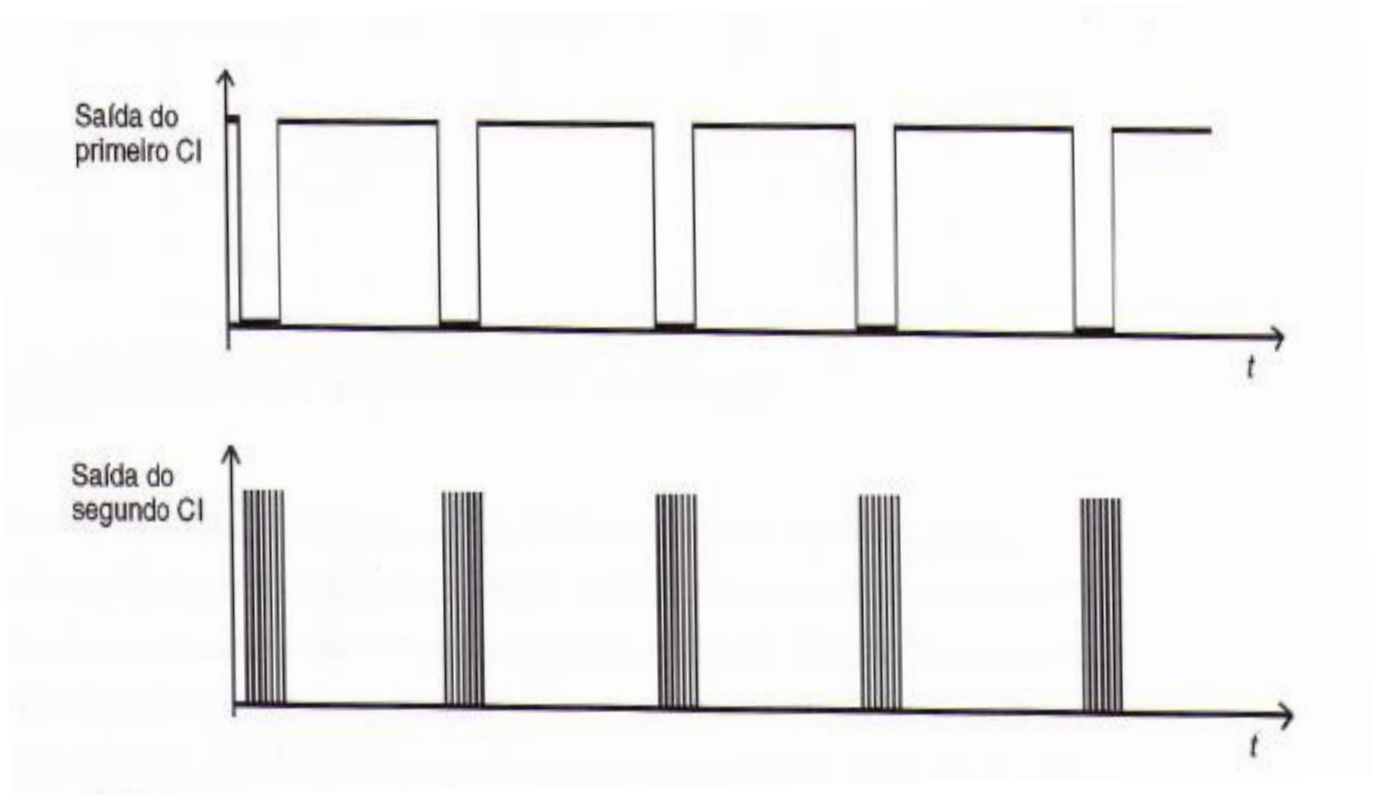
Exemplos de Aplicações com 555

Gerador de áudio intermitente



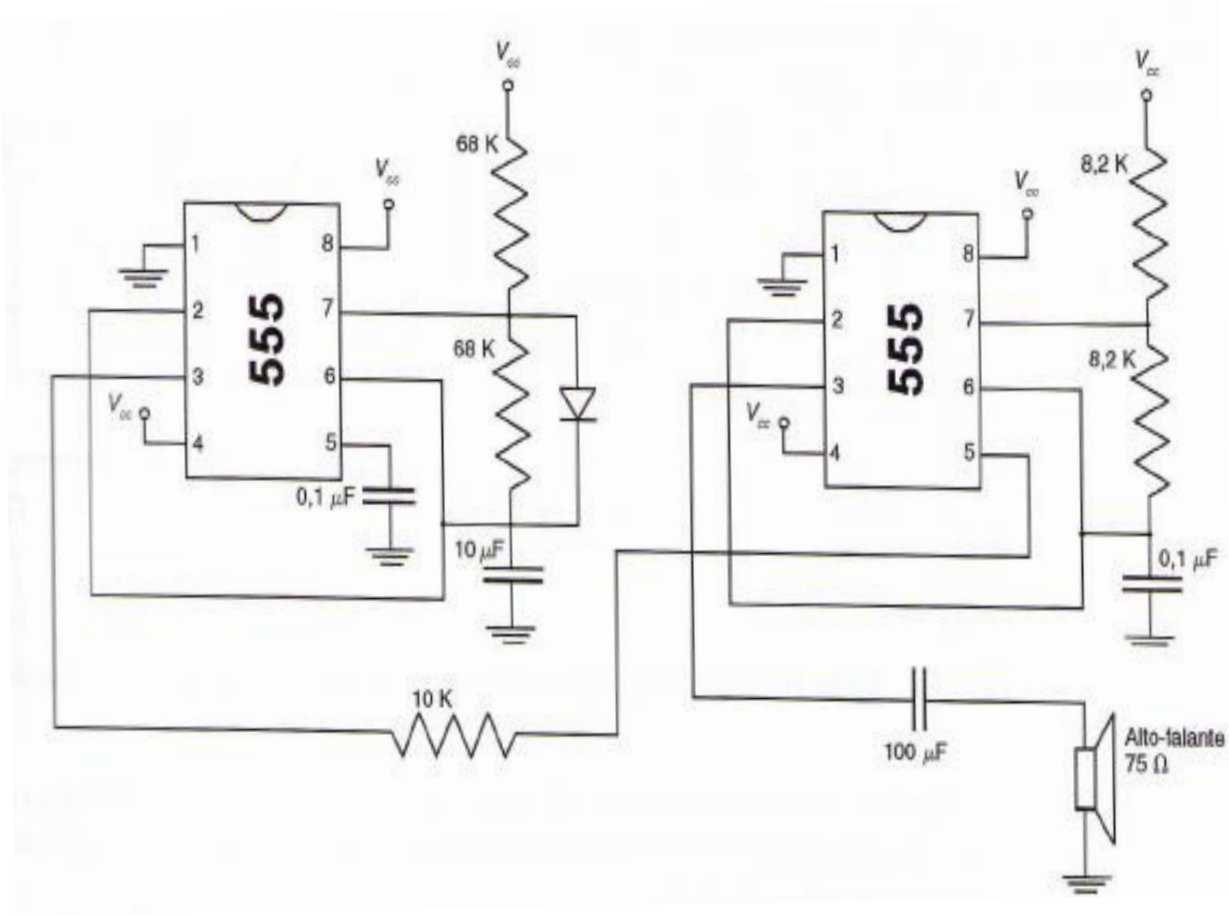
Exemplos de Aplicações com 555

Gerador de áudio intermitente



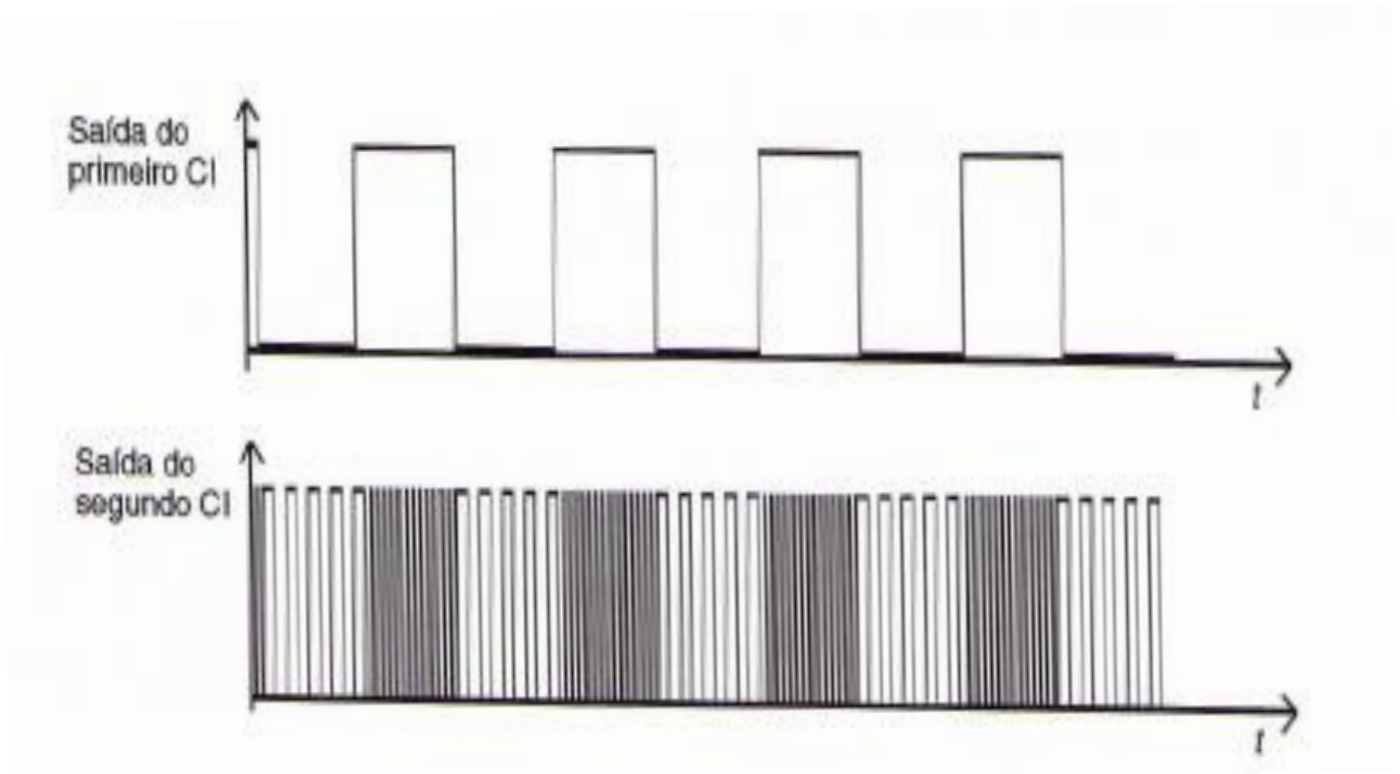
Exemplos de Aplicações com 555

Gerador de áudio de dois tons



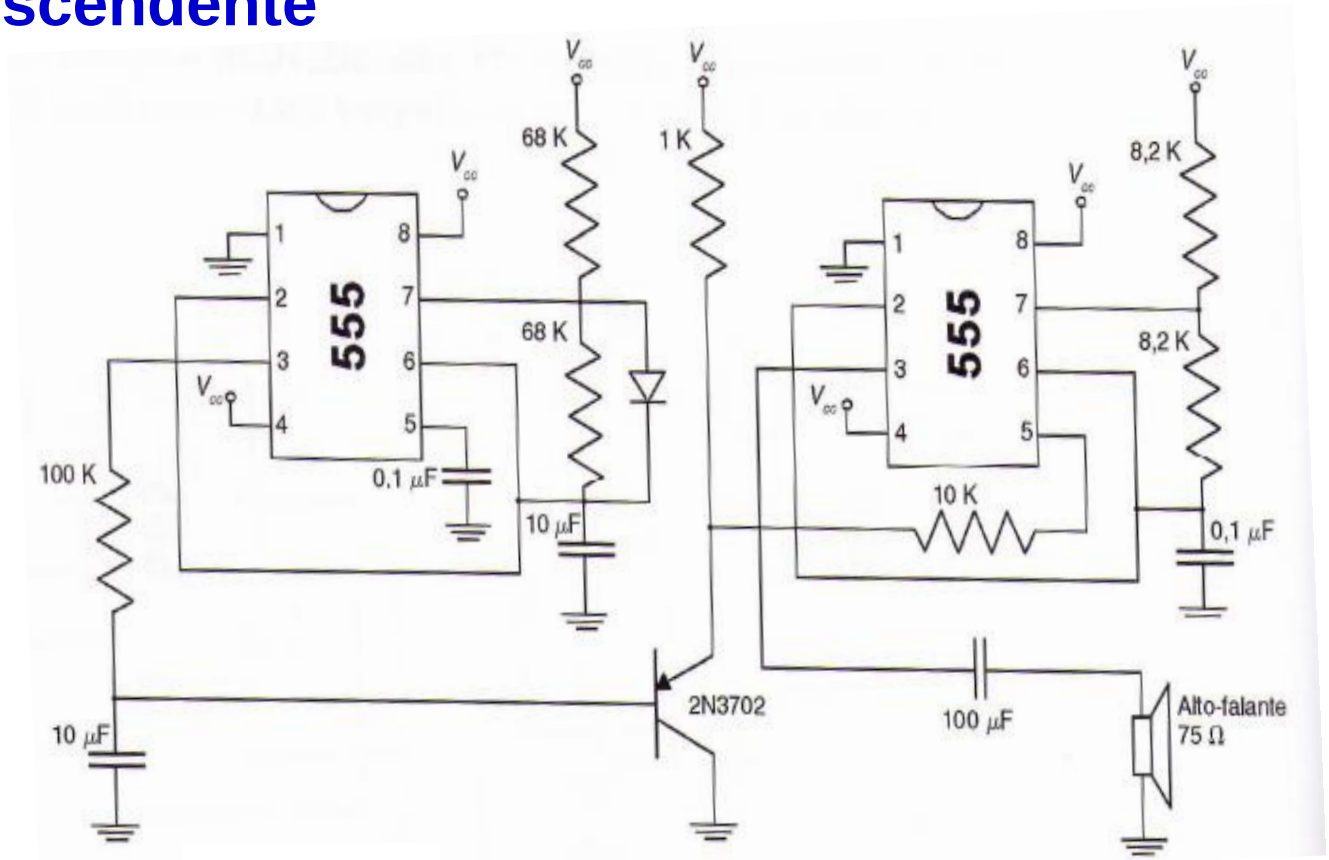
Exemplos de Aplicações com 555

Gerador de áudio de dois tons



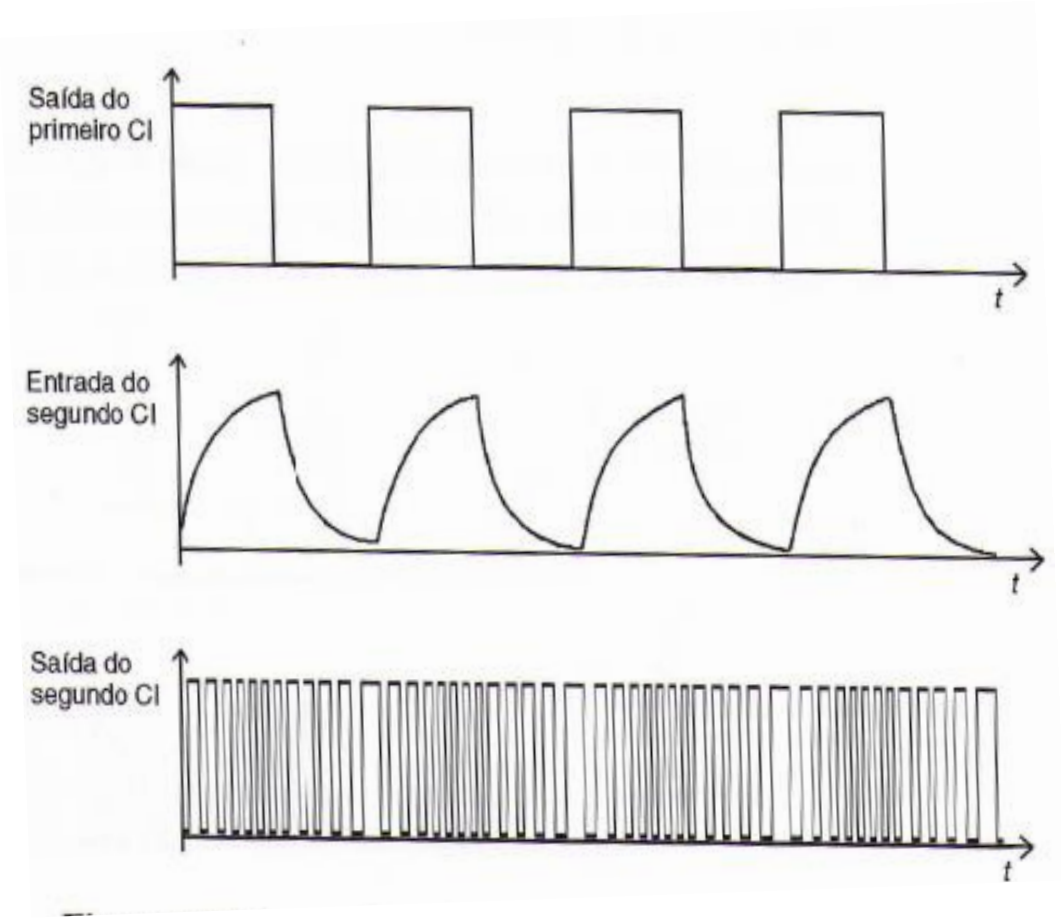
Exemplos de Aplicações com 555

Gerador de áudio de frequência ascendente e descendente



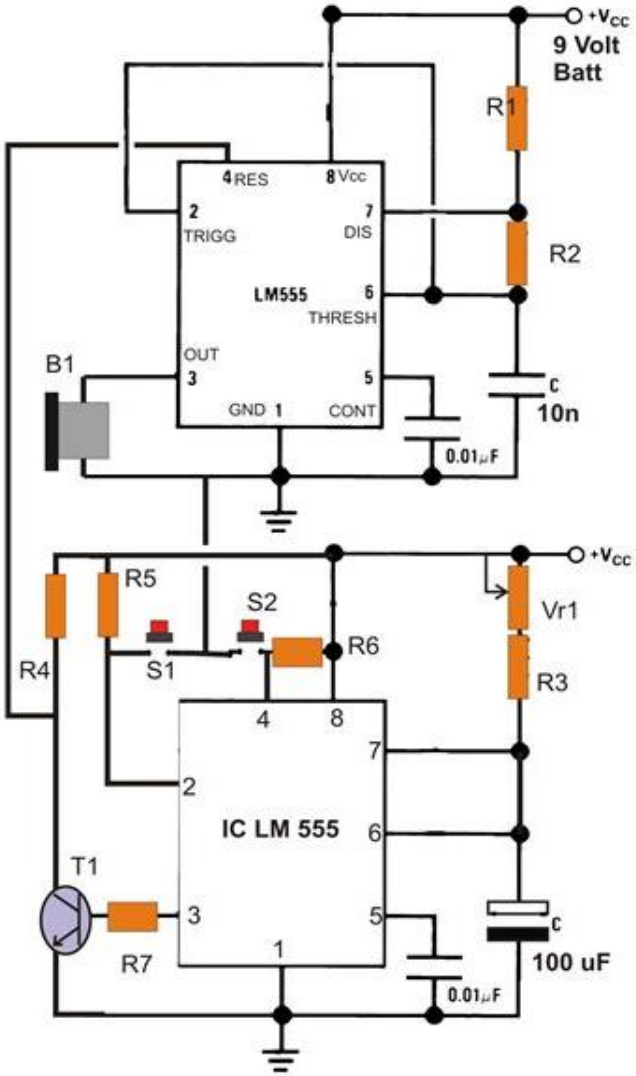
Exemplos de Aplicações com 555

Gerador de áudio de freqüência ascendente e descendente



Exemplos de Aplicações com 555

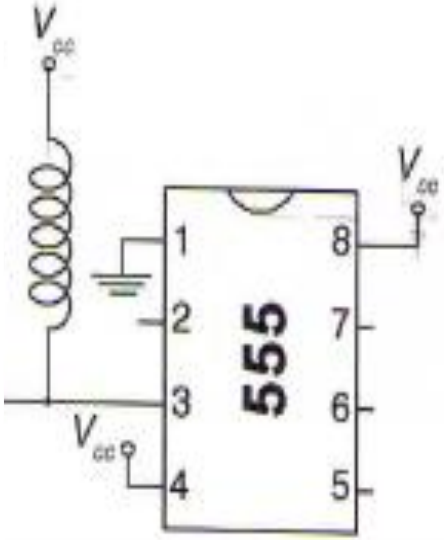
Temporizador com *Buzzer*

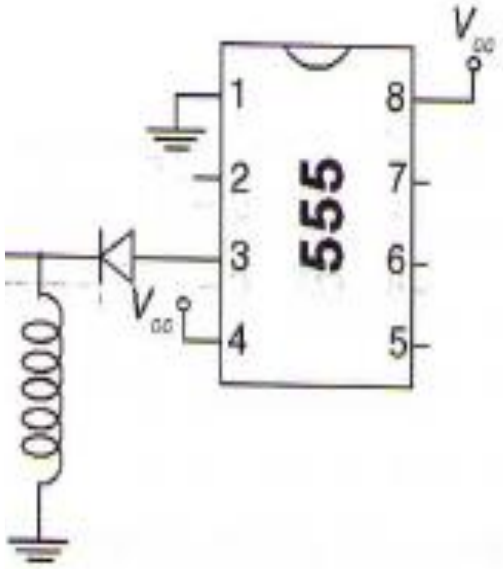


https://www.brighthubengineering.com/diy-electronics-devices/121945-simple-astable-and-monostable-multivibrator-circuits-using-ic-555-explained/

Acionamento de Cargas Indutivas

Corrente máxima suportada pelo transistor de saída = 0.2 A





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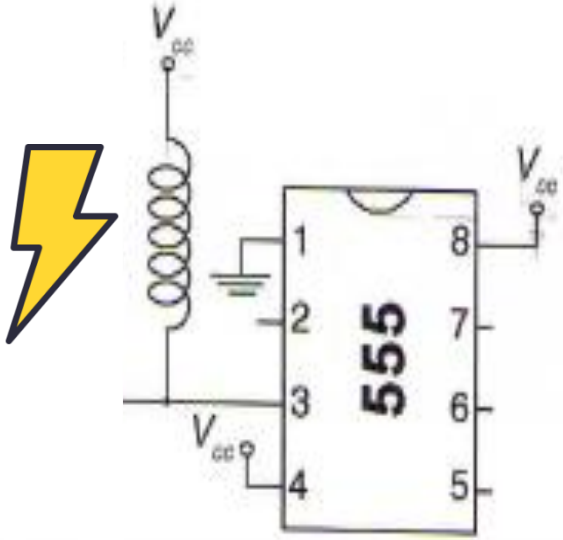

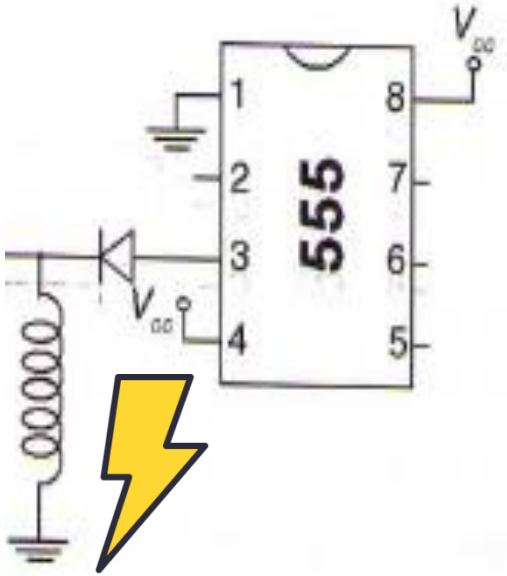

Acionamento de Cargas Indutivas

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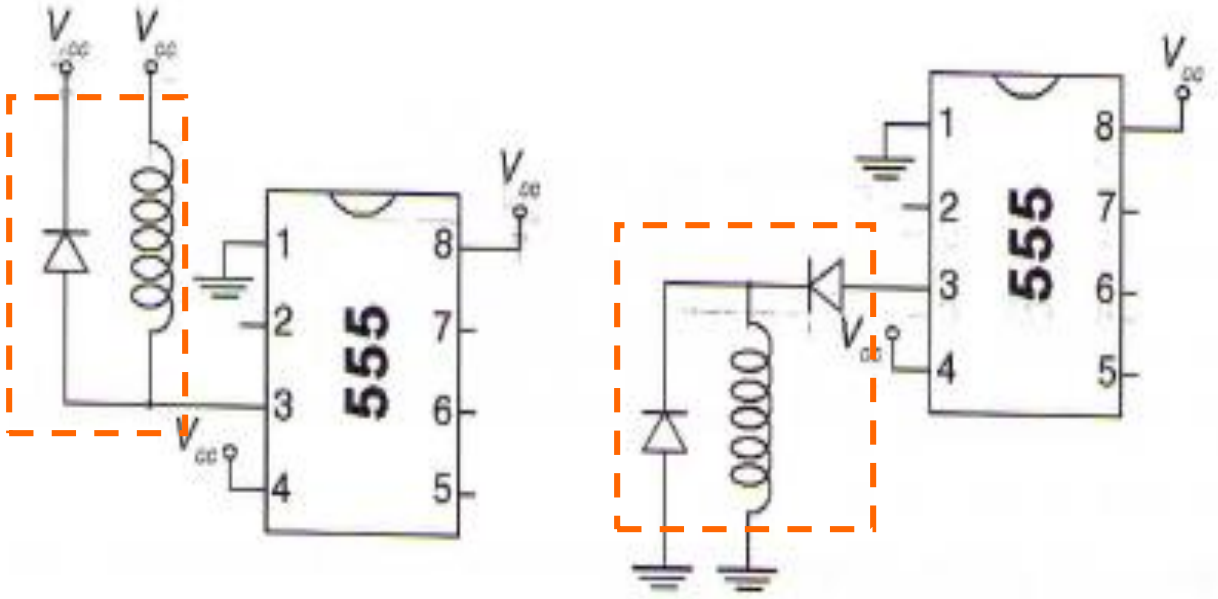
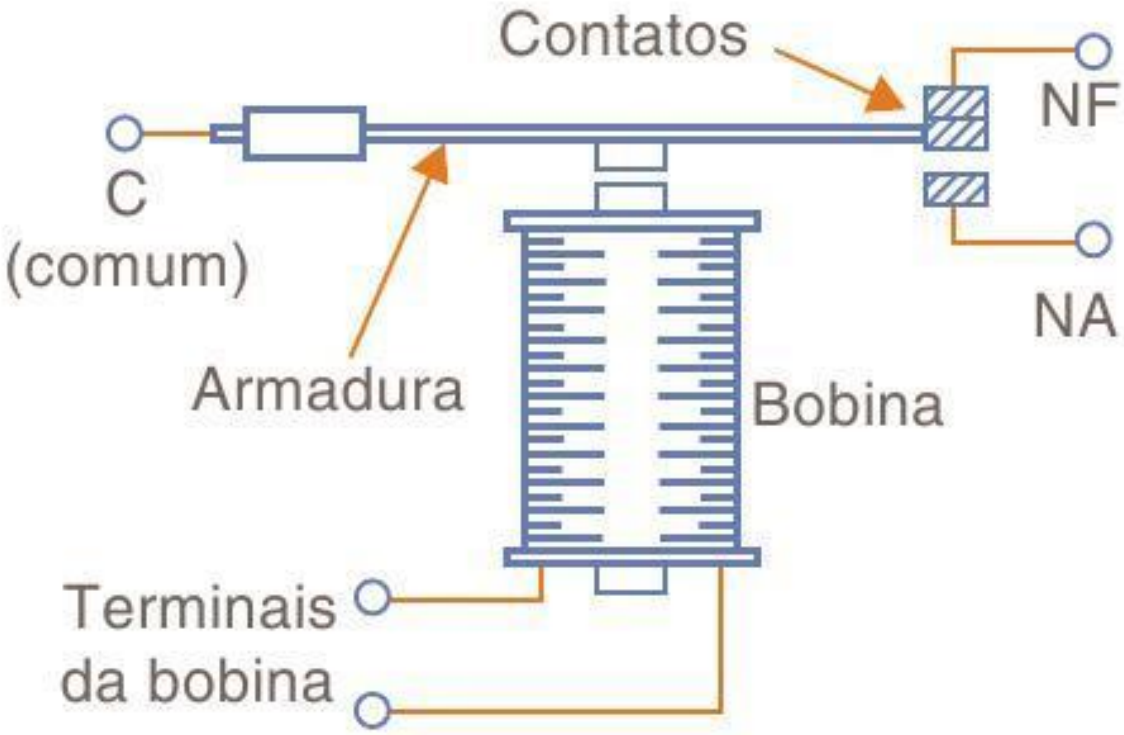


Proteção

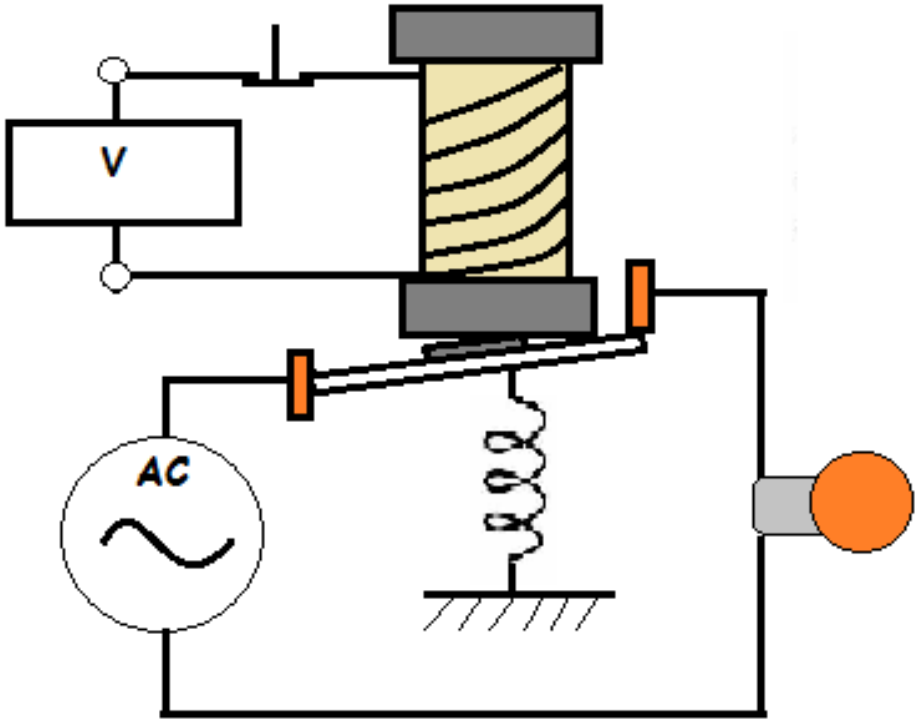
Exemplo de Cargas Indutivas

Relé

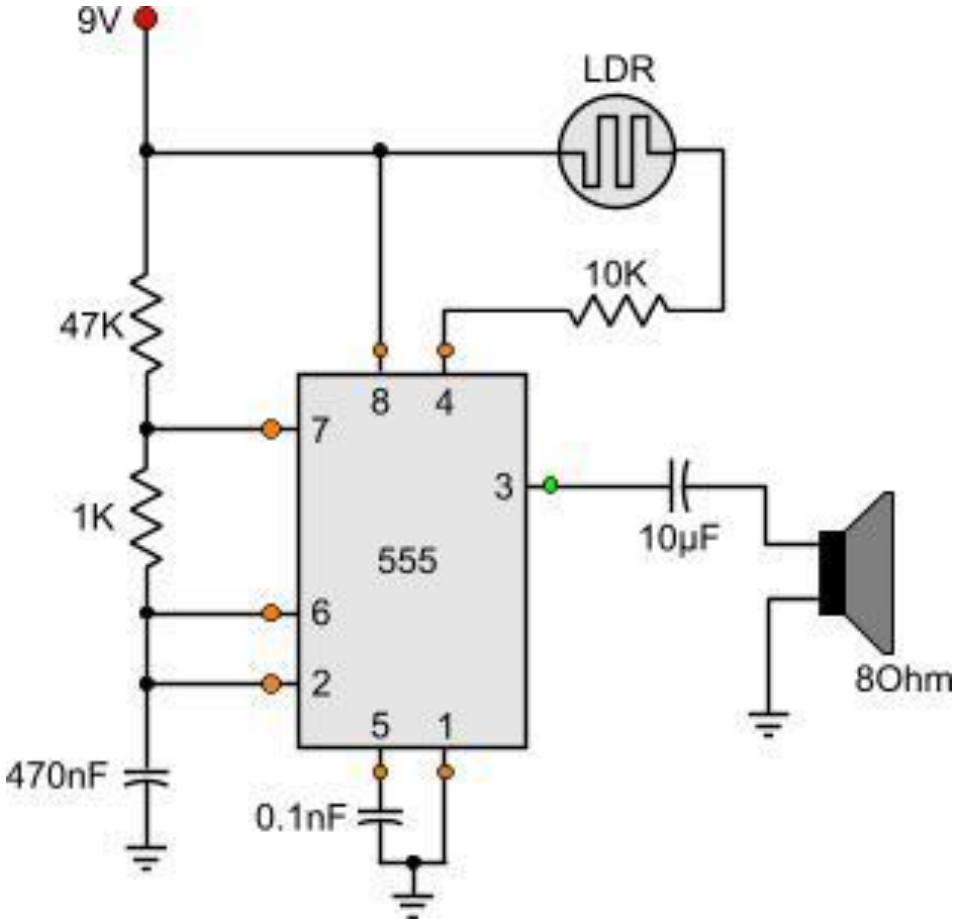


Exemplo de Cargas Indutivas

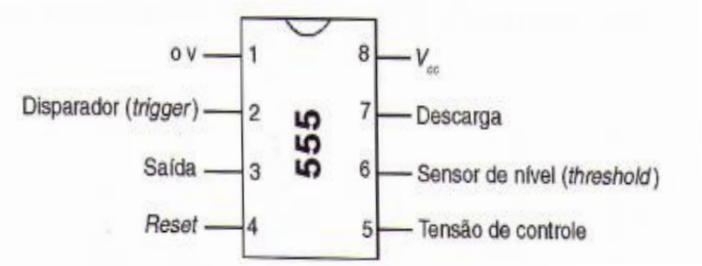
Funcionamento



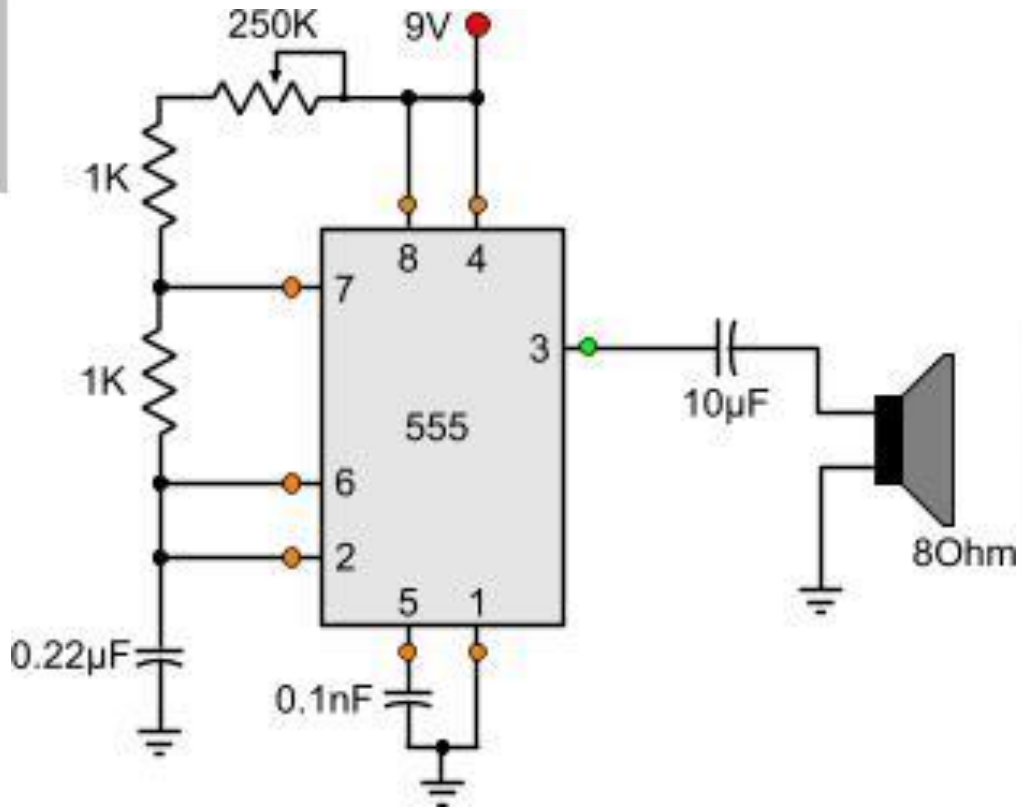
Exercício



1 - Qual o comportamento do circuito?



Exercício



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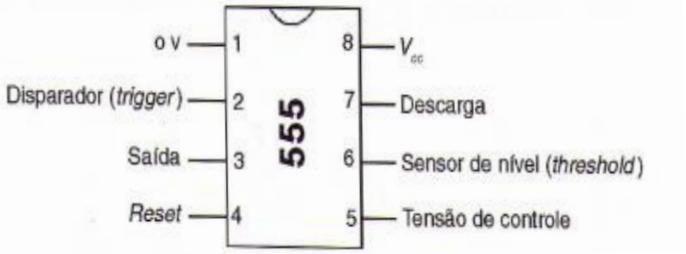
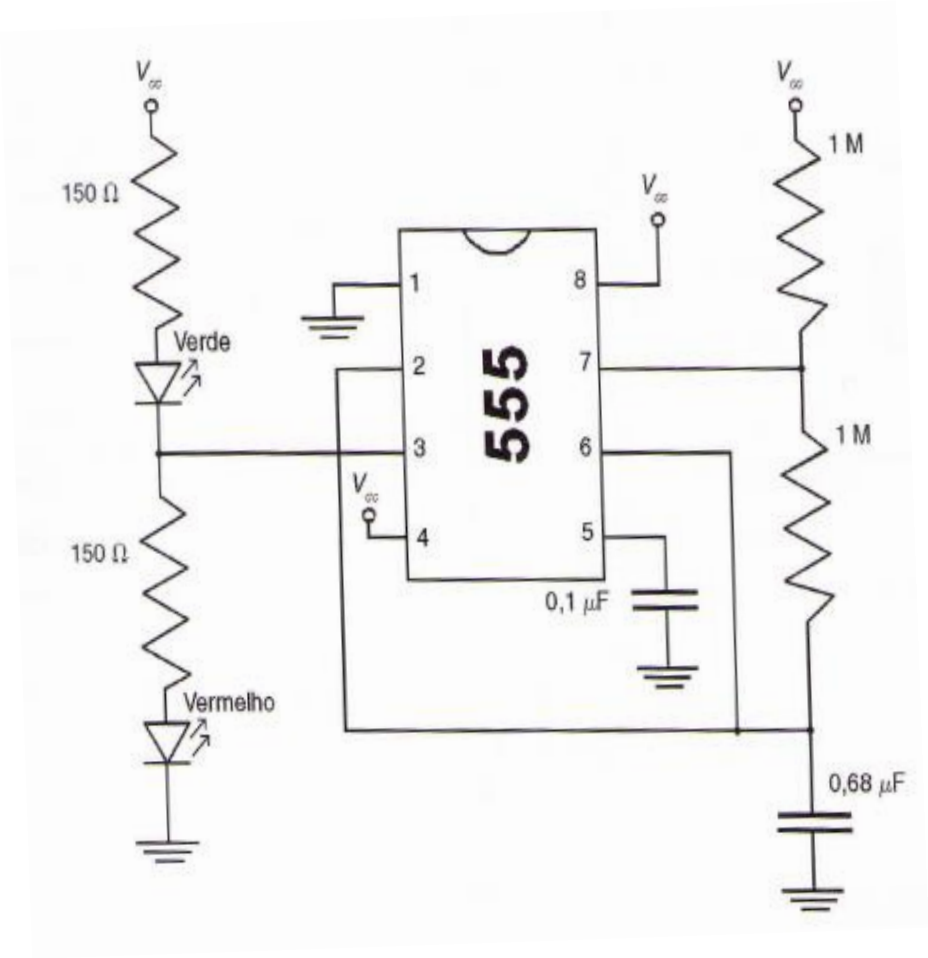
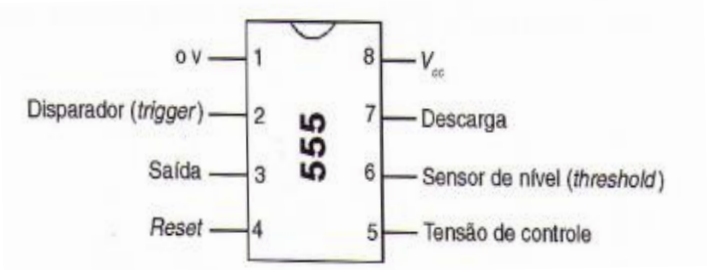


Exercício



2 – Calcule o tempo em cada um dos LEDs fica aceso. Faça um esboço do comportamento de cada LED em função do tempo.



Informações

http://pcbheaven.com/wikipages/555_Theory/

http://www.electronics-tutorials.ws/waveforms/555_timer.html