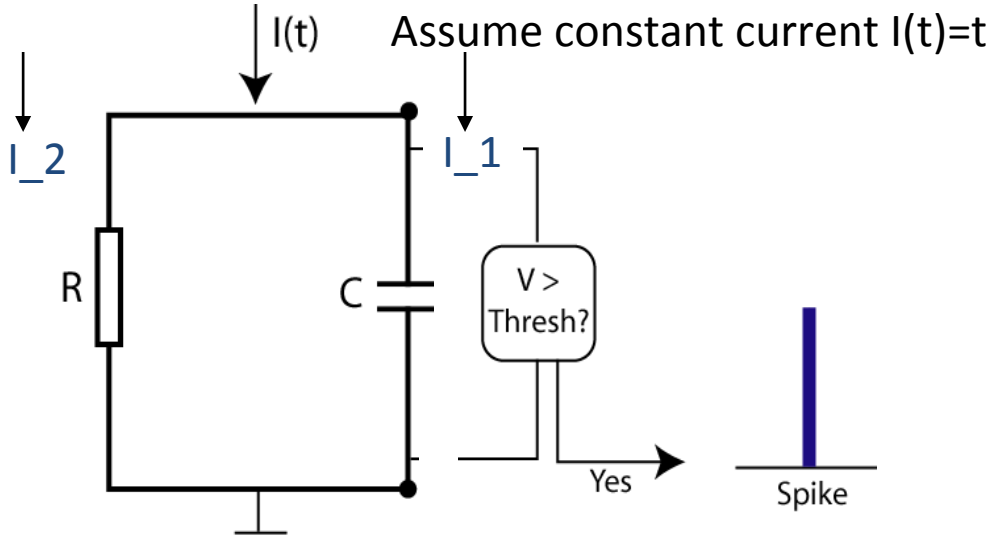
RC Circuit

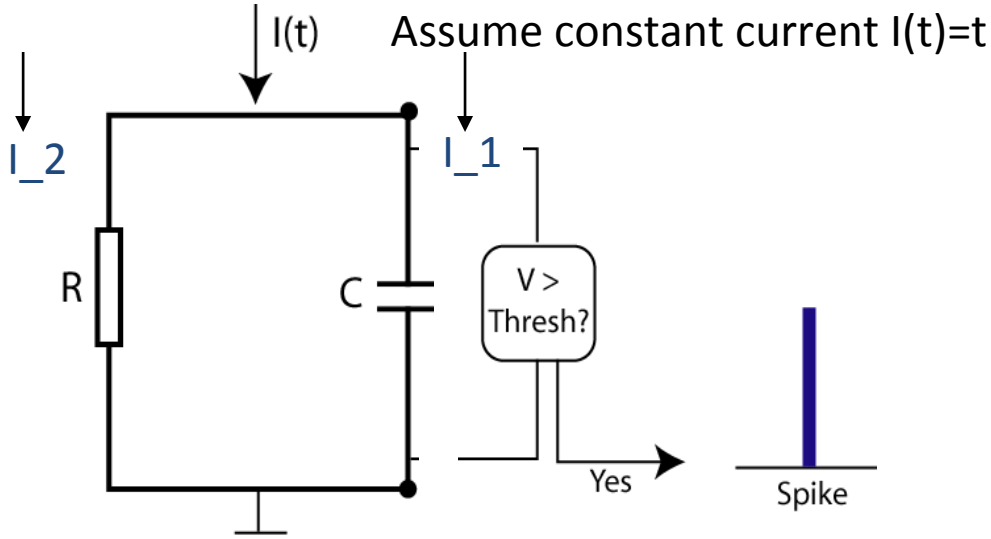


(1) C V = Q (C capacitance; V voltage; Q charge)

(2) I_1 = dQ/dt (I_1 current)

(3) C dv/dt = I_1 (taking derivative in (1) and plugging in (2))

RC Circuit



(4) V = I_2 R (Ohms law)

(5) I_2 = V/R (I current)

(6) I_1 + I_2 = 0 (Kirchkoff's law)

(7) -V/R = C dV/dt (plugging (3) and (6))

(8) Define $\tau = RC$ (time constant!)

Time constant

Assume constant current I(t)=t

$$\tau = RC$$

(1) Q=CV

(2) dQ/dt=I (Separable!)
Q=It + const

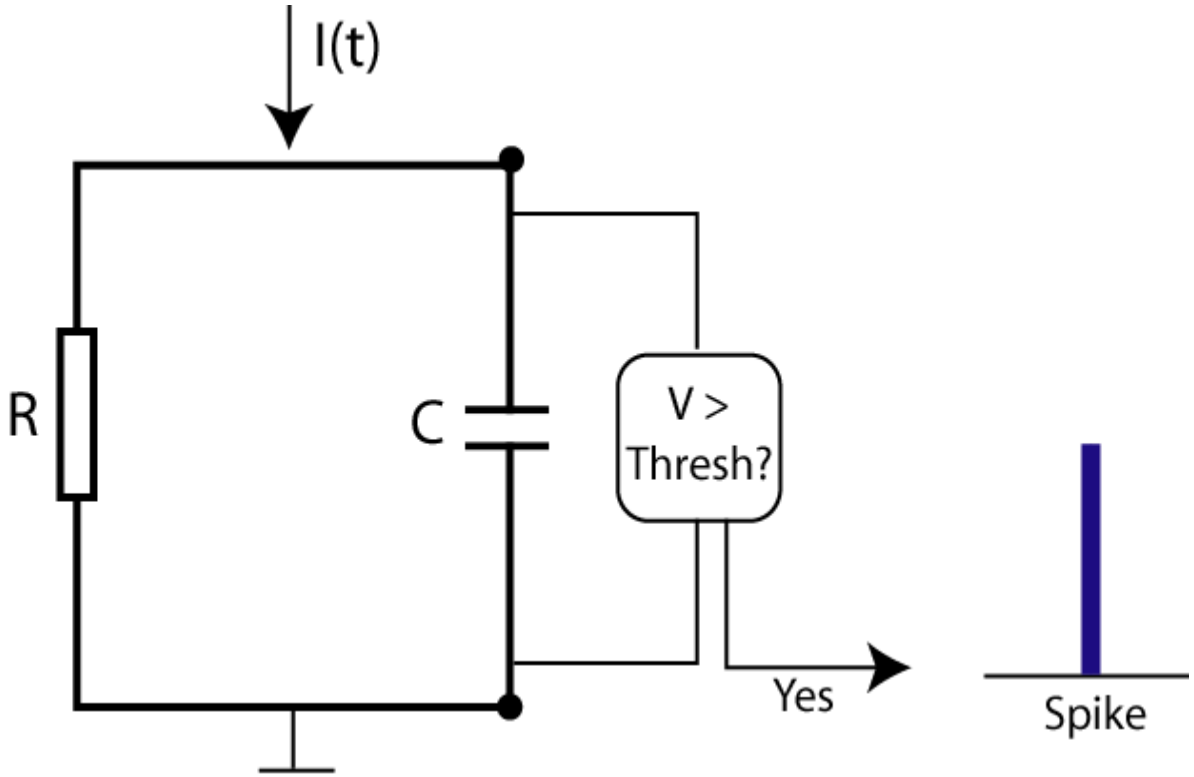
(3) C=Q/V = It/V

(4) R=V/I

(5) RC = (V/I)(It/V) = t (time units!)

[V volt; C Farad; R Ohm; I amper; Q Coulomb]

Leaky Integrate and Fire Circuit



Leak

Current

$$C\frac{dv}{dt} = \frac{-v}{R} + I(t)$$