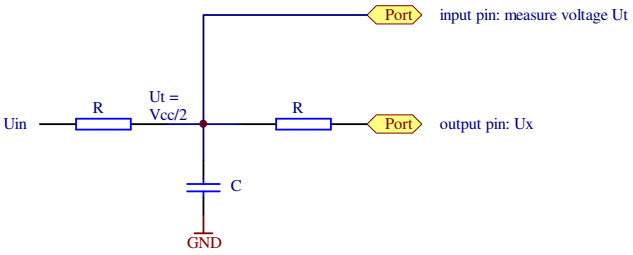
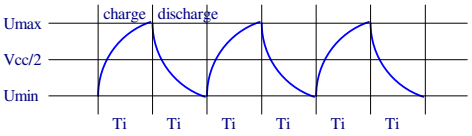


Ut charge/discharge when Uin is constant and C charged



Ts = (2^N)*Ti N is resolution Ti is interrupt cycle time Ts = conversion time

charge (Ux = Vcc)

Ut(0) = Umin

Ut(Ti) = Umin*e^-K + (Uin/2 + Vcc/2)*(1 - e^-K) = Umax (I)

discharge (Ux = 0)

Ut(0) = Umax

Ut(Ti) = Umax*e^-K + (Uin/2)*(1 - e^-K) = Umin (II)

K = Ti / (C*R/2)

solving Umax (substitute II in I)

Umax = Umin*e^-K + (Uin/2 + Vcc/2)*(1 - e^-K)

= Umax*(e^-K)*(e^-K) + (Uin/2)*(1 - e^-K)*(e^-K) + (Uin/2 + Vcc/2)*(1 - e^-K)

Umax*(1 - e^-2K) = ((Uin/2)*e^-K + Uin/2 + Vcc/2)*(1 - e^-K)

Umax = ((Uin/2)*e^-K + Uin/2 + Vcc/2)*(1 - e^-K) / (1 - e^-2K)

(1 - e^-K) / (1 - e^-2K) = (1 - e^-K) / (1 - (e^-K)*(e^-K)) = (1 - e^-K) / ((1 - e^-K)*(1 + e^-K)) = 1 / (1 + e^-K)

Umax = ((Uin/2)*e^-K + Uin/2 + Vcc/2) / (1 + e^-K)

solving Umin (substitute I in II)

Umin = Umax*e^-K + (Uin/2)*(1 - e^-K)

= Umin*(e^-K)*(e^-K) + (Uin/2 + Vcc/2)*(1 - e^-K)*(e^-K) + (Uin/2)*(1 - e^-K)

Umin*(1 - e^-2K) = ((Uin/2)*e^-K + Uin/2 + (Vcc/2)*e^-K)*(1 - e^-K)

Umin = ((Uin/2)*e^-K + Uin/2 + (Vcc/2)*e^-K)*(1 - e^-K) / (1 - e^-2K)

Umin = ((Uin/2)*e^-K + Uin/2 + (Vcc/2)*e^-K) / (1 + e^-K)

calculating Uripple = Umax - Umin

Uripple = (Vcc/2)*(1 -e^-K) / (1 + e^-K)

e^-K = (Vcc/2 - Uripple) / (Vcc/2 + Uripple)

K = ln((Vcc/2 + Uripple) / (Vcc/2 - Uripple)) = Ti / (C*R/2)

solving for CR

C*R = 2*Ti / ln((Vcc/2 + Uripple) / (Vcc/2 - Uripple))