Soru 1:

Gerçek:

$$R(T) = R_0.(1 + \alpha.T + \beta.T^2)$$

İdeal:

$$R(T) = R_0.(1 + \alpha.T)$$

Maksimum hata T = 100°C de oluşur. T = 100°C de

Gerçek: R(T) =138.42 Ohm

İdeal: R(T) =139 Ohm

Mutlak hata:Δ R = -0.58 Ohm

İdeal bağıntıda derece başı değişim: (39 Ohm/100°C) = 0.39 Ohm/°C

Buna göre

X - 0.58 Ohm

1°C – 0.39 Ohm

Hata H= 1.48°C olur. Yahut H(%) = %0.417

Soru 2:

a- $$\eta = \frac{V_O}{V_D + V_O} . \frac{V_{IN} + V_D - V_{sat}}{V_{IN}}$$

$$\eta = \frac{15}{0.8 + 15} . \frac{24 + 0.8 - 1}{24} = \%94.1$$

b- $$\Delta I_L = \frac{1}{L}(V_{IN} - V_{sat} - V_O)\, t_{ON} = \frac{1}{L}(V_O + V_D).t_{OFF}$$

$$I_{O\min} = \frac{1}{2}\Delta I_L = \frac{1}{2.f.L}(V_O + V_D).\left(1 - \frac{(V_O + V_D)}{(V_{IN} - V_{sat})}\right)$$

$$L = \frac{1}{2.f.I_{O\min}}(V_O + V_D).\left(1 - \frac{(V_O + V_D)}{(V_{IN} - V_{sat})}\right)$$

$$L = \frac{1}{2\ .x\ 100kHz\ x\ 0.1A}\ x\ (15V + 0.8V)\ x\ \left(1 - \frac{(15V + 0.8V)}{(24V - 1V)}\right) = 247\mu H$$

$$C = \frac{I_{Omin}}{4.f.\Delta V_O} = \frac{0.1A}{4\ x\ 100kHz\ x\ 25mV} = 10\mu F$$

c- $$\frac{t_{ON}}{t_{OFF}} = \frac{(V_O + V_D)}{(V_{IN} - V_{sat} - V_O)} = 1.975$$

t_{OFF} = 3.36µsn t_{ON}= 6.639µsn

Soru 3:

Ortalama değer doğrultucusu olarak kullanılmada ortaya çıkacak bağıl hata

$$h_1 = \frac{\pi}{2}\frac{R_1}{R_2}\frac{V_\gamma}{\beta.K_{V0}.V_{IP}} = \frac{\pi}{2}\frac{0.6V}{0.5x19953x10} = 9.5x10^{-6}$$

Burada R_1=R_2, β=0.5

Doğrultucunun eşik gerilimi:

$$V_\gamma' = \frac{V_\gamma}{\beta.K_{V0}} = \frac{0.6V}{0.5x19953} = 60.14\mu V$$

$$\omega_H = \frac{\pi.YE}{2.V_\gamma.\left(2 - \frac{R_2}{R_1}\frac{V_{IP}}{V_\gamma}\right)} = \frac{\pi\ x\ 5\ 10^6}{2\ x\ 0.6\ x\left(2 - 1\ x\ \frac{(-10)}{0.6}\right)} = 701.2\ x\ 10^3 rad/sn$$

$$f_H = 111.6kHz$$

Bu frekansta frekansa bağlı bağıl hata

$$h_2 = -\frac{\pi}{2}\left(1 - \frac{r_1}{R_2}\frac{V_\gamma}{V_{IP}}\right)^2\left(\frac{\omega}{\beta\ K_{VO}\omega_O}\right)^2 = -0.088$$

Soru 4:

$$V_{O1} = R_L.(1+1).\frac{V_{ref}}{R_3} \quad \Rightarrow \quad R_L = A.E^{-\alpha}$$

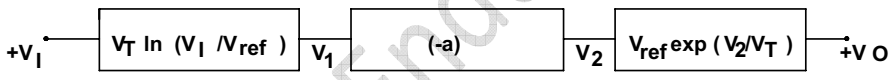
$$V_{O1} = 2.A.E^{-\alpha}.\frac{V_{ref}}{R_3} \Rightarrow \quad \frac{V_{O1}.R_3}{2.A.V_{ref}} = E^{-\alpha} \Rightarrow \quad E = \left(\frac{V_{O1}.R_3}{2.A.V_{ref}}\right)^{\frac{-1}{\alpha}}$$

Üs alma devresi gerekli

$$y = x^a$$

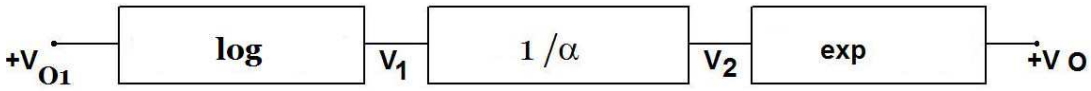
x > 0 için logaritmik kuvvetlendirici ve ters logaritmik kuvvetlendirici yardımıyla bu işlem kolayca yerine getirilebilir.

$$V_O = V_{ref}.\exp\left(\frac{a.V_T.\ln\frac{V_I}{V_{ref}}}{V_T}\right) = V_{ref}.\left(\frac{V_I}{V_{ref}}\right)^a \qquad (3.17)$$

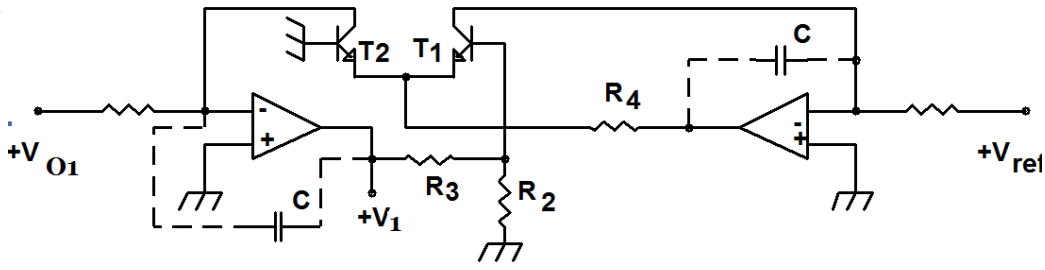


Üs alma devresi

Burada $a = \frac{-1}{\alpha}$

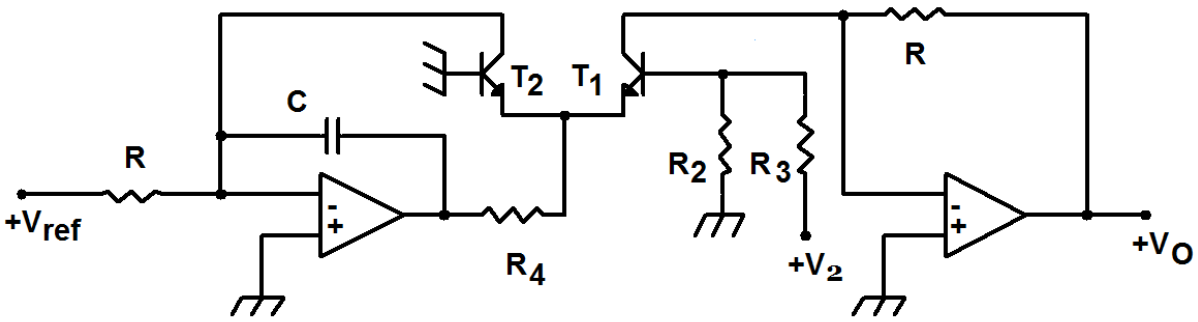


Kullanılabilecek devre blokları:



Sıcaklık kompanzasyonlu logaritmik kuvvetlendirici yapısı.

$$V_1 = -V_T \cdot \frac{R_2 + R_3}{R_2} \cdot \ln\left(\frac{V_I}{V_{ref}}\right)$$



$$V_O = V_{ref} \cdot \exp\left(\frac{R_2}{R_2 + R_3}\frac{V_2}{V_T}\right)$$

Ara blok pozitif kazançlı bir kuvvetlendirici veya zayıflatıcı (α değerine bağlı.)