CHAPTER 4

DESIGN PROCEDURE

4.1 Self-Oscillating Converter

4.1.1 The given values : P_{out}, V_{in}, V_{out}

4.1.2 Calculate collector current and output current

$$P_{in} = \frac{P_{out}}{\eta}$$

$$I_C = \frac{P_{in}}{V_{in}}$$

$$I_{out} = \frac{P_{out}}{V_{out}}$$

4.1.3 Select a transistor (see section 3.1)

Calculate base current

$$I_B = \frac{2I_C}{h_{FE(min)}}$$

4.1.4 Select a transformer core (see section 3.2.1)

Calculate current density

$$J = \left[\frac{2P_{out}n}{\rho l_w W K_w}\right]^{1/2}$$

where $n = 0.005$ to 0.010

$\rho = 1.69$ to 1.77 microohm-cm

$K_w = 0.5$ for pot core

$= 0.4$ for EE core

Calculate frequency

$$f = \frac{P_{out}\ 10^8}{2K_w B_{max} JA_{core} W}$$

where $B_{max} = B_{sat}$ of core material

4.1.5 Find V_{FB} from the Feedback Voltage Table

Calculate number of turns

$$N_1 = \frac{V_{in}\ 10^8}{4fB_{max}A_{core}}$$

$$N_2 = \frac{K_1 N_1 V_{out}}{V_{in}}$$

$$N_{FB} = \frac{K_1 N_1 V_{FB}}{V_{in}}$$

use $K_1 = 1.05$

4.1.6 Calculate wire size

wire size of $N_1 = \frac{1}{J}\frac{I_C}{2}$

" " " $N_2 = \frac{1}{J} I_{out}$

" " " $N_{FB} = \frac{1}{J}\frac{I_B}{2}$

4.1.7 Calculate bias resistances

$$R_1 = \frac{V_{FB} - V_{BE(sat)}}{I_B}$$

$$R_2 = R_1\left(\frac{V_{in}}{V_B} - 1\right)$$

where $V_B = V_{BE(sat)}$ = 0.7 V for silicon transistor

= 0.3 V for germanium transistor

4.2 Driven Converter

4.2.1 The given values : P_{out}, V_{in}, V_{out}

4.2.2 Calculate collector current and output current

$$P_{in} = \frac{P_{out}}{\eta}$$

$$I_C = \frac{P_{in}}{V_{in}}$$

$$I_{out} = \frac{P_{out}}{V_{out}}$$

4.2.3 Select a transistor (see section 3.1)

Calculate base current

$$I_B = \frac{2I_C}{h_{FE(min)}}$$

4.2.4 Select a transformer core (see section 3.2.1)

Calculate current density

$$J = \left[\frac{2P_{out}\, n}{\rho l_w W K_w}\right]^{1/2}$$

where n= 0.005 to 0.010

ρ= 1.69 to 1.77 microohm-cm

K_w= 0.5 for pot core

= 0.4 for EE core

Calculate frequency

$$f = \frac{P_{out} 10^8}{2K_w B_{max} JA_{core} W}$$

use $B_{max} = 0.8B_{sat}$

4.2.5 Design a driver whose current output is equal to I_B and frequency is as calculated

4.2.6 Calculate number of turns

$$N_1 = \frac{V_{in} 10^8}{4fB_{max} A_{core}}$$

$$N_2 = \frac{K_1 N_1 V_{out}}{V_{in}}$$

use $K_1 = 1.05$

4.2.7 Calculate wire size

wire size of $N_1 = \frac{1}{J} \frac{I_C}{2}$

" " $N_2 = \frac{1}{J} I_{out}$