

connects *before* the secondary LC filter. This is done to avoid offering gain at high frequency when the LC network starts to resonate. This configuration is typical of flyback converters featuring high-frequency noise reduction via an LC filter. Make sure the resonant frequency of this filter is placed at least 10 times above the selected crossover frequency to avoid any interaction.

As it is placed, C_{zero} capacitor looks as if it introduces an origin pole. However, if we derive the transfer function of this complete feedback chain, we get the following results:

$$V_{FB}(s) = \left(V_{out}(s) \frac{1}{sR_{upper}C_{zero}} + V_{out}(s) \right) \frac{R_{pullup}}{R_{LED}} CTR \quad (3-56)$$

Rearranging the equation gives

$$\frac{V_{FB}(s)}{V_{out}(s)} = - \left(\frac{1}{sR_{upper}C_{zero}} + 1 \right) \frac{R_{pullup}}{R_{LED}} CTR = - \left(\frac{sR_{upper}C_{zero} + 1}{sR_{upper}C_{zero}} \right) \frac{R_{pullup}}{R_{LED}} CTR \quad (3-57)$$

Equation (3-57) reveals the presence of an origin pole, f_{po} (as suspected . . .) plus a zero, f_z , introduced by the fast lane configuration. Unfortunately, if we want a type 2 amplifier, which is the most common type, we need a pole f_p somewhere. How can we obtain it? Simply by placing a capacitor from the output node to ground (Fig. 3-38a and b). If we update Eq. (3-57) with the presence of this pole, we obtain the final equation ruling the TL431 network as presented by Fig. 3-35b:

$$G(s) = \frac{V_{FB}(s)}{V_{out}(s)} = - \left(\frac{sR_{upper}C_{zero} + 1}{sR_{upper}C_{zero}} \right) \left(\frac{1}{1 + sR_{pullup}C_{pole}} \right) \frac{R_{pullup}}{R_{LED}} CTR \quad (3-58)$$

As usual, we can evaluate poles and the zero positions through the following definitions:

$$f_{po} = \frac{1}{2\pi R_{upper}C_{zero}} \quad (3-59)$$

$$f_z = \frac{1}{2\pi R_{upper}C_{zero}} \quad (3-60a)$$

$$f_p = \frac{1}{2\pi R_{pullup}C_{pole}} \quad (3-60b)$$

$$G = \frac{R_{pullup}}{R_{LED}} CTR \quad (3-61)$$

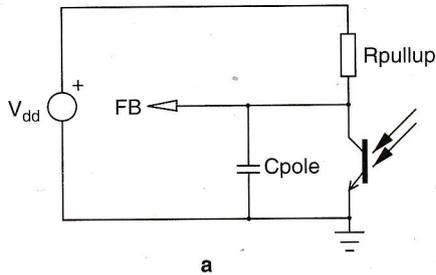


FIGURE 3-38a A simple capacitor placed between the feedback pin and ground introduces a pole.

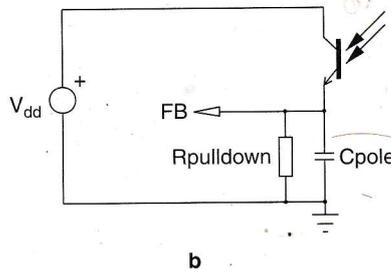


FIGURE 3-38b The same applies to a common collector configuration.

As shown by Eqs. (3-5) implies a slope change arrangement naturally b quency is simply govern

The next step is to find

3.7.1 A Type 2 Am

The goal is to apply the forward way to stabilize are free to assign the p back at Fig. 3-19b, w

The pull-up resistor d it is externally placed in order to reach a h troller, this resistor is for the sake of the ex lowing parameters:

- Crossover frequency
- Needed phase margi
- Gain attenuation rea
- Phase observed at c
- The k factor comput
- $G = 10^{-\frac{-Gf_c}{20}} = 10$