

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:

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

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

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

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

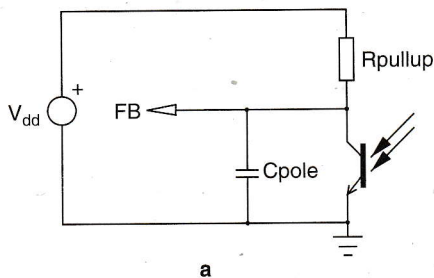


FIGURE 3-38a A simple capacitor placed between the feedback pin and ground introduces a pole.

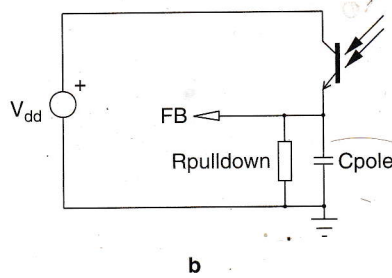


FIGURE 3-38b The same applies to a common collector configuration.

As shown by Eqs. (3-58) 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, we

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

$$G = 10^{-\frac{-Gf_c}{20}} = 10$$