

$$\omega_{z1} = \frac{1}{r_{cf}C}$$

$$\omega_{z2} = \frac{D'^2 R}{DL} \quad (\text{RHPZ})$$

$$\omega_{p1} = \frac{V_{in} - 2V_{out}}{V_{in} - V_{out}} \frac{1}{RC}$$

Reference 2, 3, 4, and 5 equations:

$$\frac{V_{out}(s)}{V_{err}(s)} = \frac{\left(1 + \frac{s}{\omega_{z1}}\right) \left(1 - \frac{s}{\omega_{z2}}\right) \left(1 + \frac{s}{\omega_{z3}}\right)}{\left(1 + \frac{s}{\omega_{p1}}\right)} A_c F_h(s) \quad (2A-24)$$

$$\frac{V_{out}(s)}{V_{in}(s)} = \frac{\left(1 + \frac{s}{\omega_{z1}}\right)}{\left(1 + \frac{s}{\omega_{p1}}\right)} A_l F_a(s) F_h(s) \quad (2A-25)$$

$$\omega_{z1} = \frac{1}{r_{cf}C}$$

$$\omega_{z2} = \frac{D'^2 R}{DL} \quad (\text{RHPZ})$$

$$\omega_{z3} = \frac{1}{RC_s D'} > \frac{F_{sw}}{2} \quad C_s \text{ is the resonant capacitor calculated on CCM CC-PWM switch model}$$

$$\omega_{p1} = \frac{D' \frac{K_c}{K} \left(1 + 2 \frac{S_e}{S_n}\right) + 1 + D}{RC} \quad \text{for deep CCM:} \quad \omega_{p1} \approx \frac{1 + D}{RC}$$

$$F_h(s) = \frac{1}{1 + \frac{s}{\omega_n Q_p} + \frac{s^2}{\omega_n^2}}$$

$$F_a(s) = \left(1 + \frac{s}{\omega_a Q_a} + \frac{s^2}{\omega_a^2}\right)$$

$$A_l = M \frac{\frac{K_c}{K} \left(M - 2 \frac{S_e}{S_n}\right) - M}{\frac{K_c}{K} \left(1 + 2 \frac{S_e}{S_n}\right) + 2M + 1}$$

$$A_c = -\frac{R}{R_i} \frac{1}{\frac{K_c}{K} \left(1 + 2 \frac{S_e}{S_n}\right) + 2M + 1}$$

$$\omega_n = \frac{\pi}{T_{sw}}$$