

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

$$\omega_{p1} = \frac{1}{RC} + \frac{T_{sw}}{LC} [m_c D' - 0.5]$$

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

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

$$Q_p = \frac{1}{\pi(m_c D' - 0.5)}$$

$$m_c = 1 + \frac{S_e}{S_n}$$

Current-mode, DCM:

Reference 2 equations:

$$\frac{V_{out}(s)}{V_{err}(s)} = F_m H_c \frac{1 + \frac{s}{\omega_{z1}}}{\left(1 + \frac{s}{\omega_{p1}}\right) \left(1 + \frac{s}{\omega_{p2}}\right)} \quad (2A-9)$$

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

$$\omega_{p1}' = \frac{1}{RC} \frac{2m_c - (2 + m_c)M}{m_c(1 - M)}$$

$$\omega_{p2}' = 2F_{sw} \left(\frac{M}{D}\right)^2$$

$$H_c = \frac{2M_c V_{out}}{D} \frac{1 - M}{2m_c - (2 + m_c)M}$$

$$F_m = \frac{1}{S_n m_c T_{sw}}$$

$$M = \frac{2}{1 + \sqrt{1 + \frac{8\tau_L}{D^2}}} \quad \text{with } \tau_L = \frac{L}{RT_{sw}}$$

For a forward topology in voltage mode, all transfer functions and component definitions remain the same, except V_{in} which becomes NV_{in} , with $N = \frac{N_s}{N_p}$. In current mode, adopting the scaling in V_{in} , the sense resistor R_i must also account for the transformer presence and must be changed to $R_i' = R_i N$. Also, some half-bridge topologies require the input voltage to be divided by 2 given the transformer connection (e.g., via a capacitive bridge).

2A.2 Boost

Voltage-mode, CCM

Reference 1 equations:

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

$$\omega_{z2} = \frac{D'^2}{L} (R - r_{Cf} || R)$$

$$K_d = \frac{V_{in}}{V_{peak} D'^2} = \frac{V_{out}}{V_{in} V_{peak}}$$

$$M = \frac{1}{D'} \frac{1}{1 + \frac{r_{Lf}}{D'^2 R} + \dots}$$

$$\omega_0 = \frac{1}{\sqrt{LC}} \sqrt{\frac{r_{Lf} + D}{r_{Cf} + \dots}}$$

$$Q = \frac{\omega_0}{\frac{r_{Lf}}{L} + \frac{1}{C(r_{Cf} + R)}}$$

Voltage-mode, DCM

Reference 1 equations: