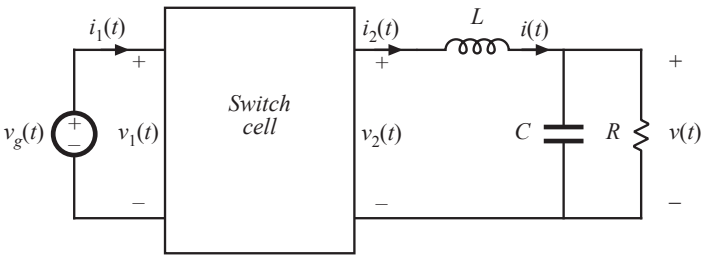
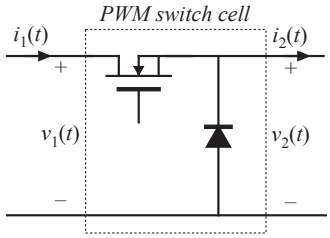
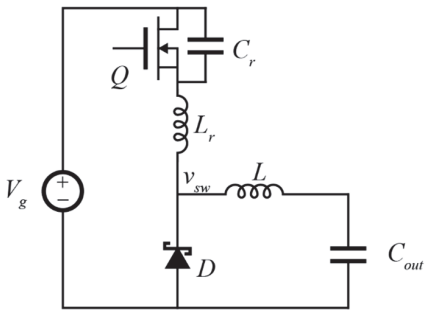
Identification of Resonant Switch





Switching Cell Conversion Ratio



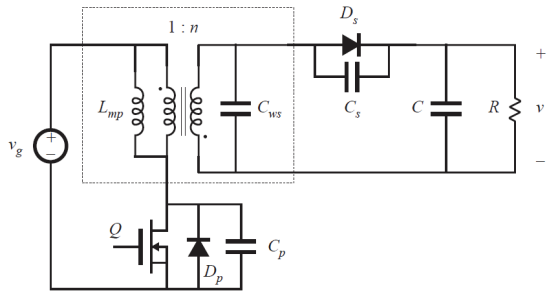
Conversion Ratios of Various Switch Cells

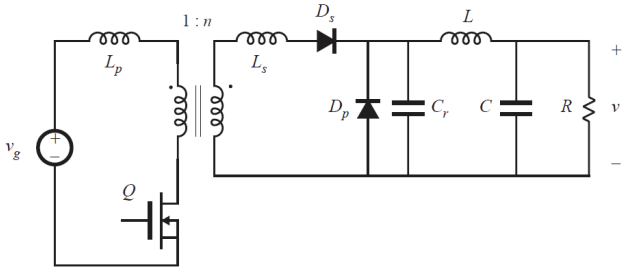
$$P_{1/2}(x) = \frac{1}{2\pi}\left[\frac{1}{2}x + \pi + \sin^{-1}x + \frac{1}{x}\left(1 - \sqrt{1-x^2}\right)\right]$$

$$P_1(x) = \frac{1}{2\pi}\left[\frac{1}{2}x + 2\pi + \sin^{-1}x + \frac{1}{x}\left(1 - \sqrt{1-x^2}\right)\right] \approx 1$$

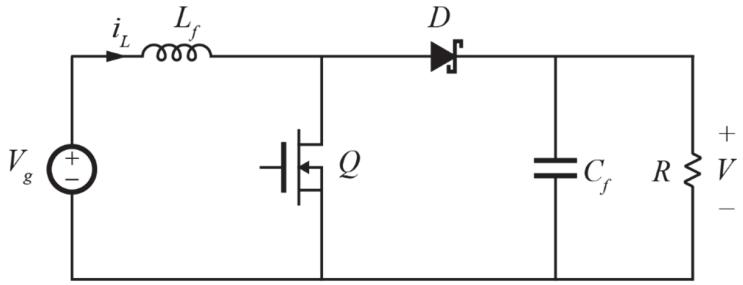
Switch Cell	Conv. Ratio μ	Load Current Range	Conv. Ratio Range	Requirements on *Q*
PWM	D	N/A	$0 \le \mu \le 1$	
ZVS-QR (half)	$\mathbf{1 - FP_{1/2}\left(\frac{1}{J_L}\right)}$	$\mathbf{0 \le J_L \le \infty}$	$\mathbf{0 \le \mu \le 1}$	
ZVS-QR (full)	$1 - FP_1\left(\frac{1}{J_L}\right)$	$0 \le J_L \le \infty$	$0 \le \mu \le 1$	Bidirectional voltage
ZCS-QR (half)	$FP_{1/2}(J_L)$	$1 \le J_L \le \infty$	$0 \le \mu \le 1$	Unidirectional Current*
ZCS-QR (full)	$FP_1(J_L)$	$1 \le J_L \le \infty$	$0 \le \mu \le 1$	

Resonant Switch Identification Examples

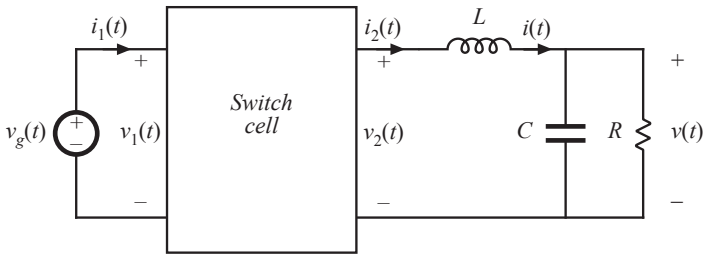


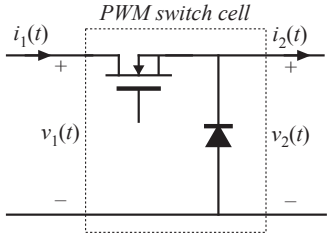


ZCS-QR Boost



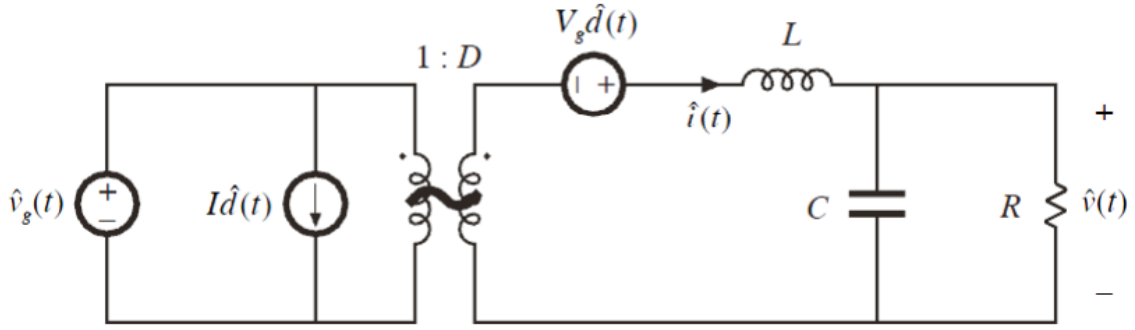
SSM - PWM Parent





SSM, PWM Case

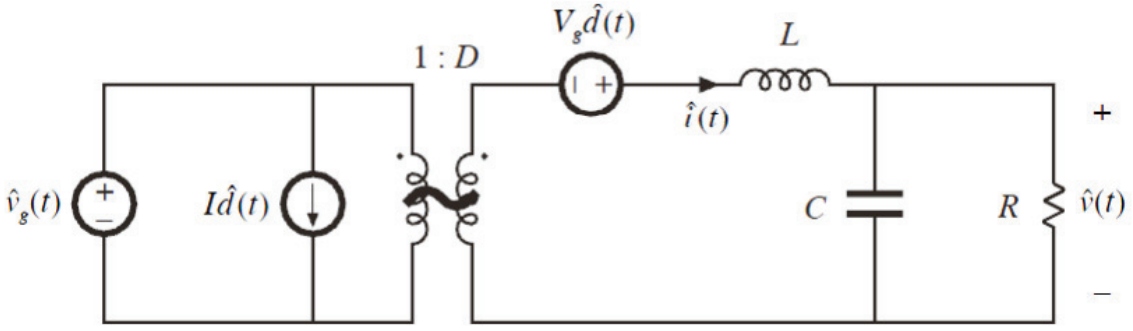
Textbook, Fig.7.17(a)



ZVS-QR Switch Cell SSM

$$M = 1 - \frac{F}{2\pi}\left[\frac{1}{2J_L} + \pi + \sin^{-1}\left(\frac{1}{J_L}\right) + \sqrt{J_L^2 - 1} + J_L\right]$$

ZVS-QR Buck SSM



SSM, Soft-Switching Buck