

SWITCHING POWER SUPPLY TOPOLOGIES

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Switching Power Supply Topologies

Type of Converter	BUCK	BOOST	BUCK BOOST (Inverting)	SEPIC	FLYBACK	FORWARD	2 SWITCH FORWARD	ACTIVE CLAMP FORWARD	HALF BRIDGE	PUSH PULL	FULL BRIDGE	PHASE SHIFT ZVT
Circuit Configuration												
Ideal Transfer Function*	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{t_{ON}}{T_P}\right) = D$	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{T_P}{T_P - t_{ON}}\right) = \frac{1}{1-D}$	$\frac{V_{OUT}}{V_{IN}} = -\left(\frac{t_{ON}}{T_P - t_{ON}}\right) = -\left(\frac{D}{1-D}\right)$	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{D}{1-D}\right)$	$\frac{V_{OUT}}{V_{IN}} = D \times \sqrt{\frac{T_P \times V_{OUT}}{2 \times I_{OUT} \times L_P}}$	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = \left(\frac{N_S}{N_P}\right) \times D$	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = \left(\frac{N_S}{N_P}\right) \times D$	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = \left(\frac{N_S}{N_P}\right) \times D$	$\frac{V_{OUT}}{V_{IN}} = \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = \left(\frac{N_S}{N_P}\right) \times D$	$\frac{V_{OUT}}{V_{IN}} = 2 \times \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = 2 \times \left(\frac{N_S}{N_P}\right) \times D$	$\frac{V_{OUT}}{V_{IN}} = 2 \times \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = 2 \times \left(\frac{N_S}{N_P}\right) \times D$	$\frac{V_{OUT}}{V_{IN}} = 2 \times \left(\frac{N_S}{N_P}\right) \times \left(\frac{t_{ON}}{T_P}\right) = 2 \times \left(\frac{N_S}{N_P}\right) \times D$
Drain Current*	$I_{Q1} (max) = I_{OUT}$	$I_{Q1} (max) = I_{OUT} \times \left(\frac{1}{1-D}\right)$	$I_{Q1} (max) = I_{OUT} \times \left(\frac{1}{1-D}\right)$	$I_{Q1} (max) = I_{OUT} \times \left(\frac{D}{1-D}\right)$	$I_{Q1} (max) = \left(\frac{V_{IN} \times t_{ON}}{L_P}\right)$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$	$I_{Q1} (max) = \left(\frac{N_S}{N_P}\right) \times I_{OUT}$
Drain Voltage*	$V_{DS} = V_{IN}$	$V_{DS} = V_{OUT}$	$V_{DS} = V_{IN} - V_{OUT}$	$V_{DS} = V_{IN} + V_{OUT}$	$V_{DS} = V_{IN} + V_{OUT} \times \left(\frac{N_P}{N_S}\right)$	$V_{DS} = 2 \times V_{IN}$	$V_{DS} = V_{IN}$	$V_{DS} = V_{IN} \times \left(\frac{1}{1-D}\right)$	$V_{DS} = V_{IN}$	$V_{DS} = 2 \times V_{IN}$	$V_{DS} = V_{IN}$	$V_{DS} = V_{IN}$
Average Diode Current*	$I_{D1} = I_{OUT} \times (1-D)$	$I_{D1} = I_{OUT}$	$I_{D1} = I_{OUT}$	$I_{D1} = I_{OUT}$	$I_{D1} = I_{OUT}$	$I_{D1} = I_{OUT} \times D$	$I_{D1} = I_{OUT} \times D$	$I_{D1} = I_{OUT} \times D$	$I_{D1} = \left(I_{OUT} \times D\right) + \frac{I_{OUT}}{2} \times (1-2D)$	$I_{D1} = \left(I_{OUT} \times D\right) + \frac{I_{OUT}}{2} \times (1-2D)$	$I_{D1} = \left(I_{OUT} \times D\right) + \frac{I_{OUT}}{2} \times (1-2D)$	$I_{D1} = \frac{1}{2} \times I_{OUT}$
Diode Reverse Voltage*	$V_{D1} = V_{IN}$	$V_{D1} = V_{OUT}$	$V_{D1} = V_{IN} - V_{OUT}$	$V_{D1} = V_{OUT} + V_{IN}$	$V_{D1} = V_{OUT} + V_{IN} \times \left(\frac{N_S}{N_P}\right)$	$V_{D1} = V_{OUT} + V_{IN} \times \left(\frac{N_S}{N_P}\right)$	$V_{D1} = V_{OUT} + V_{IN} \times \left(\frac{N_S}{N_P}\right)$	$V_{D1} = V_{OUT} + V_{IN} \times \left(\frac{N_S}{N_P}\right) \times \left(\frac{1}{1-D}\right)$	$V_{D1} = V_{IN} \times \left(\frac{N_S}{N_P}\right)$	$V_{D1} = V_{IN} \times \left(\frac{N_S}{N_P}\right) \times 2$	$V_{D1} = V_{IN} \times \left(\frac{N_S}{N_P}\right) \times 2$	$V_{D1} = V_{IN} \times \left(\frac{N_S}{N_P}\right)$
Voltage and Current Waveforms												

* Excludes ripple current and output diode voltage drop. Continuous conduction mode shown (unless otherwise noted). For reliable operation follow recommendations in datasheets and application notes.