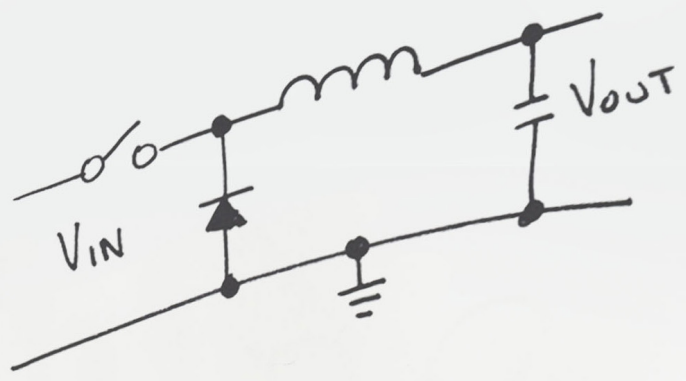


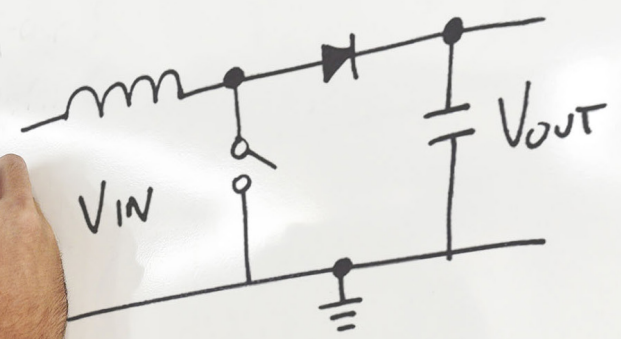
Power Topologies Quick Reference Guide



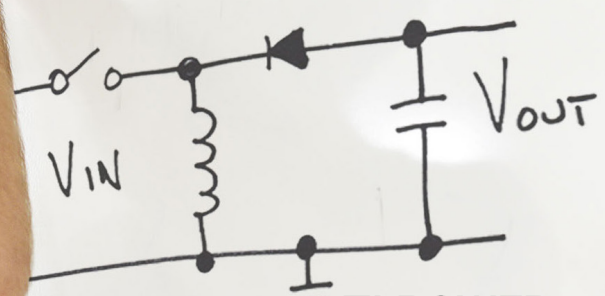
Buck
 $V_{OUT} < V_{IN}$ $V_{OUT} = D \times V_{IN}$

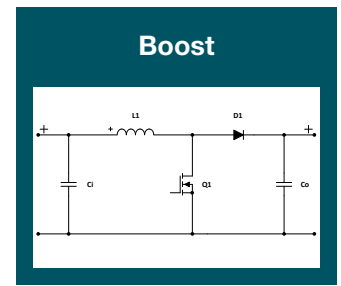
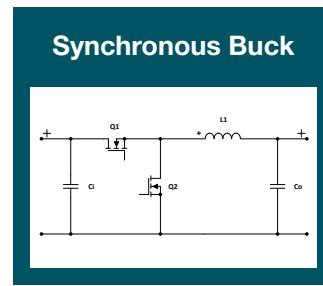
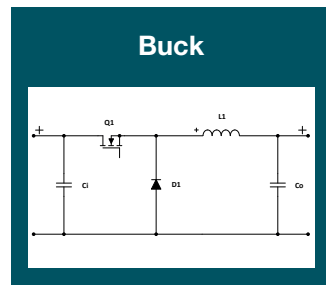


$V_{OUT} = \frac{V_{IN}}{1-D}$



Buck Boost





Duty Cycle

$$D = \frac{V_{out} + V_f}{V_{in} + V_f}$$

$$D = \frac{V_{out}}{V_{in}}$$

$$D = \frac{V_{out} + V_f - V_{in}}{V_{out} + V_f}$$

Q1 FET Voltage

$$V_{Q1} = V_{in} + V_f$$

$$V_{Q1} = V_{in}$$

$$V_{Q1} = V_{out} + V_f$$

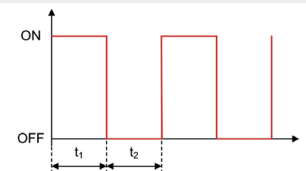
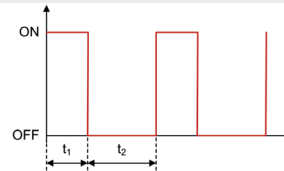
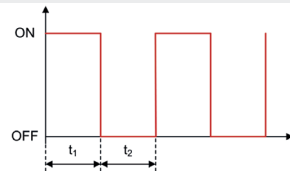
D1 Diode Voltage

$$V_{D1} = V_{in}$$

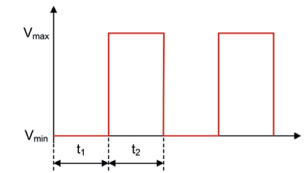
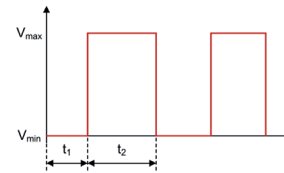
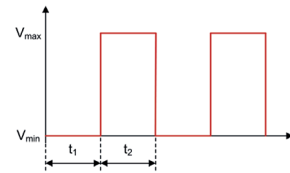
$$V_{D2} = V_{in}$$

$$V_{D1} = V_{out}$$

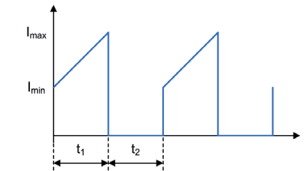
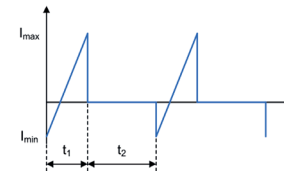
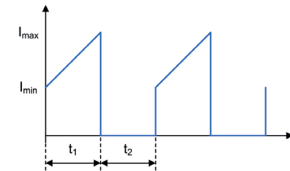
PWM



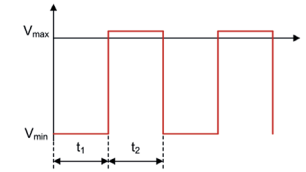
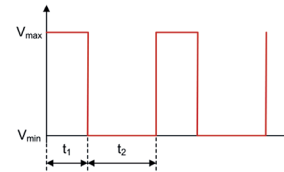
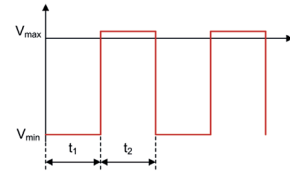
Q1 FET Voltage



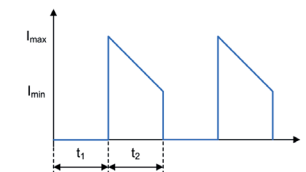
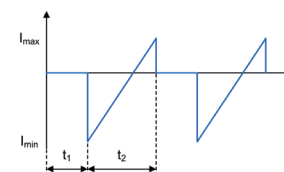
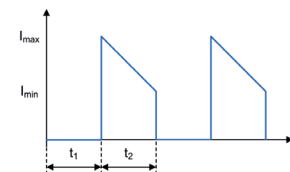
Q1 FET Current



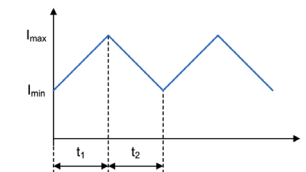
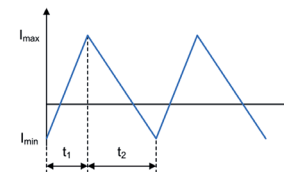
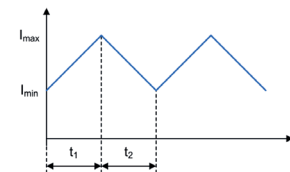
D1 Diode / Q2 FET Voltage



D1 Diode / Q2 FET Current

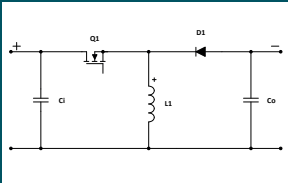


L1 Inductor Current



L2 Inductor Current

Inverting Buck - Boost

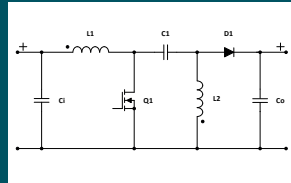


$$D = \frac{-V_{out} + V_f}{-V_{out} + V_f + V_{in}}$$

$$V_{Q1} = V_{in} + V_f - V_{out}$$

$$V_{D1} = V_{in} - V_{out}$$

Sepic

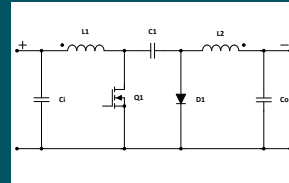


$$D = \frac{V_{out} + V_f}{V_{out} + V_f + V_{in}}$$

$$V_{Q1} = V_{in} + V_{out} + V_f + \frac{V_{C1,ripple}}{2}$$

$$V_{D1} = V_{in} + V_{out} + \frac{V_{C1,ripple}}{2}$$

Cuk

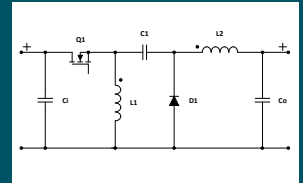


$$D = \frac{-V_{out} + V_f}{-V_{out} + V_f + V_{in}}$$

$$V_{Q1} = V_{in} - V_{out} + V_f + \frac{V_{C1,ripple}}{2}$$

$$V_{D1} = V_{in} - V_{out} + \frac{V_{C1,ripple}}{2}$$

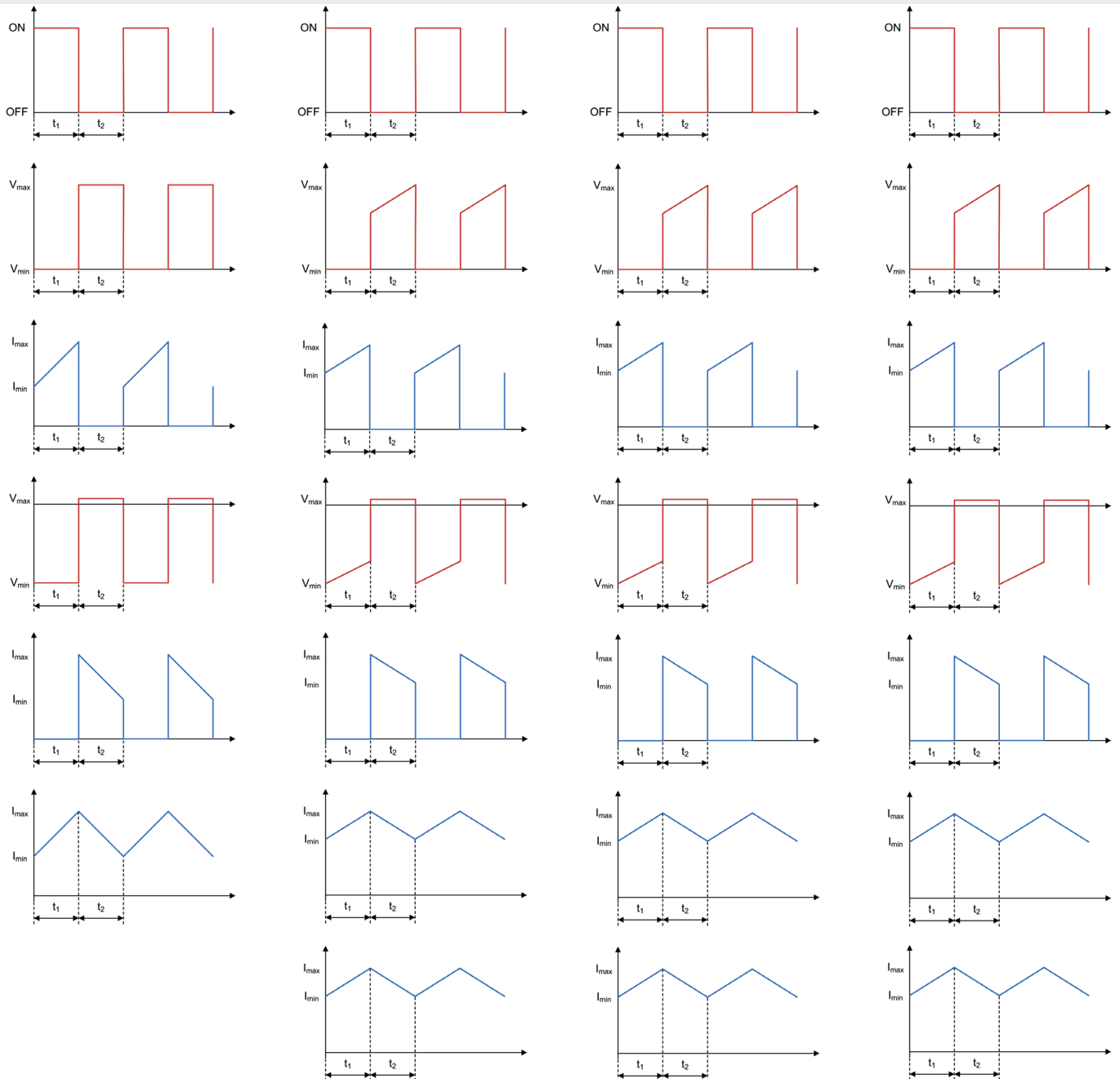
Zeta

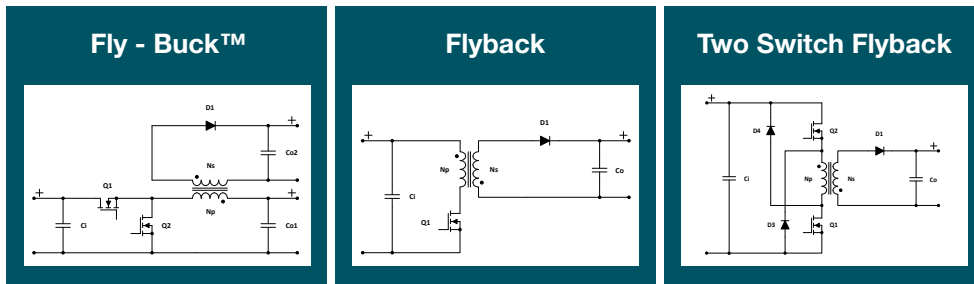


$$D = \frac{V_{out} + V_f}{V_{out} + V_f + V_{in}}$$

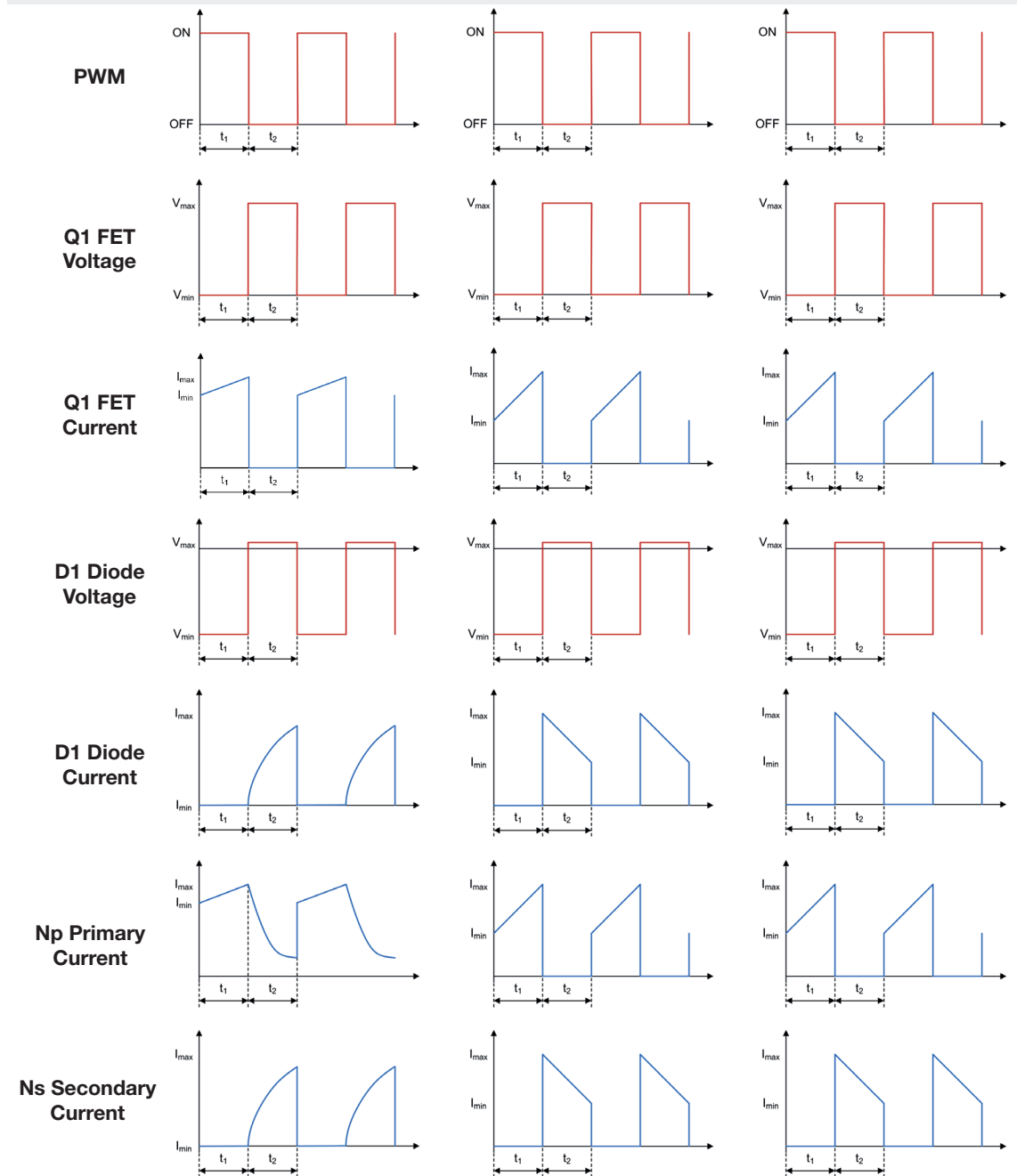
$$V_{Q1} = V_{in} + V_{out} + V_f + \frac{V_{C1,ripple}}{2}$$

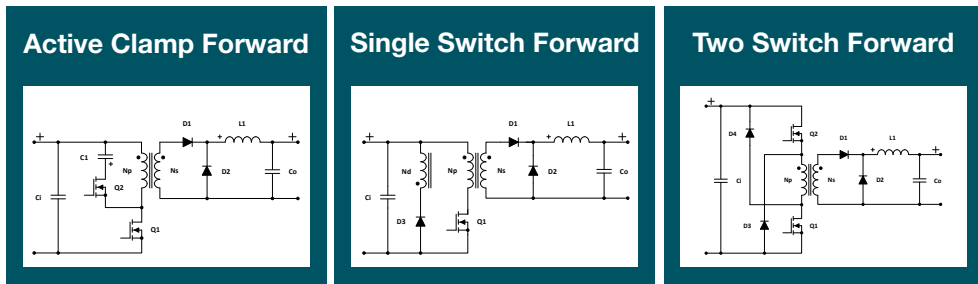
$$V_{D1} = V_{in} + V_{out} + \frac{V_{C1,ripple}}{2}$$



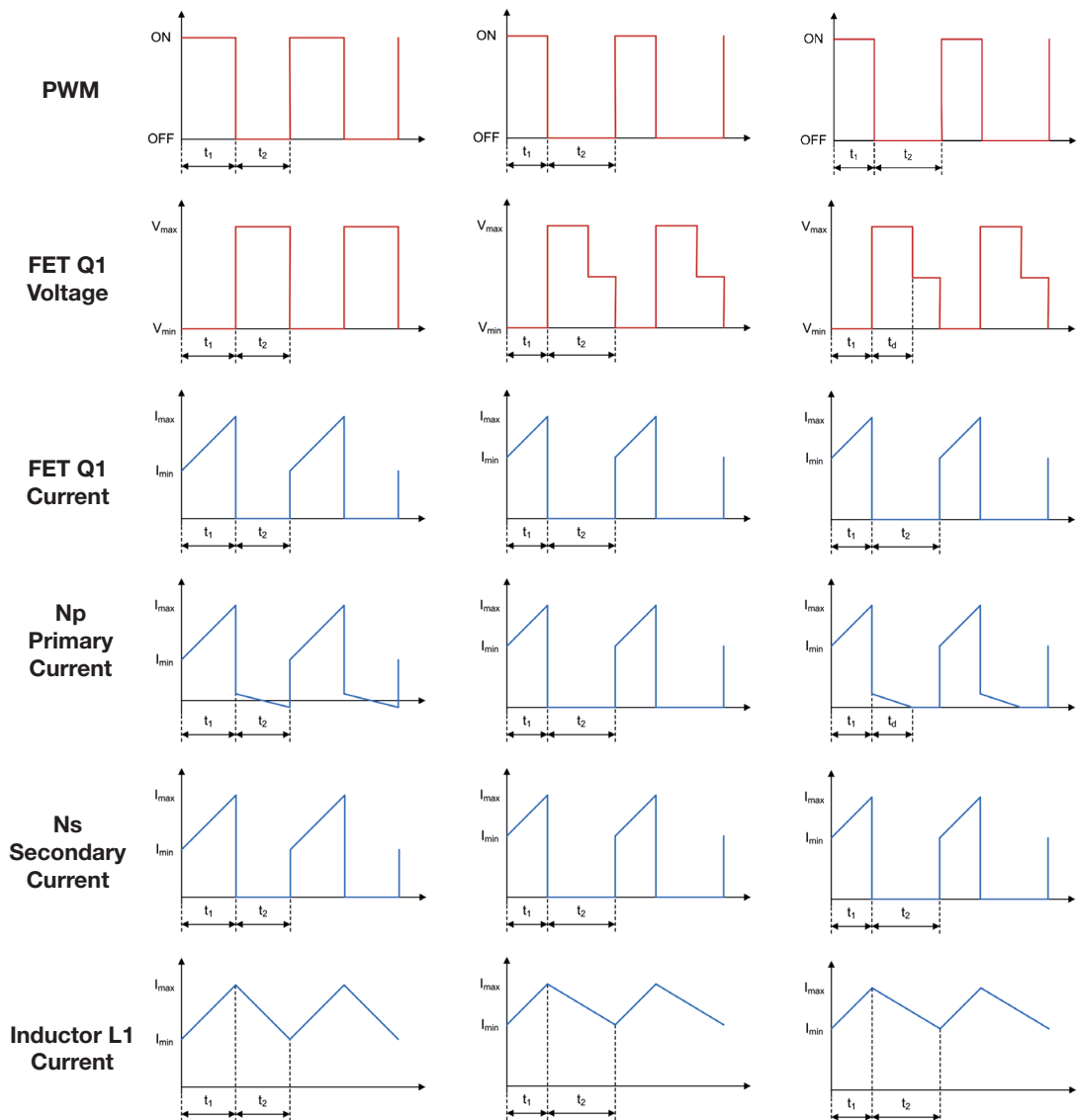


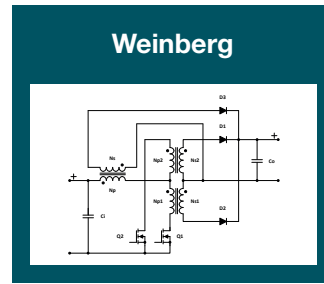
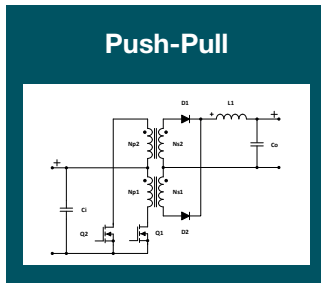
	Fly - Buck™	Flyback	Two Switch Flyback
Duty Cycle	$D = \frac{V_{out_pri}}{V_{in}}$	$D = \frac{(V_{out} + V_f) \cdot \frac{N_p}{N_s}}{V_{in} + (V_{out} + V_f) \cdot \frac{N_p}{N_s}}$	$D = \frac{(V_{out} + V_f) \cdot \frac{N_p}{N_s}}{V_{in} + (V_{out} + V_f) \cdot \frac{N_p}{N_s}}$
Q1 FET Voltage	$V_{Q1} = V_{in}$	$V_{Q1} = V_{in} + (V_{out} + V_f) \cdot \frac{N_p}{N_s}$	$V_{Q1} = \frac{V_{in} + (V_{out} + V_f) \cdot \frac{N_p}{N_s}}{2}$
D1 Diode Voltage	$V_{D1} = V_{out_sec} + (V_{in} - V_{out_pri}) \cdot \frac{N_s}{N_p}$	$V_{D1} = V_{out} + V_{in} \cdot \frac{N_s}{N_p}$	$V_{D1} = V_{out} + V_{in} \cdot \frac{N_s}{N_p}$





Duty Cycle	$D = \frac{(V_{out} + V_f)}{V_{in} \cdot \frac{N_s}{N_p}}$	$D = \frac{(V_{out} + V_f)}{V_{in} \cdot \frac{N_s}{N_p}}$	$D = \frac{(V_{out} + V_f)}{V_{in} \cdot \frac{N_s}{N_p}}$
Q1 FET Voltage	$V_{Q1} = \frac{V_{in}}{(1-D)}$	$V_{Q1} = 2 \cdot V_{in} + V_f$	$V_{Q1} = V_{in} + V_f$
D1 Diode Voltage	$V_{D1} = V_{clamp} \cdot \frac{N_s}{N_p} - V_f$	$V_{D1} = (V_{in} + V_f) \cdot \frac{N_s}{N_d} - V_f$	$V_{D1} = (V_{in} + 2 \cdot V_f) \cdot \frac{N_s}{N_p} - V_f$
D2 Diode Voltage	$V_{D2} = V_{in} \cdot \frac{N_s}{N_p} - V_f$	$V_{D2} = V_{in} \cdot \frac{N_s}{N_p} - V_f$	$V_{D2} = V_{in} \cdot \frac{N_s}{N_p} - V_f$





Duty Cycle

$$D = \frac{1}{2} \cdot \frac{(V_{out} + V_f)}{V_{in} \cdot \frac{N_s}{N_p}}$$

Q1 FET Voltage

$$V_{Q1} = 2 \cdot V_{in}$$

D1 Diode Voltage

$$V_{D1} = 2 \cdot V_{in} \cdot \frac{N_s}{N_p} - V_f$$

Duty Cycle

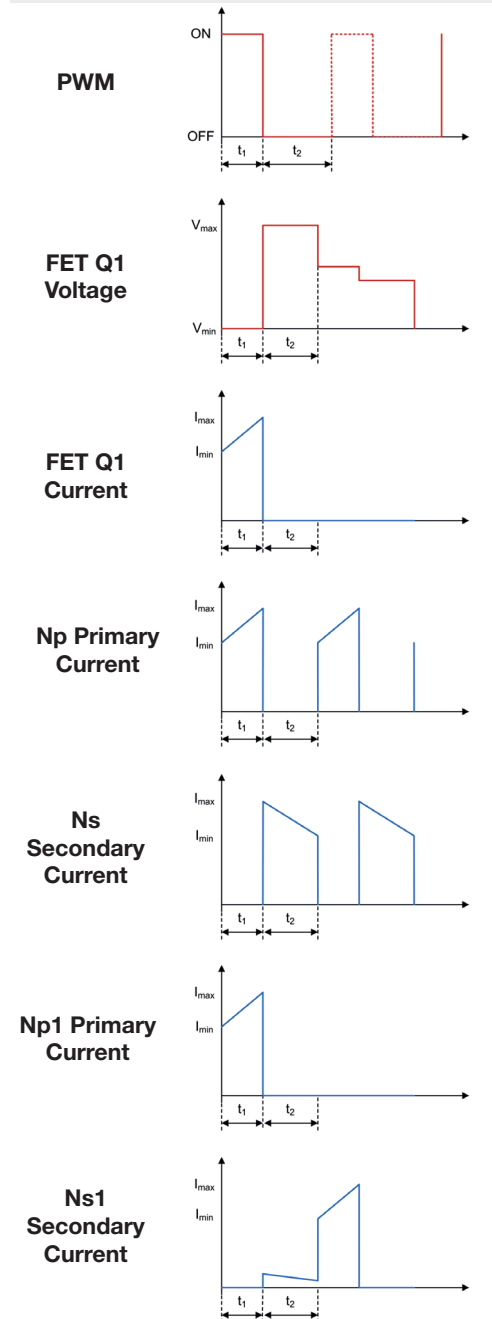
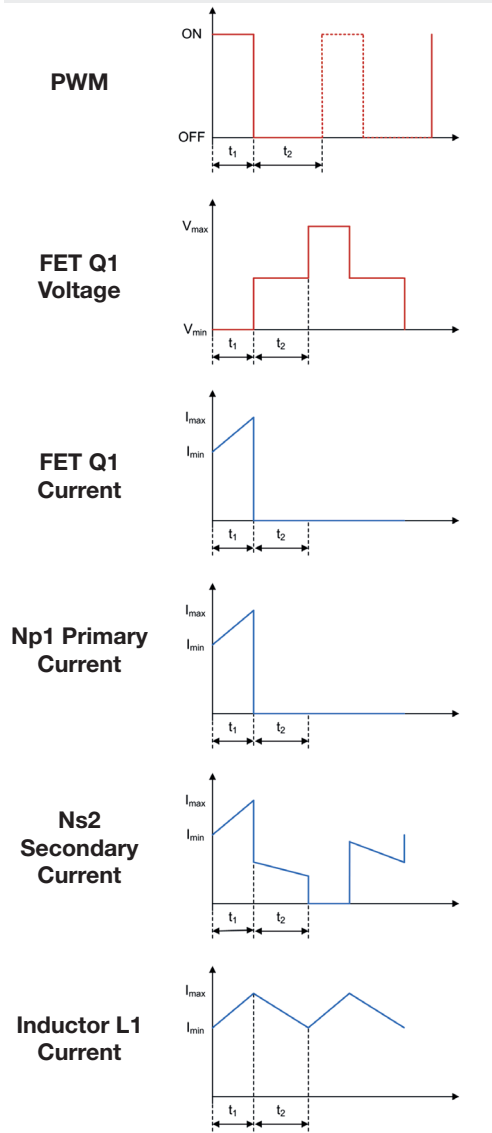
$$D = \frac{1}{2} \cdot \frac{V_{out} + V_f}{V_{in} \cdot \frac{N_s}{N_p}}$$

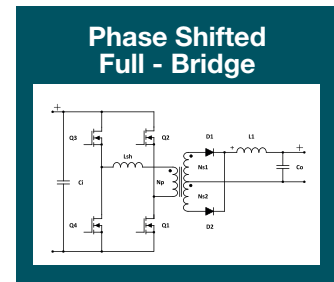
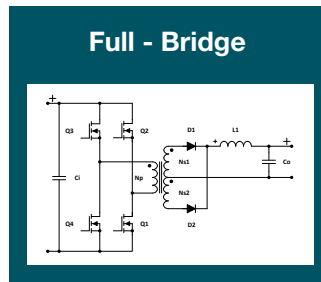
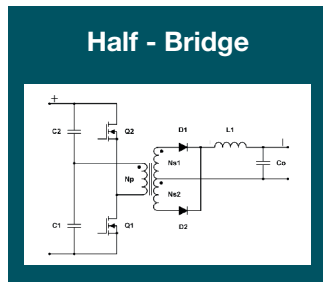
Q1 FET Voltage

$$V_{Q1} = V_{in} + 2 \cdot \frac{N_p}{N_s} \cdot (V_{out} + V_f)$$

D1 Diode Voltage

$$V_{D1} = 2 \cdot (V_{out} + V_f)$$





Duty Cycle

$$D = \frac{V_{out} + V_f}{V_{in} \cdot \frac{N_s}{N_p}}$$

$$D = \frac{1}{2} \cdot \frac{V_{out} + V_f}{V_{in} \cdot \frac{N_s}{N_p}}$$

$$D = \frac{V_{out} + V_f}{V_{in} \cdot L_p \cdot \frac{N_s}{L_p + L_s} \cdot \frac{N_s}{N_p}} \quad (\text{Transformer})$$

Q1 FET Voltage

$$V_{Q1} = V_{in}$$

$$V_{Q1} = V_{in}$$

$$V_{Q1} = V_{in}$$

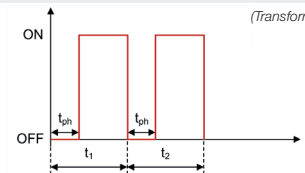
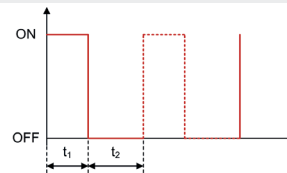
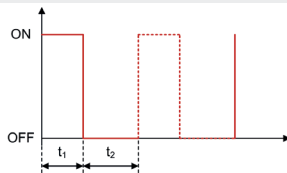
D1 Diode Voltage

$$V_{D1} = V_{in} \cdot \frac{N_s}{N_p} - V_f$$

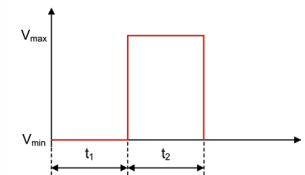
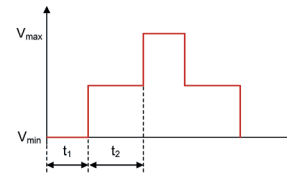
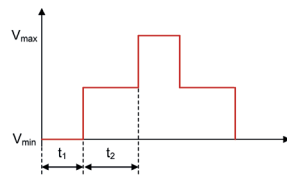
$$V_{D1} = 2 \cdot V_{in} \cdot \frac{N_s}{N_p} - V_f$$

$$V_{D1} = \frac{2 \cdot V_{in} \cdot L_p}{L_p + L_s} \cdot \frac{N_s}{N_p} - V_f$$

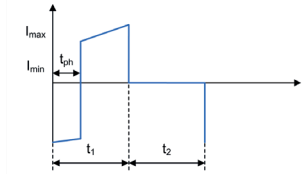
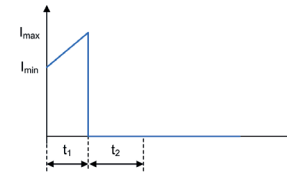
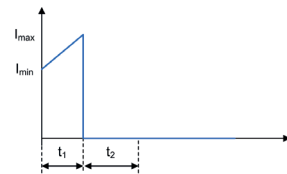
PWM



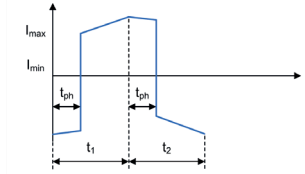
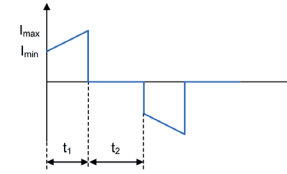
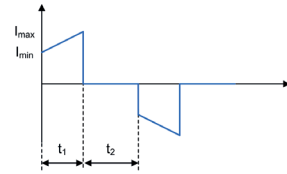
Q1 FET Voltage



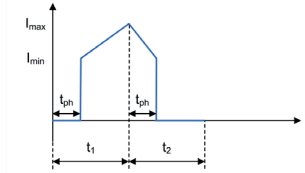
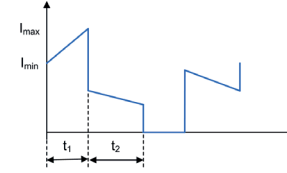
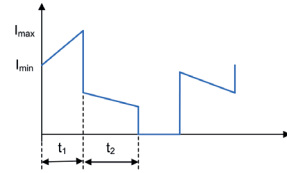
Q1 FET Current



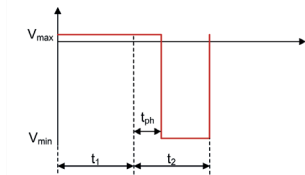
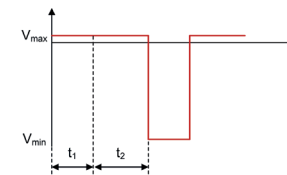
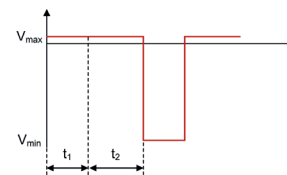
Np Primary Current



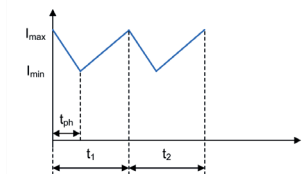
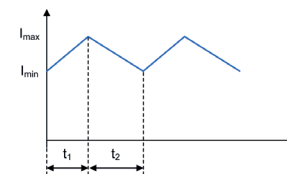
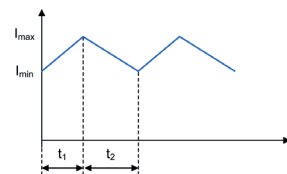
Ns Secondary Current & Diode D1 Current



Diode D1 Voltage



Inductor L1 Current



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