Half Bridge Isolated Buck

- Replace transistors $Q_3$ and $Q_4$ with large capacitors
- Voltage at capacitor centerpoint is $0.5V_g$
- $v_c(t)$ is reduced by a factor of two
- $M = 0.5nD$

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Push Pull Converter

$V = nDV_g \quad 0 \leq D \leq 1$

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6.3.2 Forward Converter

- Buck-derived transformer-isolated converter
- Single-transistor and two-transistor versions
- Maximum duty cycle is limited
- Transformer is reset while transistor is off

Subinterval 1
Subinterval 2

\[ n_1 : n_2 : n_3 \]

\[ i_M = I_M n_1 / n_2 \]

\[ v_2 = -v_0 \frac{n_2}{n_1} \]

\[ v_3 = -v_0 \frac{n_3}{n_1} \]

\[ D_2 \text{ off} \]

\[ D_3 \text{ on} \]

\[ V_{ds} \]

\[ C \]

\[ R \]

\[ V \]

Subinterval 3

\[ n_1 : n_2 : n_3 \]

\[ i_M = I_M n_1 / n_2 \]

\[ v_1 = V_g + V_i \]

\[ Q_1 \text{ off} \]

\[ D_1 \text{ off} \]

\[ L \]

\[ C \]

\[ R \]

\[ V \]
Forward Waveforms

\[ M_1 = \frac{V_1}{V_q} = D \frac{V_{di}}{V_q} \]

\[ N_1 = \frac{D V_{di}}{V_q} - V \]

Transformer Saturation When D>0.5

magnetizing current waveforms, for \( n_1 = n_2 \)

\[ D \leq \frac{1}{1 + \frac{V_{di}}{V_q}} \]

\[ V_{di,m} = V_{di}(1 + \frac{n_1}{n_2}) \]
Two-Transistor Forward Converter

$Q_1 \& Q_2$ operated synchronously

$V = nDV_S \quad D \leq \frac{1}{2} \quad \text{max}(v_{Q1}) = \text{max}(v_{Q2}) = V_S$

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