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Soft-Switching Operation and Phase-Modulated Full-Bridge DC-DC Converter

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Switching Power Pole – Turn-ON Characteristic

The diagram illustrates the circuit for a switching power pole, showing the voltage and current relationships over time.

Ref.: Book, “First Course in Power Electronics,” by N. Mohan

Need for zero turn-on losses
Zero Voltage Switching (ZVS)

- ZVS turn-on – Voltage $V_{DS}$ is brought down to zero before the switch turns on.
- ZVS turn-on – Negative current before turn-on discharges $C_{ds}$ and anti-parallel diode carries current before the switch turns on.
- ZVS turn-off – Cannot guarantee zero turn-off losses, but $C_{ds}$ limits voltage $dv/dt$. 

![Diagram of Zero Voltage Switching (ZVS)]
Synchronous Buck ZVS Converter
Phase-shift Modulated Full-Bridge dc-dc Converter
Interval 2 and 4 are expanded for clarity. In actual circuit, these intervals are very small when compared to $T_s$. 

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