Ideal Switching Waveforms
Capacitive switching loss

ANALYSIS OF NONLINEAR CAPACITANCES
Example Device $C_{oss}$
Datasheet Reported Capacitance

13 Typ. capacitances

\[ C = f(V_{DS}); \quad V_{GS} = 0 \, V; \quad f = 1 \, \text{MHz} \]

14 Typ. Coss stored energy

\[ E_{oss} = f(V_{DS}) \]
Modeling Nonlinear Capacitances

Energy and Charge Equivalents
$C_{oss}$ Losses in a Half Bridge
$M_2$ Energy Loss
$M_1$ Energy Loss

![Diagram of a circuit with a switch, resistor, capacitor, and voltage source](image-url)
Total Half Bridge $C_{oss}$ Loss
Energy Equivalent

Matlab Code:

\[V_{dc} = 550;\]

\[V_{ds} = [0 \ 5 \ 10 \ 40 \ 50 \ 75 \ 100 \ 150 \ 200 \ 300 \ 400 \ 500 \ 600];\]

\[C_{oss} = [5500 \ 2500 \ 1900 \ 550 \ 95 \ 50 \ 38 \ 30 \ 29 \ 27 \ 25 \ 24] \times 10^{-12};\]

\[vx = 0.01:.01:V_{dc};\]
\[Cx = 10.\text{^}\text{log10}(C_{oss}),vx,'linear');\]

\[E = \text{cumtrapz}(vx, Cx.*vx);\]
\[C_{eq\_e} = 2*(E)/vx.^2;\]