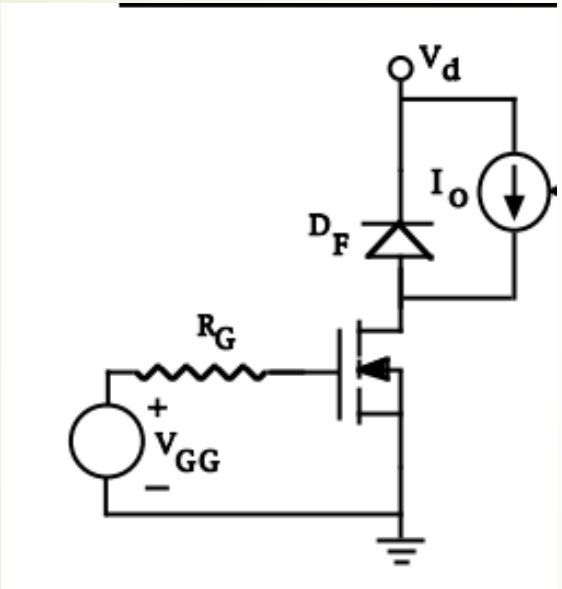
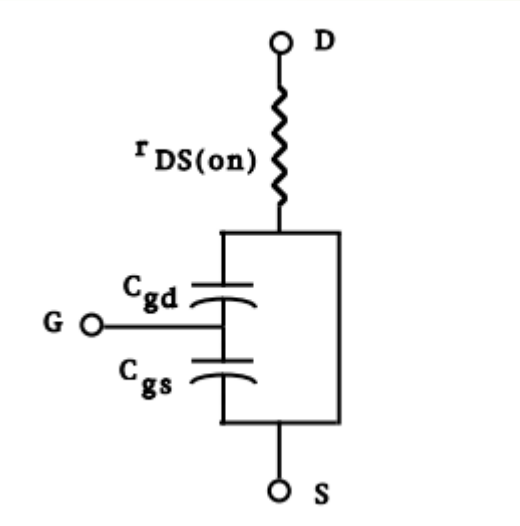
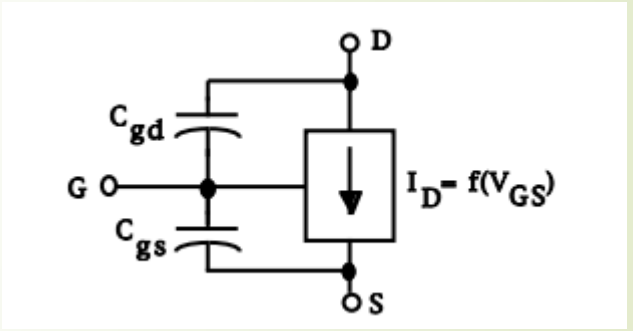
POWER MOSFET SWITCHING CHARACTERISTIC



Buck Converter as Load

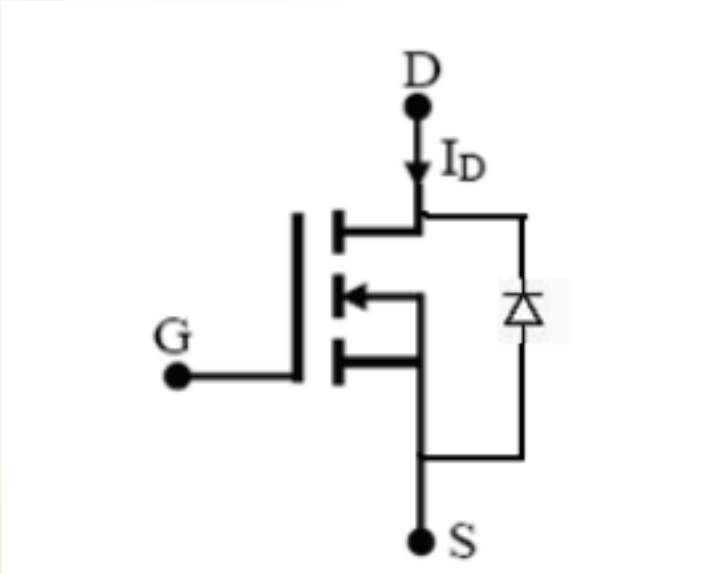


Triode Region Circuit Model



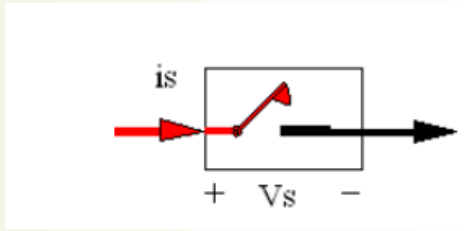
cut-off and Saturation Circuit Model

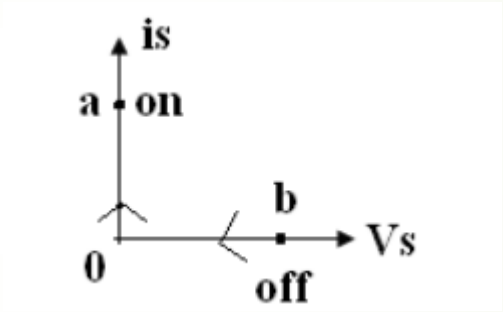
- Switching Devices Categories:
  - Uncontrolled: Diodes
  - Semi controlled: Thyristors
  - Fully controlled/Controlled: Transistors

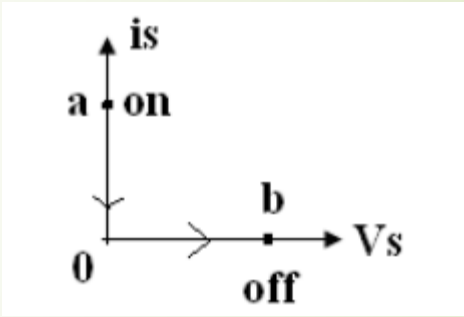


- İdeal Switch
  - On-state : Vs=0
  - Off-state: is=0;

  Thus, Power dissipation is zero.

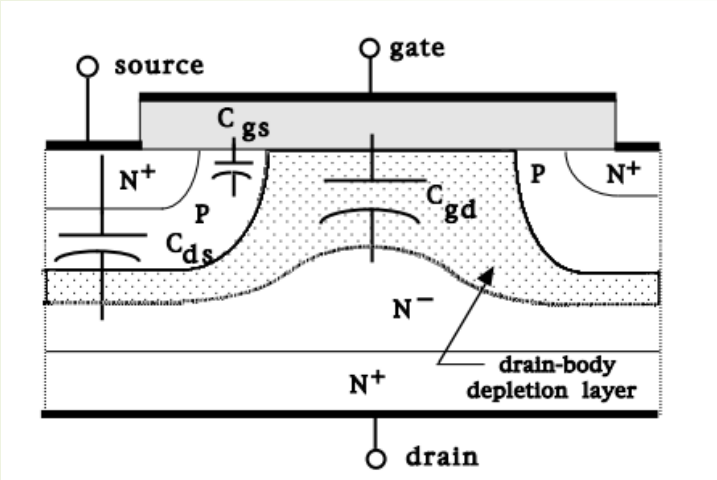


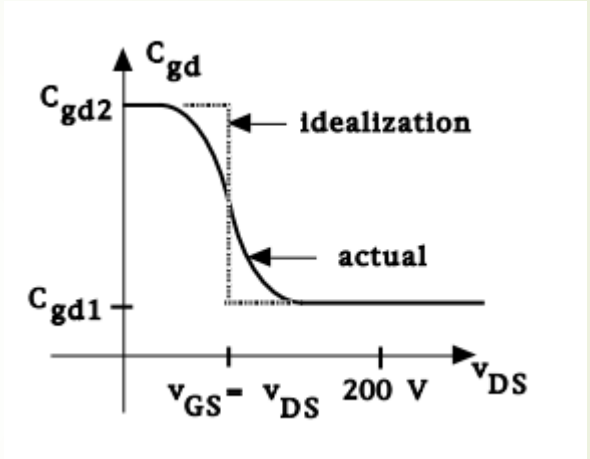


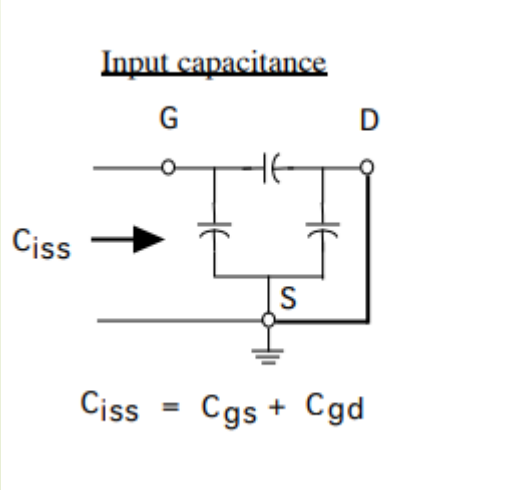


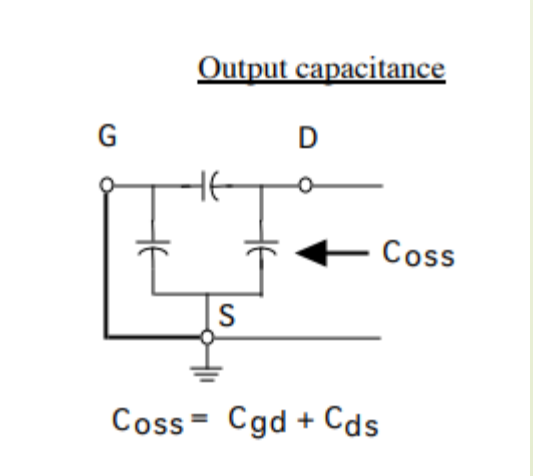
- Practical Switch
  - Conduction Loss
  - Blocking Loss
  - Turn on Loss
  - Turn of Loss
  - Driver Circuit Loss

- Mosfet Capacitance
  - Cgs is almost constant
  - Cgd vaties with Vds



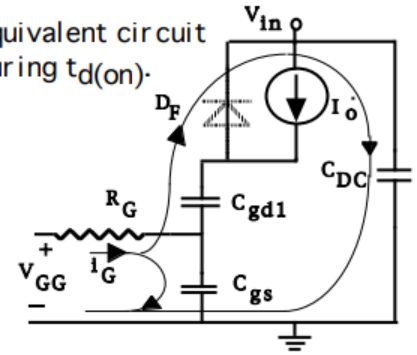




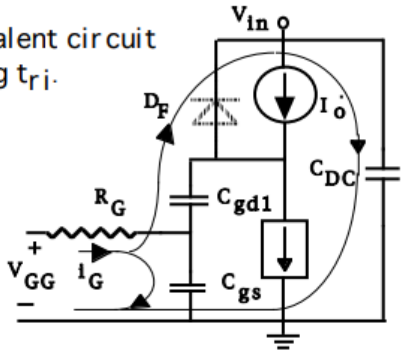


Turn-on and Turn-of Equaivalent Circuits

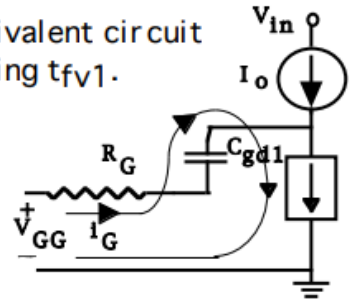
- Equivalent circuit during $t_{d(on)}$.



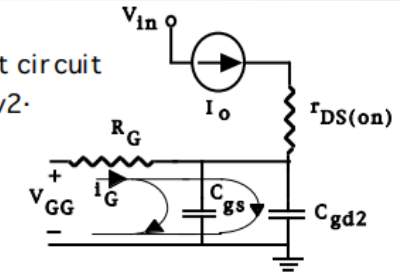
- Equivalent circuit during t_{ri}.



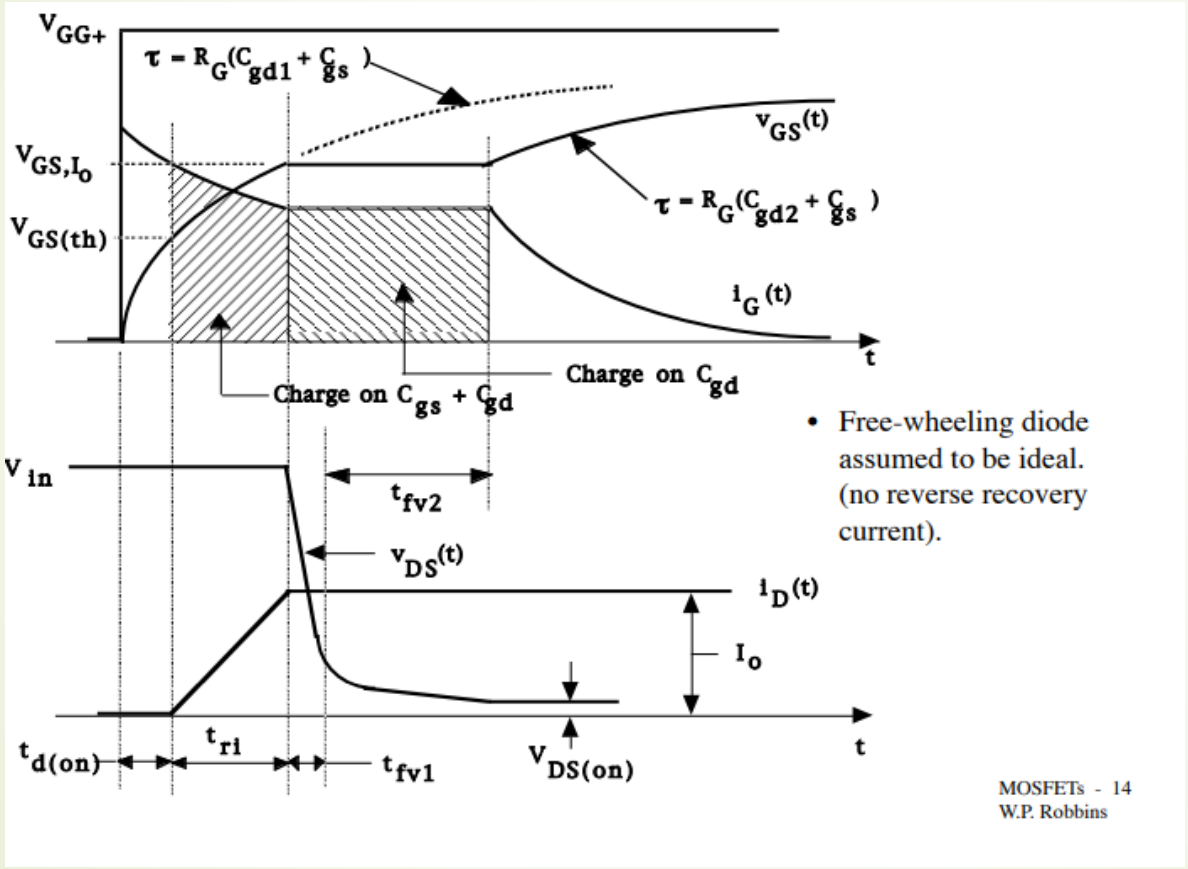
- Equivalent circuit during t_{fv1}.



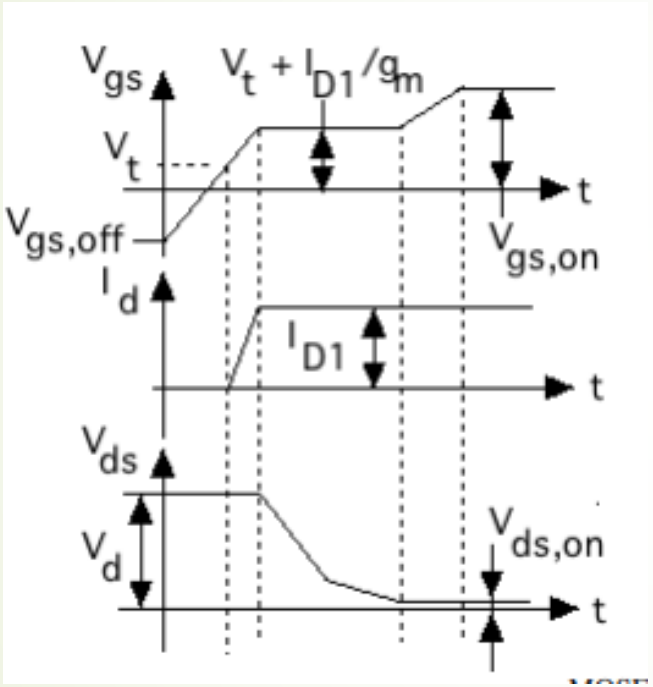
- Equivalent circuit during t_{fv2}.



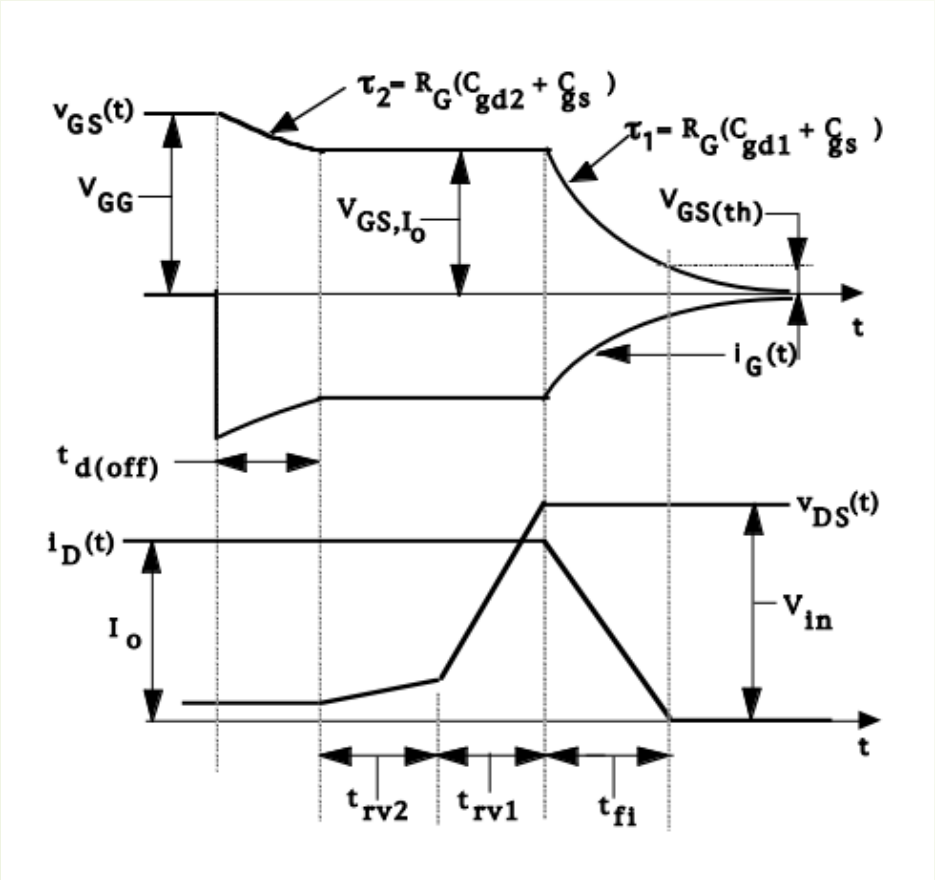
Turn-on Wavefroms



- Free-wheeling diode assumed to be ideal. (no reverse recovery current).


V_{gs}
$V_t + I_{D1}/g_m$
V_t
t
$V_{gs,off}$
$V_{gs,on}$
I_d
I_{D1}
t
V_{ds}
V_d
$V_{ds,on}$
t

Turn-off Waveforms



On-state Losses

- Pon= Io^2*Rds(on)

- Rds(on) changes with Vgs and temperature

.

Large Vgs make layer and channel resistances smaller.

If temperature increases, Rds(on) increase.(Decreasing carrier mobility)