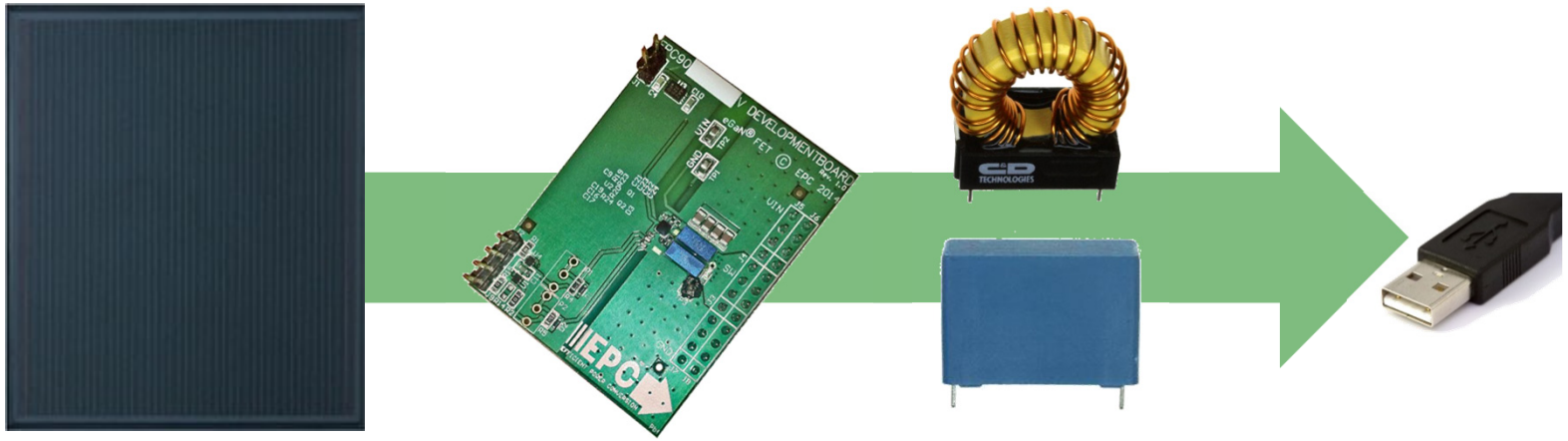
Announcements

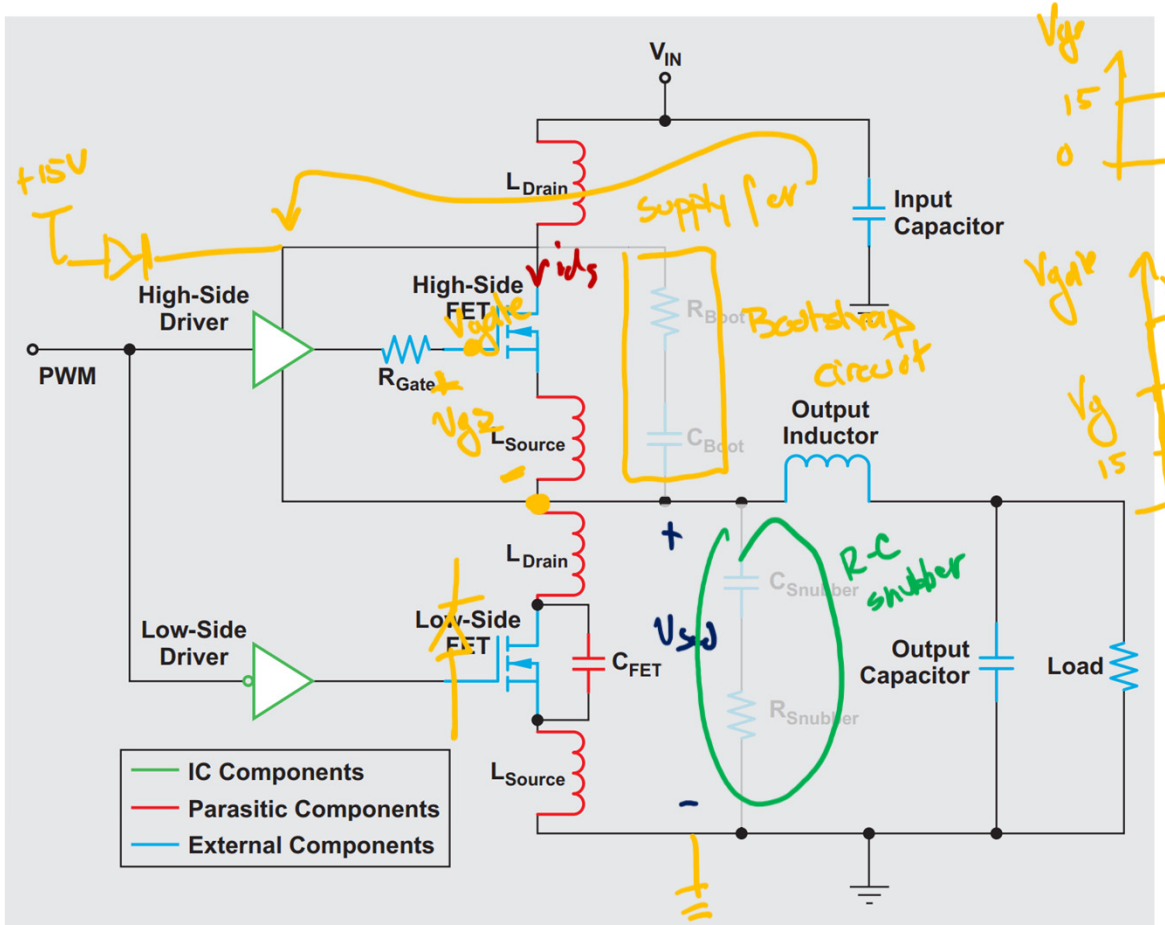
- Experiment 1 assigned
  - Model PV panel for future converter design/analysis
  - Self-assign lab groups of 3 in canvas **this week**
  - Complete experiment next week 9/23-9/27
  - Report due 10/4

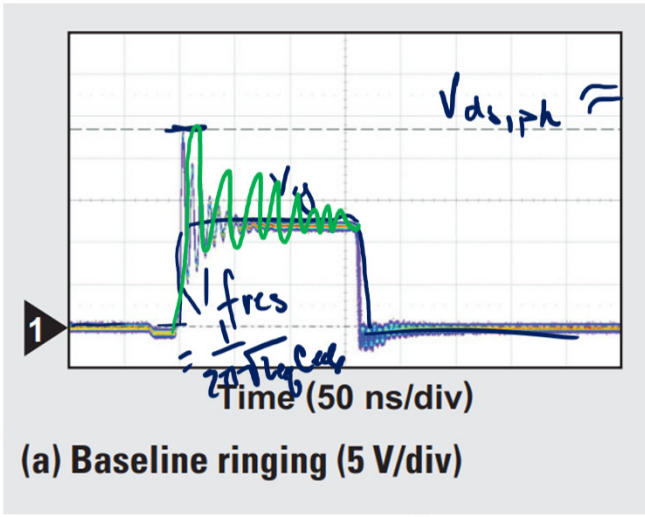


Lab Time

- Experiments performed in MK225
- E-mail Elizabeth Sutton (esutton4@utk.edu) to schedule
  - MTWF: 10 am - 2 pm
  - R: 12 pm - 4 pm
  - One e-mail *per group*
- Read through lab and plan your procedure in advance

Experimental Switching Waveforms





(a) Baseline ringing (5 V/div)

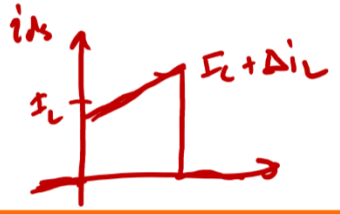
$V_{ds,ph} \approx 2V_g$ in Buck

$E_{lost} = \frac{1}{2} L_p I_L^2$

all lost if ringing dies out before end of period

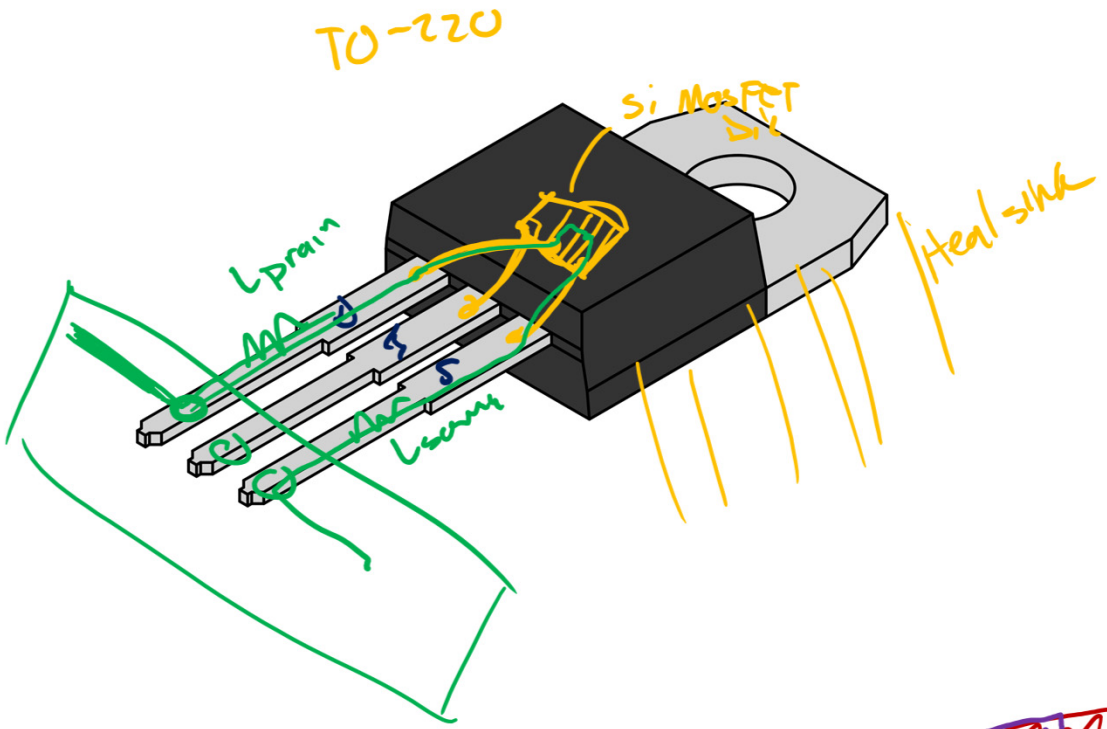
$P_{sw} = \frac{1}{2} L_p I_L^2 f_s$

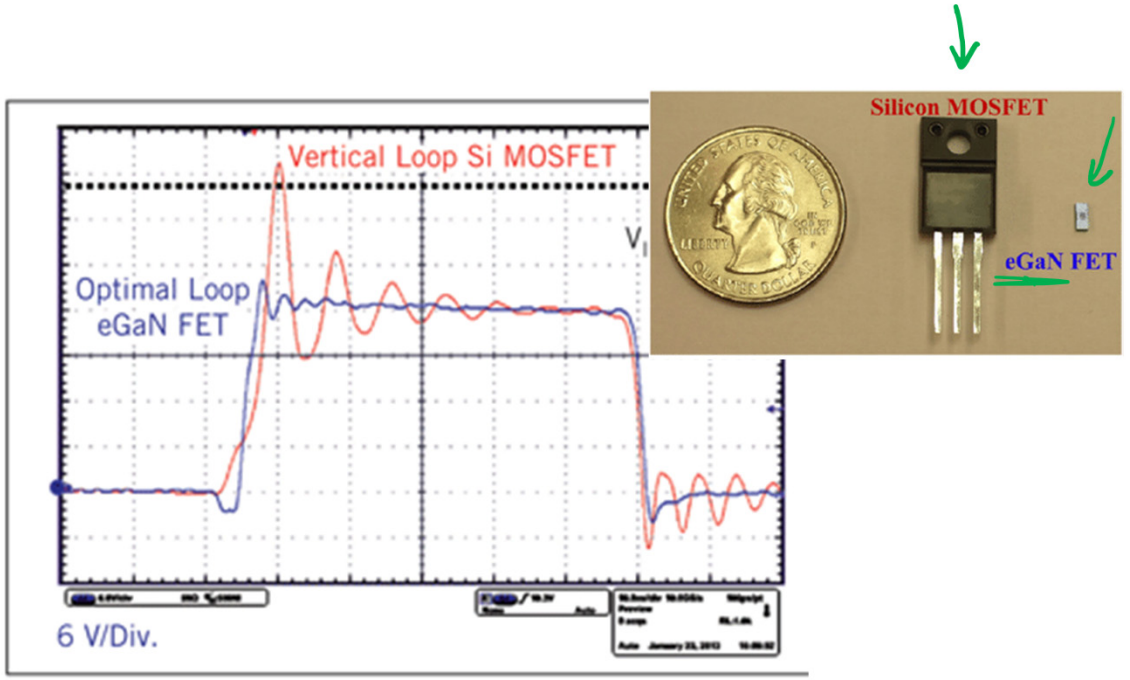
or $\frac{1}{2} L_p (I_L + \Delta i_L)^2 f_s$

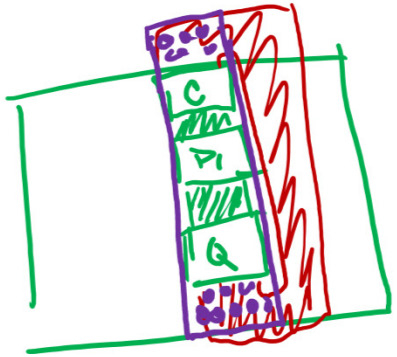


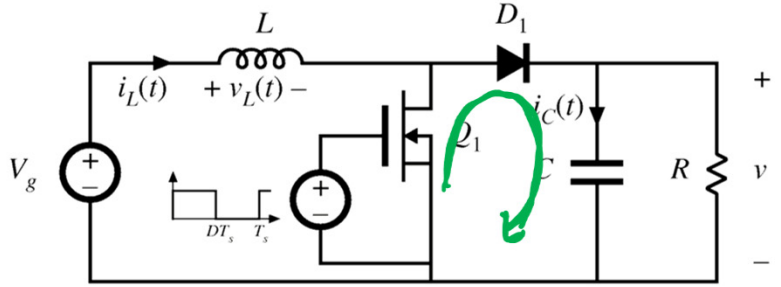
TI, “Controlling switch-node ringing in synchronous buck converters”

Device Packaging and Layout









The Double Pulse Test

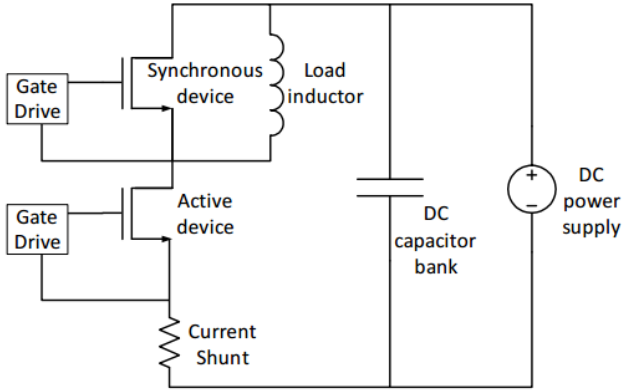


Fig. 7. Double pulse test circuit schematic.

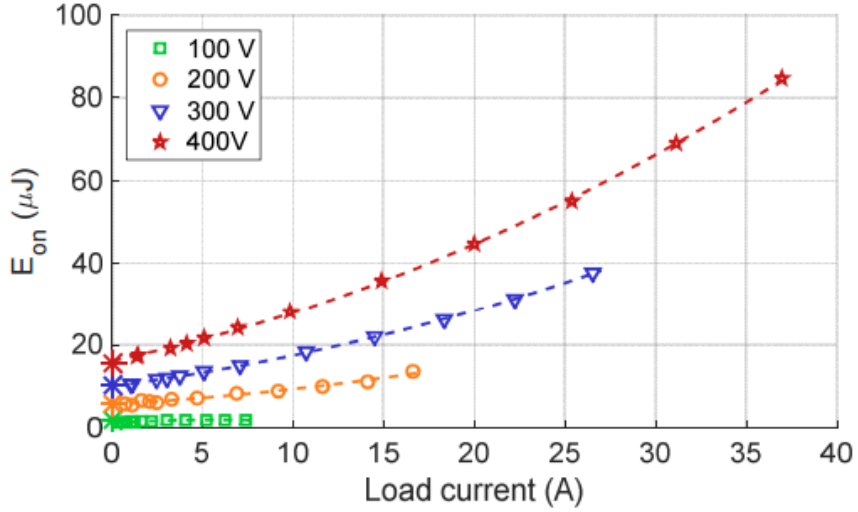
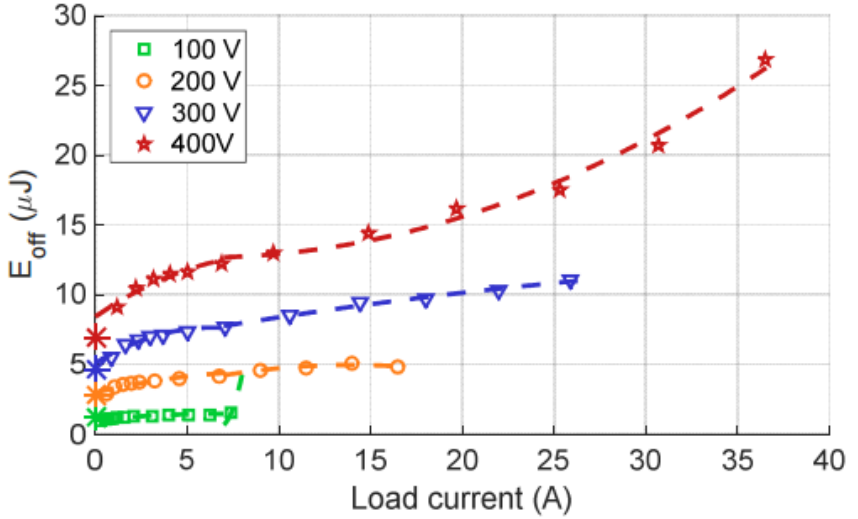
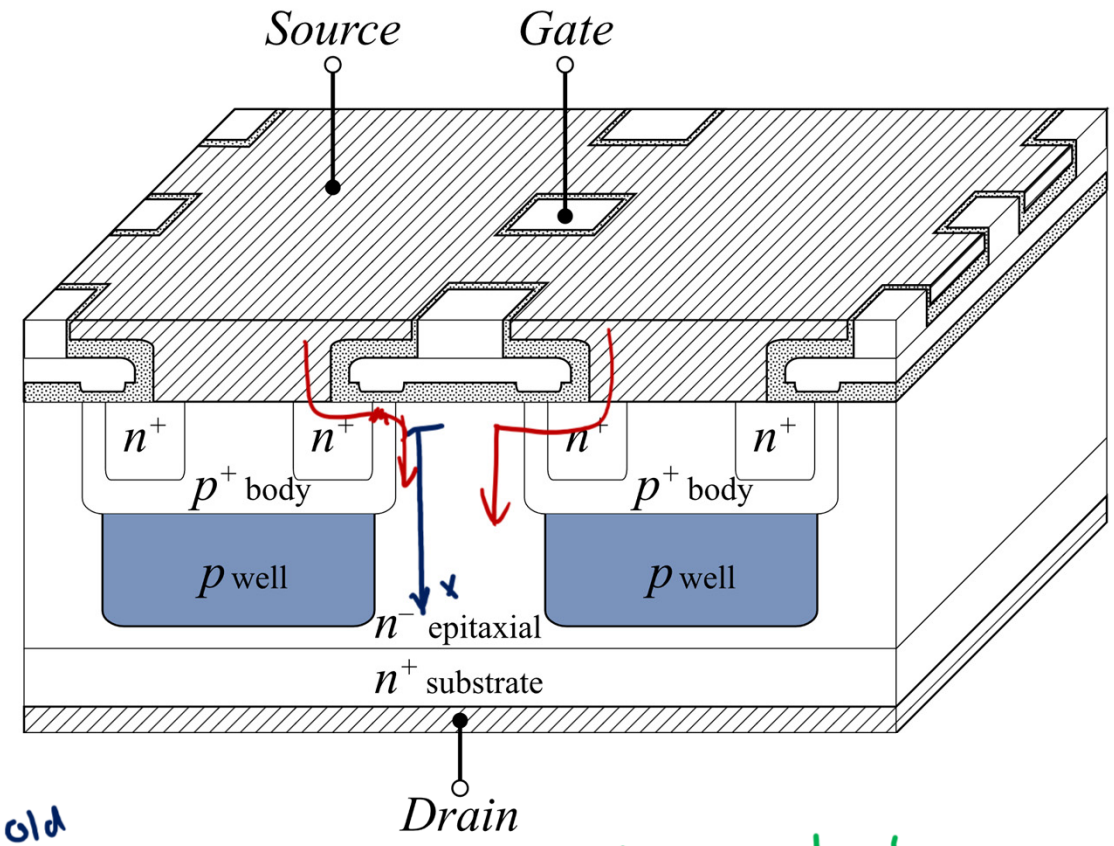


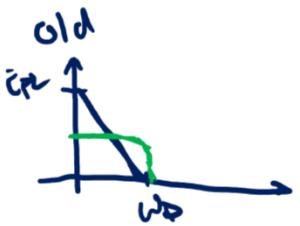
Fig. 16. Turn-on energy E_{on} at 25 °C.



Other Device Structures

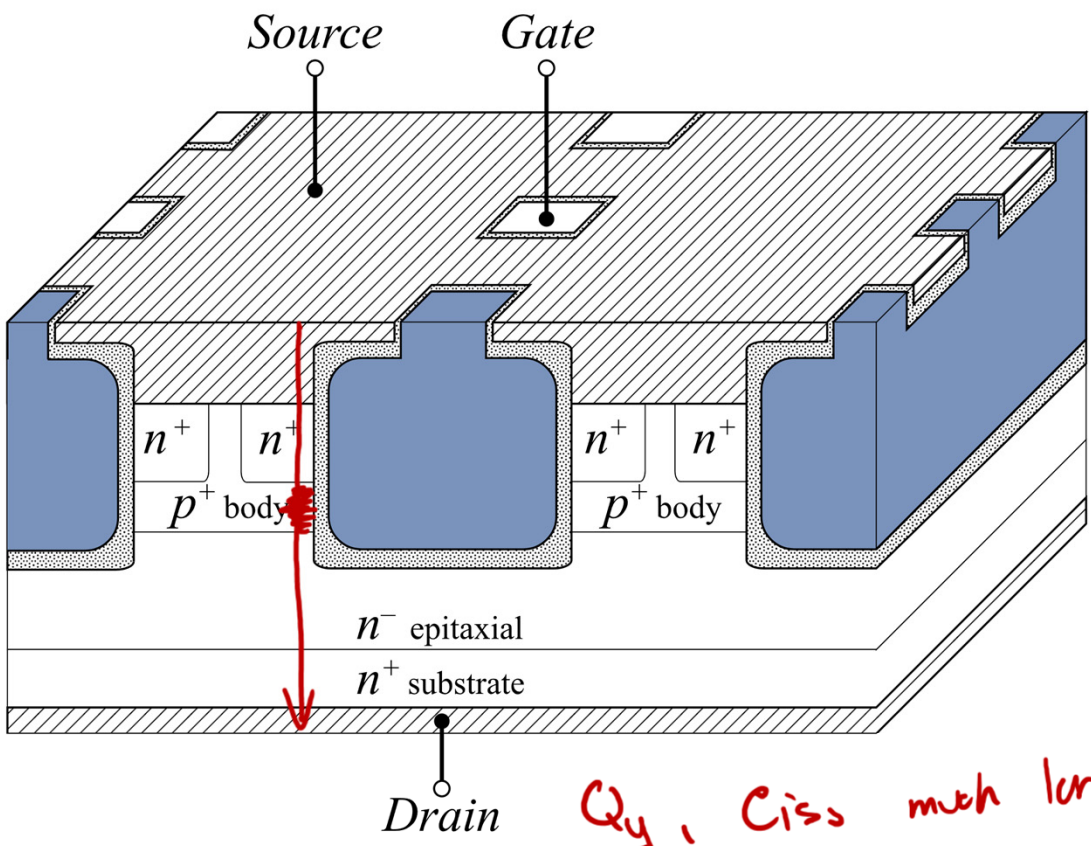
Superjunction





$R_{sp} \rightarrow$ $k_1 V_{BV}$ instead of $k_2 V_{BV}^2$

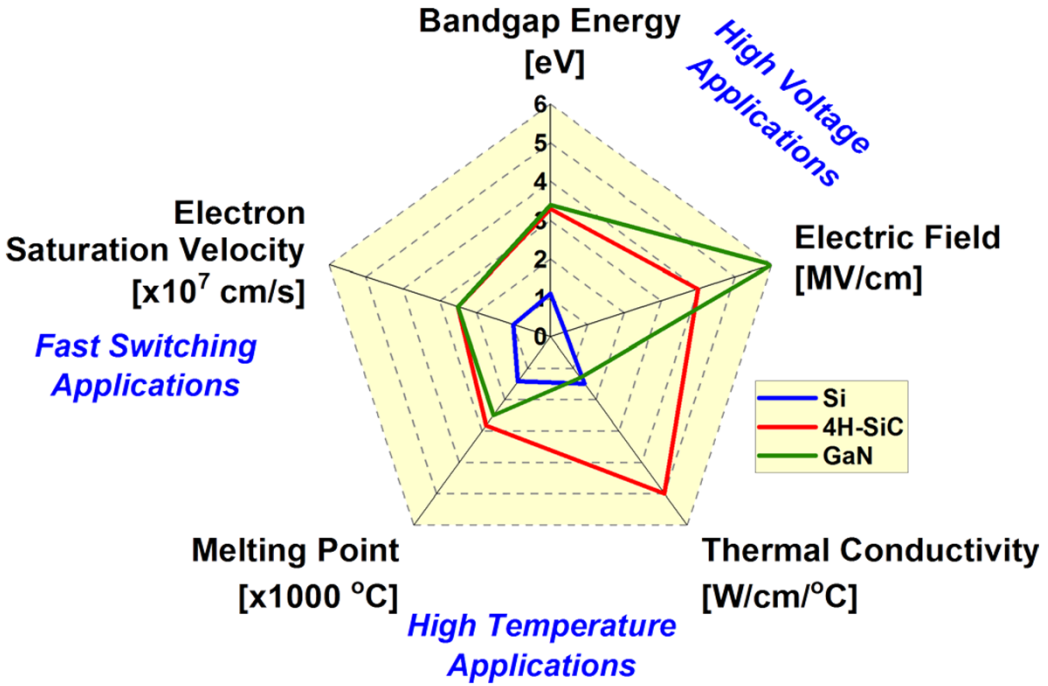
Trench Gate

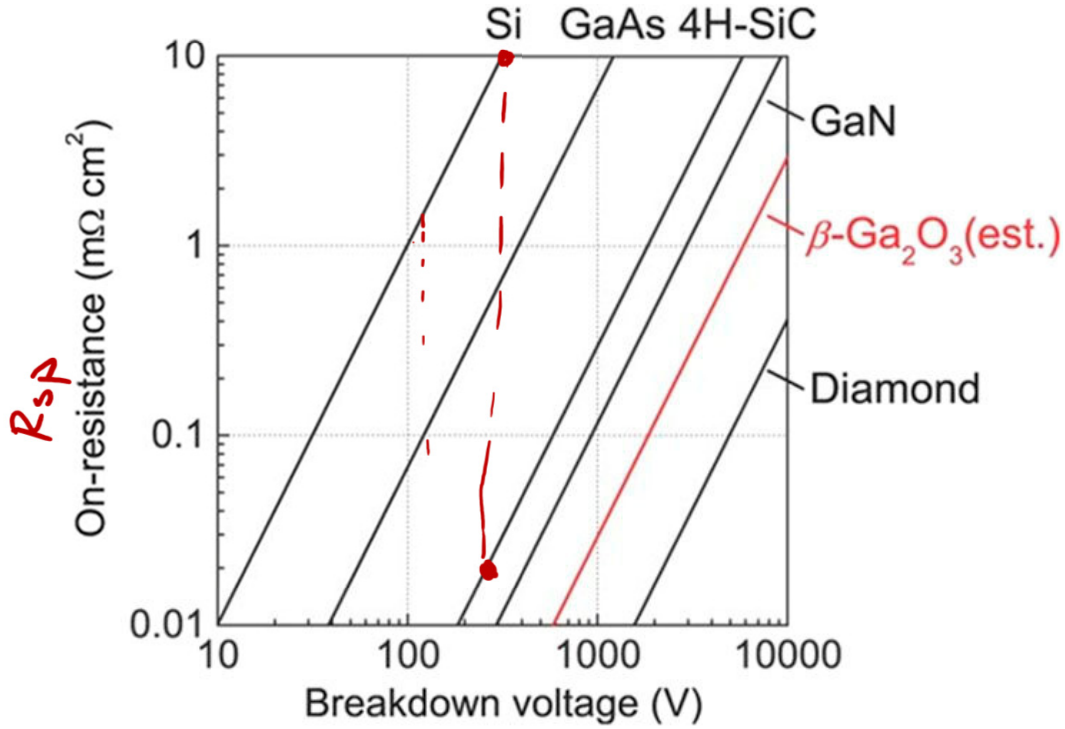


Q_g, C_{iss} much larger

Lower R_{on} @ Low voltages

Wide Bandgap Materials





https://potenntial.eecs.utk.edu/About.php?topic=PowerSemiconductors

GaN HEMTs

gate current not zero

Not a MOSFET

No body diode

very high reverse conduction loss due to V_{th} shift